Healthy Mind, Healthy Body v1.0
Unit 1: **Substance Use**

World Health Organization

Activity 3:
The Human Brain and Functions

Student Name:	Teacher Name:
Class Name:	Date:

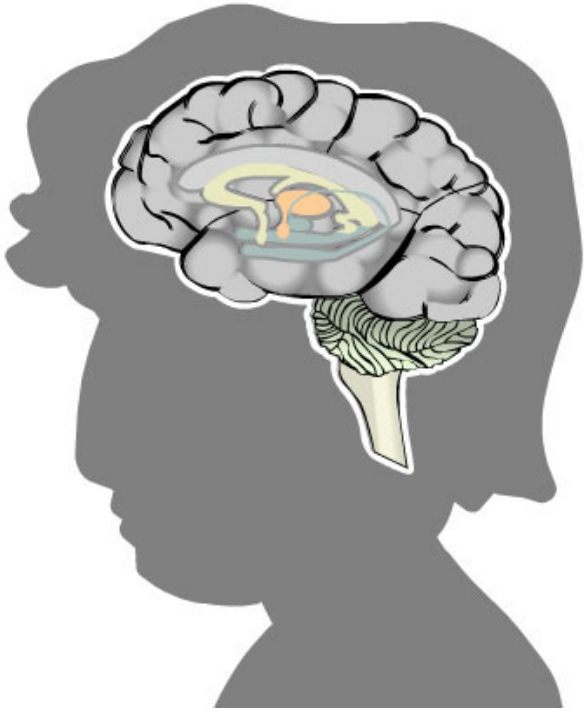
Why?
This activity provides a description of the anatomy and physiology of the brain. This information promotes an understanding of neuroscience and the physical reality of drug use.

How?
This activity consists of four parts.

Part 1: Read the information about different parts of the brain.

The Human Brain

Click on the active areas in the graphic to view information on different parts of the brain.



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Cerebral Cortex

Divided into right and left hemispheres

Encompasses about two-thirds of the brain mass and lies over and around most of the remaining brain structures

Most highly developed part of the brain

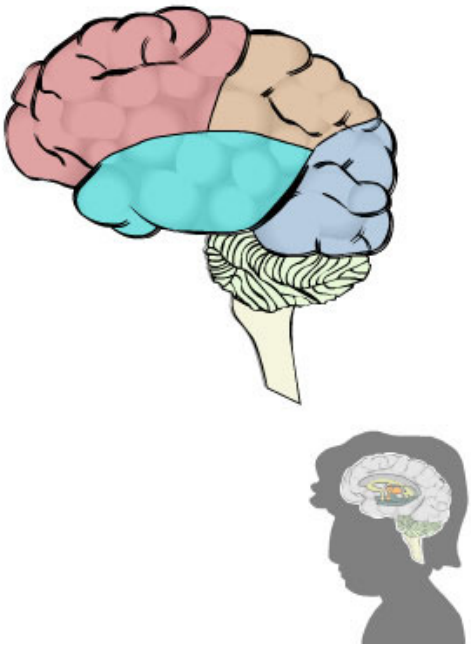
Responsible for thinking, perceiving, producing language, and understanding language

Most recent structure in the history of brain development

Can be divided into areas with specific functions

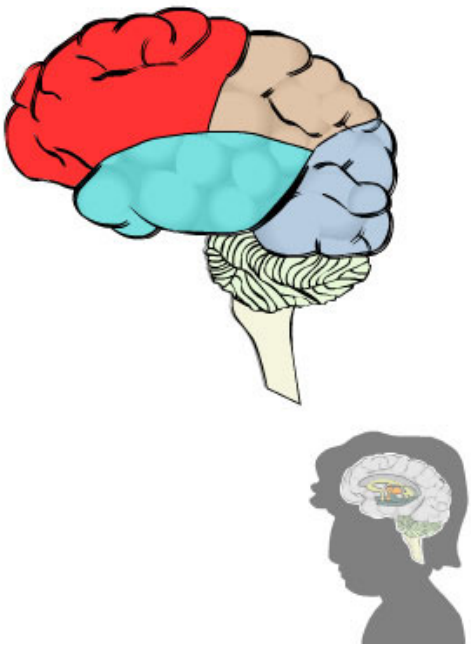
Many functions, such as touch, are found in both the right and left cerebral hemispheres.

