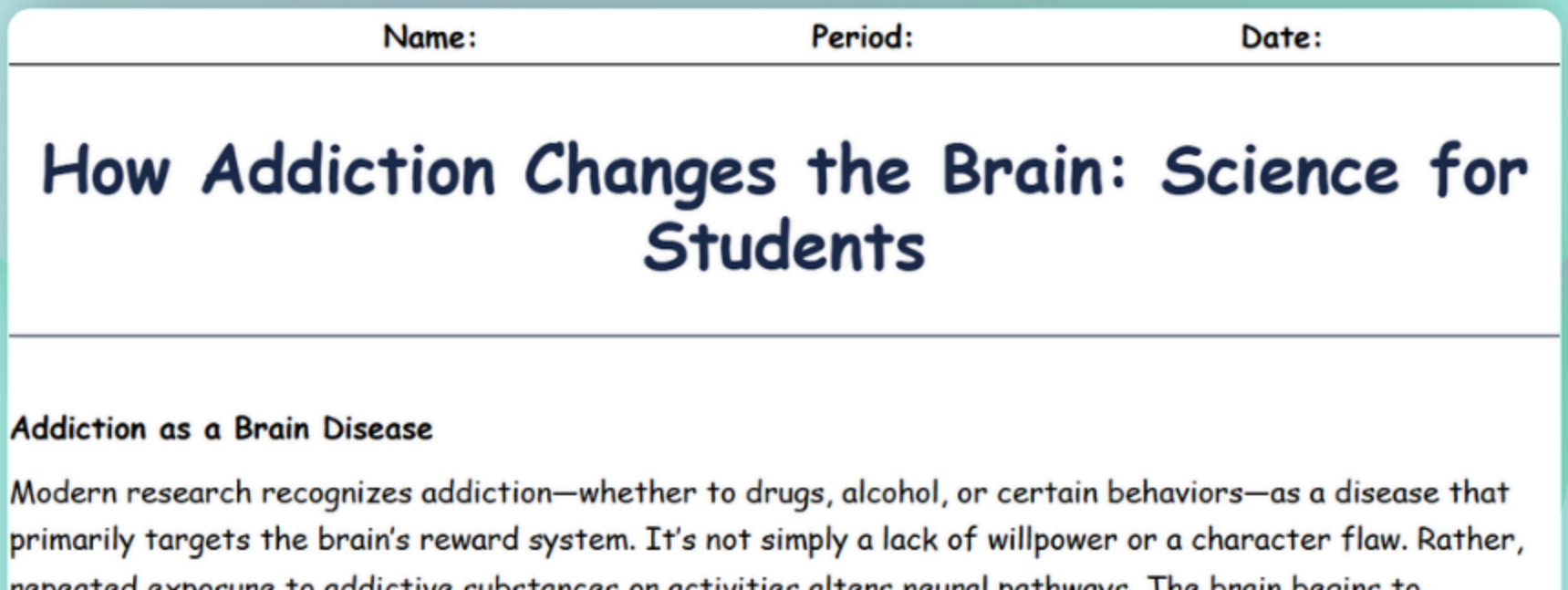
NO PREP

How Addiction Changes the Brain

Science for Students

Includes: Student reading, case study, differentiated questions, teacher key



Name: Period: Date:

How Addiction Changes the Brain: Science for Students

Addiction as a Brain Disease

Modern research recognizes addiction—whether to drugs, alcohol, or certain behaviors—as a disease that primarily targets the brain's reward system. It's not simply a lack of willpower or a character flaw. Rather, repeated exposure to addictive substances or activities alters neural pathways. The brain begins to

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Addiction as a Brain Disease

Modern research recognizes addiction (whether to drugs, alcohol, or certain behaviors) as a disease that primarily targets the brain's reward system. It's not simply a lack of willpower or a character flaw. Rather, repeated exposure to addictive substances or activities alters neural pathways. The brain begins to prioritize the substance above other necessities, such as food or social interaction. This can lead to compulsive use despite harmful consequences. Understanding that addiction is anchored in brain chemistry highlights why "just stop" is often an oversimplified solution.

The Role of Dopamine

At the center of addiction lies the neurotransmitter dopamine, which produces feelings of pleasure and reward. When someone uses a drug, such as cocaine or opioids, dopamine levels can skyrocket, creating intense euphoria. Over time, the brain adjusts by producing less dopamine on its own or reducing the number of dopamine receptors. This adaptation means the individual needs more of the substance to feel "normal," a phenomenon known as tolerance. Eventually, seeking that high becomes the person's primary focus, overshadowing relationships, academics, or other responsibilities.

