**INSTRUCTOR GUIDE TEMPLATE**

**ACTIVITY TITLE: Drugs and the Brain**

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| \***Theme**: | The effect of drugs on the brain at cellular, molecular, and cognitive level |
| \***Objective**(s):  *(What key learning do you want students to come away with?)* | Learn about different types of neurotransmitters and synaptic connections and how drugs change their behavior |

**LESSON OUTLINE:**

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| **1. Introduction:**  *Plan a script of what you will say to start.*  *- What will this be about? Why’s it interesting?*  *(Hook)* | How do you feel before and after you drink Red Bull?  Have you ever been addicted to drugs?  Why do we have black-outs after having too much alcohol? |

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| **2. Building Background:**  *List questions you can use to immediately engage your audience and prepare their thinking for your activity.*  *-What prior knowledge might they have about/related to your topic?*  *-What prior knowledge (background) do they need for your activity?* | Q: Can you name drugs that might target the brain? What are some physical, psychological effects of these drugs? How would you categorize them?  A: Stimulants, Depressants, and Hallucinogens. Some drugs fall into multiple categories –e.g. marijuana  Q: Before we talk about how our brains look like under drugs, let’s talk about how our brains work normally.  A: Your brain takes information in through your surroundings, process it, and you respond to it. So your response can be an action, a thought, a mood, a behavior, a perception, or learning. For example, my senses tell me I’m cold when I walk outside. My brain helps me take that information and I decide to act: I’m going to go back inside to get a coat.  The brain can be divided into different parts and those parts have different jobs that they are mostly responsible for. These parts work both separately and together to form the output of the brain. Average adult male brain contains over 86 billion neurons. Neurons connect with and transmit information through connections called synapses. An electric signal will travel down the cell until it gets to the next cell where it has a connection. That connection is called a synapse.  Q: Let’s look at the synapse more closely.  A: when the electrical signal reaches the synapse of the signal sending cell it signals the cell to release factors into the space between the cells. These factors are called “neurotransmitters”  Q: How do neurotransmitters work?  A: They bind to receptors on the signal receiving cell and the electrical current travels to the receiving cell. When the signal sending cell is no longer stimulated, the neurotransmitters are cleared from the synapse or taken back up to be recycled for next time.  Q: Two types of synapses  A: Excitatory synapse is a synapse in which an action potential in a presynaptic neuron increases the probability of an action potential occurring in a postsynaptic cell. Inhibitory synapse, on the other hand, is a synapse in which the more presynaptic cell is activated, the less the postsynaptic cell is. |

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| **3. Lesson & Activity:**  *Outline the key components of your lesson.*  **Plan/Note**:  - key ideas/ vocabulary  - scaffolds  - images/media  - extension questions  \*Consider how to best deliver your content!  \*Plan interactive components that encourage active thinking in your students. | In this session, we will cover caffeine, alcohol, and marijuana.  Q: How do drugs cause such varied and specific effects?  A: Different drugs target different brain regions, neural pathways, neuronal types, and neurotransmitter receptors. All of these variables take action together generate variabilities in behavior.  Caffeine is a stimulant. After you have RedBull, you feel enhanced alertness and wakefulness, endurance, productivity and motivation, increased arousal and locomotion. Also your perception of hunger and fatigue decreases. It has been shown that the activity in the pituitary gland increases after caffeine intake. Functional MRI during an auditory odd ball task shows that the motor task related activity increases with caffeine intake.  Alcohol is a kind of depressants. Some of the behavioral changes includes anxiety reduction, pain relief, sedation, cognitive/memory impairment, euphoria, dissociation, and physiological changes. Alcohol acts as an agonist at inhibitory synapses and antagonist at excitatory synapses. Alcohol stimulates the release of beta-endorphins that bind to opioid receptors, thereby releasing dopamine. Dopamine release is associated with the pleasurable, reinforcing and rewarding effects of alcohol.  Stroop Test: can be a measure of cognitive flexibility  Adolescents with family history of alcohol use show increased activation in the frontal lobe during the Stroop test.  Q: How might a stimulant affect one’s performance on the Stroop?  Marijuana is both a depressant and stimulant. Behavioral effect varies, including relaxation, stimulation, hallucinations, and paranoia. We have endogenous cannabinoid receptors to which marijuana bind to and activate. Some of the side effects of cannabinoid receptor activation include increased lipogenesis, increased insulin resistance, and decreased satiety. Compared to non-smokers, marijuana smokers demonstrated significantly lower anterior cingulate activity during Stroop task. |

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| **4. Wrap Up:**  *- Review key ideas*  *- Share takeaways and final thoughts*  *- Discuss connections to other questions and ideas. Extensions.*  *- Ask: Who could you teach what you learned here today?*  *- Ask/Suggest: What can I do to learn more?* | Most drugs targeting the nervous system act by changing synaptic transmission. They can reduce or increase transmission. They can act at excitatory or inhibitory synapses.  With the changes in these synaptic connections, drug use can alter how brain regions and networks operate.  Neuroimaging studies show different BOLD response under the influence during a cognitive task (auditory oddball task, Stroop Task) |

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| **MATERIALS NEEDED: *\*\*(please list all items and quantities necessary for preparation)*** |
| Slides |

\*\*attach any printouts to end of document here

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| **Other Notes** |
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**Extra Resources:**