In most people, language abilities are found in the left hemisphere.



Frontal Lobe

Related to decision-making, problem solving, and planning



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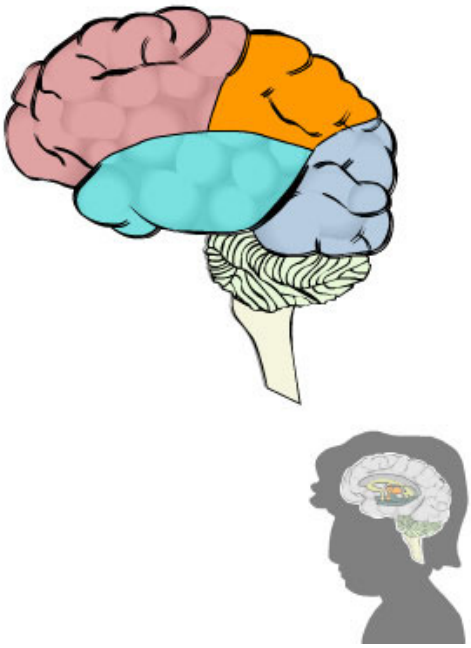
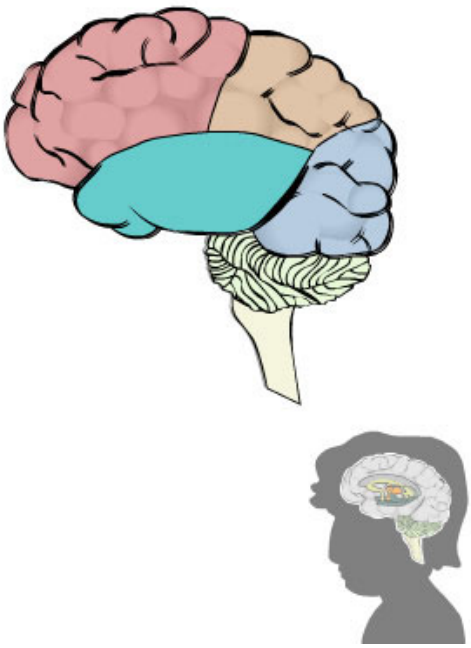
Parietal Lobe

Related to the reception and processing of sensory information from the body



Temporal Lobe

Related to memory, emotion, hearing, and language



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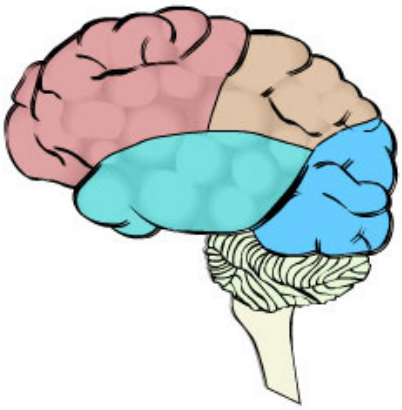
Occipital Lobe

Related to vision



Limbic System

A set of more primitive brain structures found on top of the brainstem and buried under the cortex.

Involved in many of our emotions and motivations, particularly those related to survival, such as fear, anger, and sexual behaviour.

Involved in feelings of pleasure that are related to our survival, such as those experienced from eating and sex.

Two limbic system structures called the amygdala and the hippocampus are also involved in memory.

Drugs of abuse act directly on the primitive brainstem and limbic structures, which can override the cortex in controlling our behaviour.

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Thalamus

Located in the diencephalons

Involved in sensory perception and regulation of motor functions, or movement

Areas of the cerebral cortex that are involved in sensory perception and movement connect with other parts of the brain and spinal cord that have similar roles.

Hypothalamus

Located in the diencephalons

Involved in sensory perception and regulation of motor functions, or movement

Areas of the cerebral cortex that are involved in sensory perception and movement connect with other parts of the brain and spinal cord that have similar roles.