How Drugs Hijack Brain Circuits

Drugs override the natural reward circuits that help us learn and repeat beneficial behaviors, like exercising or spending time with loved ones. Instead of these activities releasing dopamine in a controlled fashion, substances flood the brain, creating a powerful association between the drug and pleasure. This hijacking can make everyday joys feel dull in comparison. It also ingrains drug-taking habits so

deeply that people continue using even when they know it leads to negative outcomes like failing grades, lost jobs, or damaged relationships.

Teen Brains: Increased Vulnerability

Because a teenager's brain is still developing, addiction can form faster and with more lasting impact than in adults. Neural circuits related to decision-making and impulse control are among the last to fully mature, typically in the mid-20s. This developmental window means teens may underestimate risks, overvalue immediate rewards, and struggle more with self-regulation. Consequently, experimenting with drugs during this critical period poses a higher chance of creating deep-seated addictive patterns that persist into adulthood.

Recovery and Neuroplasticity

Despite the challenges, recovery is possible. The brain exhibits neuroplasticity, meaning it can reorganize and form new connections even after damage from substance abuse. Treatment often includes behavioral therapies, support groups, and sometimes medication to help stabilize brain chemistry. Over time, healthy habits—like regular exercise and balanced nutrition—can restore some of the natural reward pathways. Early intervention is crucial; the sooner someone receives help, the better the odds of reversing some of the damage and developing healthier coping mechanisms for stress or emotional pain.

Key Information: Brain Changes at a Glance

Process	Effect on the Brain
Dopamine Flood	Causes intense highs, reinforcing substance use
Tolerance	Requires increasing amounts of the substance to achieve the same effect
Withdrawal	Unpleasant symptoms when the substance is reduced or stopped
Neuroplasticity	The brain's ability to adapt, crucial for overcoming addiction

Case Study Excerpt

Carlos always considered himself a casual gamer. But during his sophomore year, he developed a strong interest in online gaming that went beyond fun. He'd play until the early morning, ignoring homework and skipping meals. Initially, his parents were just worried about his grades, but soon they noticed Carlos becoming irritable and anxious whenever he was forced offline. The thrill of winning matches and leveling up had begun to dominate his thoughts. Frustrated by repeated warnings, his parents took away his gaming console. Carlos experienced intense agitation, pacing the room, unable to concentrate on anything else. It mirrored the cravings and withdrawals seen in substance addiction. Recognizing the parallels, they sought help from a counselor specializing in behavioral addictions. Through therapy, Carlos learned about how repetitive rewards can retrain the brain to focus only on the source of dopamine—in this case, gaming. Over time, he gradually introduced healthier hobbies, like playing an actual sport and reconnecting with friends face-to-face. The transition wasn't immediate or easy. Yet Carlos's progress demonstrated that even non-substance-related behaviors could profoundly alter brain circuits, and that reclaiming balance was entirely achievable with the right support.

1. How did Carlos's experience illustrate the concept of addiction beyond substances?

2. What steps helped Carlos regain balance in his life?

Multiple Choice

1. Dopamine is a neurotransmitter that:

    a) Signals pleasure or reward, reinforcing behaviors

    b) Erases memories completely

    c) Lowers stress by making you sleepy

    d) Creates emotional numbness in the brain and eliminates all feeling

2. Neuroplasticity refers to the brain's ability to:

    a) Stop functioning whenever exposed to drugs

    b) Permanently lock in addictive patterns with no chance of change

    c) Adapt and form new neural connections even after damage

    d) Ensure every neuron remains the same from birth

3. Teen brains are more vulnerable to addiction because:

    a) Teen neural pathways are still developing, leading to increased risk-taking

    b) Teens have a lower intelligence level

    c) They can't experience dopamine

    d) Teens are already immune to common drugs, preventing any possible addiction

Matching

Write the letter of the correct definition on the line next to each term.

Term	Definition
1. ___ Tolerance	A) The use of a substance or behavior despite harmful consequences
2. ___ Withdrawal	B) The brain's capacity to reorganize and form new connections
3. ___ Addiction	C) The discomfort that occurs when a drug is stopped or reduced
4. ___ Neuroplasticity	D) Circuitry in the brain that reinforces behaviors by releasing dopamine
5. ___ Reward System	E) A need for increased amounts of a substance to achieve the same effect

Fill-in-the-Blank

1. _____ is the brain chemical heavily involved in reward and pleasure pathways.

2. A teen's brain is more susceptible to _____ development due to ongoing maturation.

3. _____ allows the brain to heal and adapt even after substance abuse.

Short Answer

Answer each question in 2-4 complete sentences.

1. Why is the concept of "just stop" often not sufficient for someone struggling with addiction?

_____

_____

_____

2. How does understanding the brain help in treating addiction?

3. What might be some non-drug examples of addictive behaviors?