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Cerebellum

Represents only one-eighth of the total weight of the brain

Coordinates the brain's instructions for skilled, repetitive movements

Maintains balance and posture

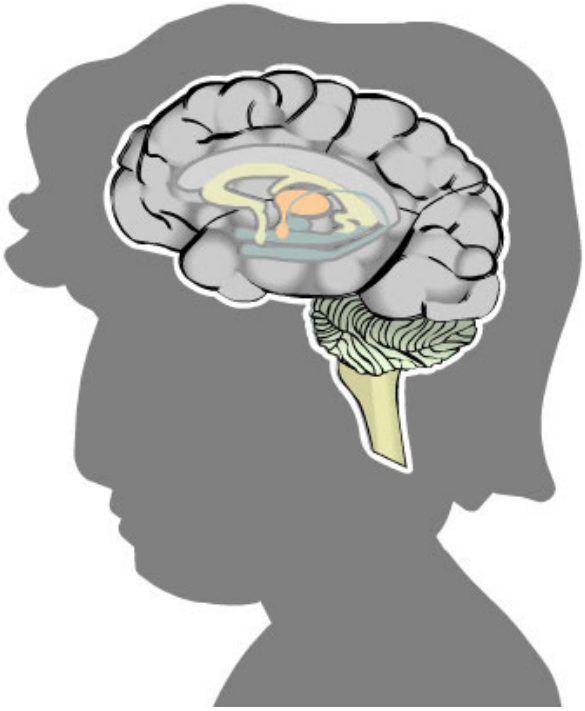
Is a prominent structure located above the brainstem

Brainstem

Connects the brain and the spinal cord

Controls heart rate, breathing, eating, and sleeping

Directs the spinal cord, other parts of the brain, and the body to do what is necessary to maintain these basic functions



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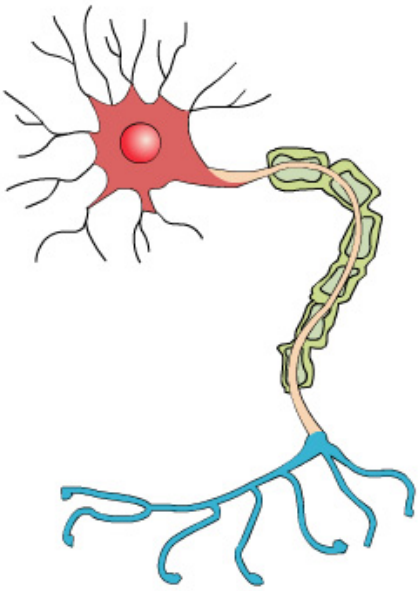
Why?

How?

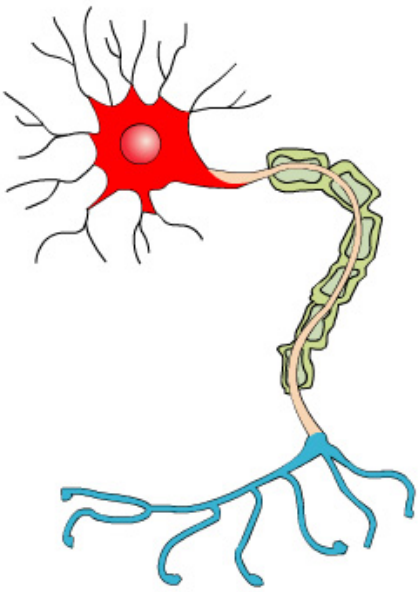
The Human Brain

Click on the active areas in the graphic to view information on different parts of the brain.



Cell Body

Directs all activities of the neuron



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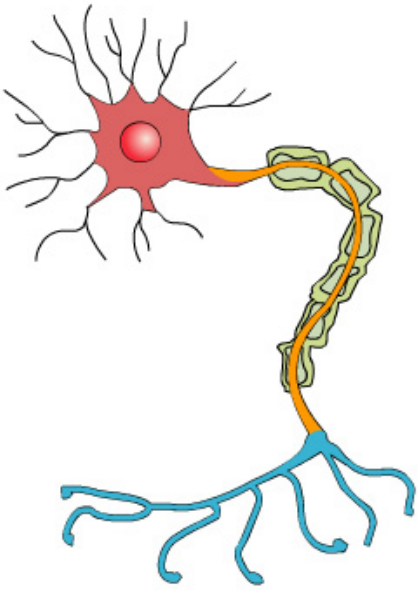
Axon

A long, single fibre

Transmits messages, which are in the form of electrical impulses, from the cell body to the dendrites of the other neurons or to body tissues such as muscles



Myelin

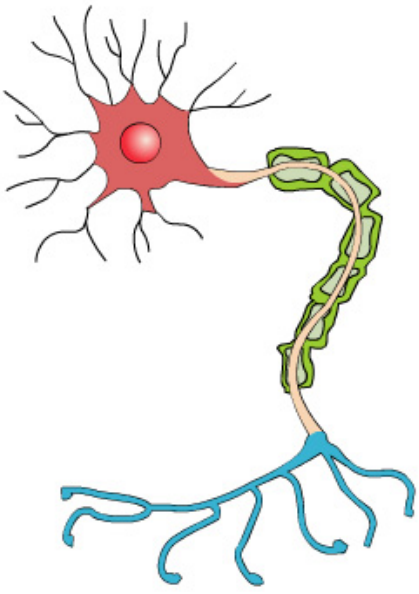
Substance that covers the axons of many neurons

Primary function is to increase the rate at which nerve impulses travel along the axon

The rate of conduction of a nerve impulse along a heavily myelinated axon can be as fast as 120 metres per second.

In contrast, a nerve impulse can travel no faster than about 2 metres per second along an axon without myelin.

The thickness of the myelin covering on an axon is closely linked to the function of that axon. For example, axons that travel a long distance, such as those that extend from the spinal cord to the foot, generally contain a thick myelin covering to allow faster transmission of the nerve impulse.



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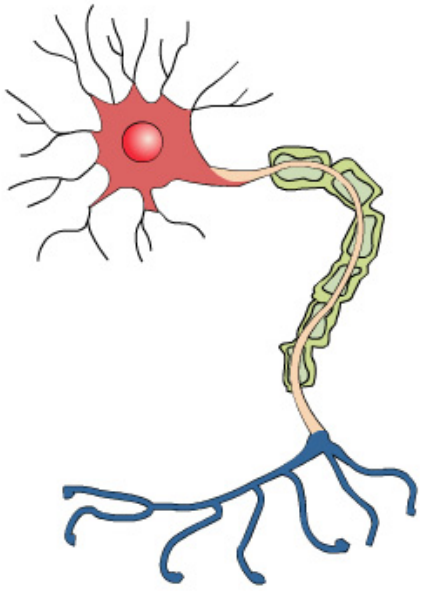
Dendrites

Short fibres that receive messages from other neurons and relay them to the cell body



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Why?

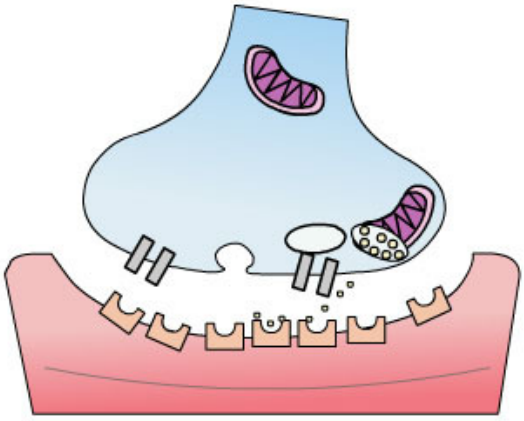
How?

Neurotransmission

The transfer of a message from the axon of one nerve cell to the dendrites of another

Communication between nerve cells occurs mainly through the release of chemical substances into the extremely small space between the axon and dendrites, known as the synapse.

When neurons communicate, a message that travels as an electrical impulse moves down the axon and toward the synapse.



Neurotransmitters

Are molecules released as the result of a message

Travel as electrical impulses, which move down the axon toward the synapse

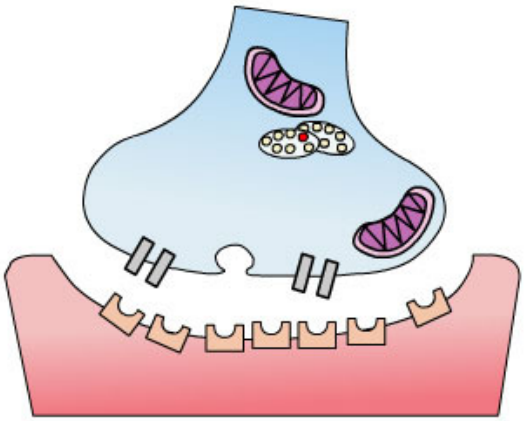
Diffuse across the synapse and bind to special molecules called receptors

Result in the stimulation or inhibition of an electrical response in the receiving neuron's dendrites

Act as chemical messengers, which carry information from one neuron to another

Have precise roles to play and only couple with specific receptor molecules

After the message carried by the neurotransmitter is processed by the receiving nerve cell, the neurotransmitter is deactivated in one of two ways. An enzyme breaks it down or it is reabsorbed back into the nerve cell that released it.



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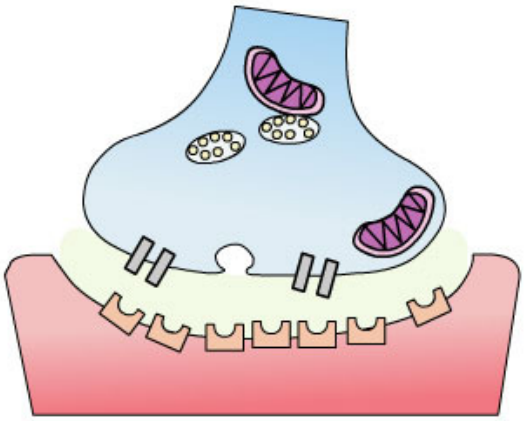
Synapse

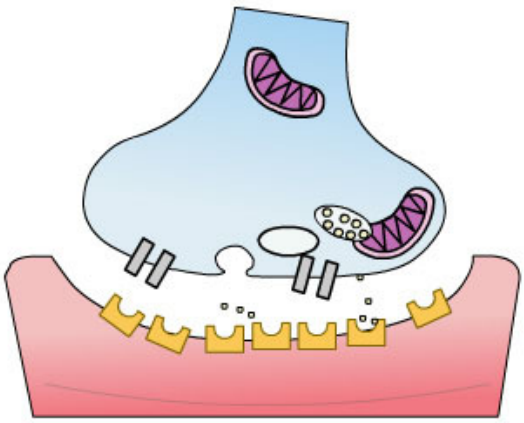
The space between the axon and dendrites, where nerve cell communication occurs



Receptors

Located within the cell membranes of the dendrites on a nerve cell

Bind only to very specific neurotransmitter molecules



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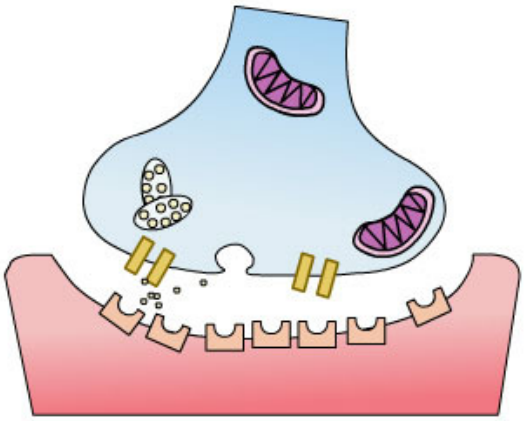
Transporters

Enable the re-absorption of neurotransmitters back into the nerve cell that released them

Pick up specific neurotransmitters from the synapse and carry them back across the cell membrane and into the axon

Reside in the cell membranes of the axons that release neurotransmitters



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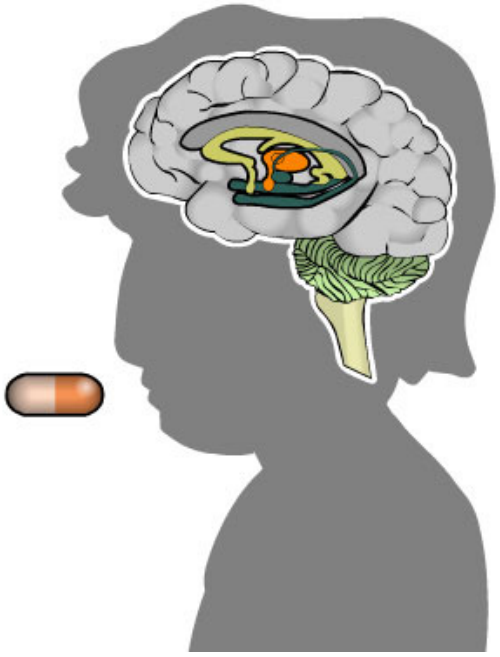

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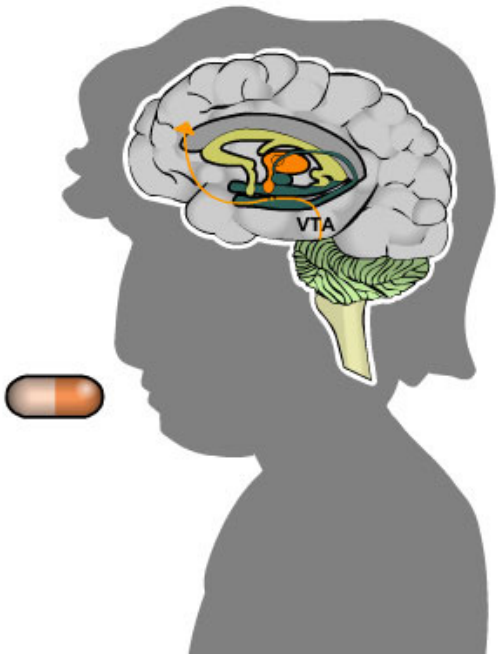
Pleasure Circuit

Known as the mesolimbic dopamine system

Messages begin at the ventral tegmental area, travel through the nerve cells in the limbic system structure called the nucleus accumbens, and finally reach fibres in a related part of the frontal region of the cerebral cortex.

All addicting drugs activate the brain's pleasure circuit.



Drugs of Abuse

Almost all drugs that change the way the brain works do so by affecting chemical neurotransmission

Drugs like heroin and LSD mimic the effects of a natural neurotransmitter.

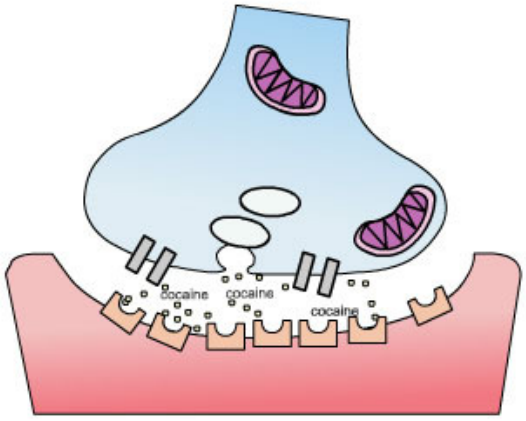
Drugs like PCP block receptors and thereby prevent neural messages from getting through.

Drugs like cocaine interfere with the molecules that are responsible for transporting neurotransmitters back into the neurons that released them.

Finally, drugs such as met amphetamine cause neurotransmitters to be released in greater amounts than normal.

Prolonged drug use changes the brain in fundamental and long-lasting ways. These long-lasting changes are a major component of an addiction.

At some point, a figurative "switch" in the brain "flips" during drug use. This change



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neurotransmission

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At some point, a figurative "switch" in the brain "flips" during drug use. This change marks the transformation from a drug abuser to a drug addict.