

Messing with the Message

The Effects of Drugs on Your Brain



National Drug Facts Week

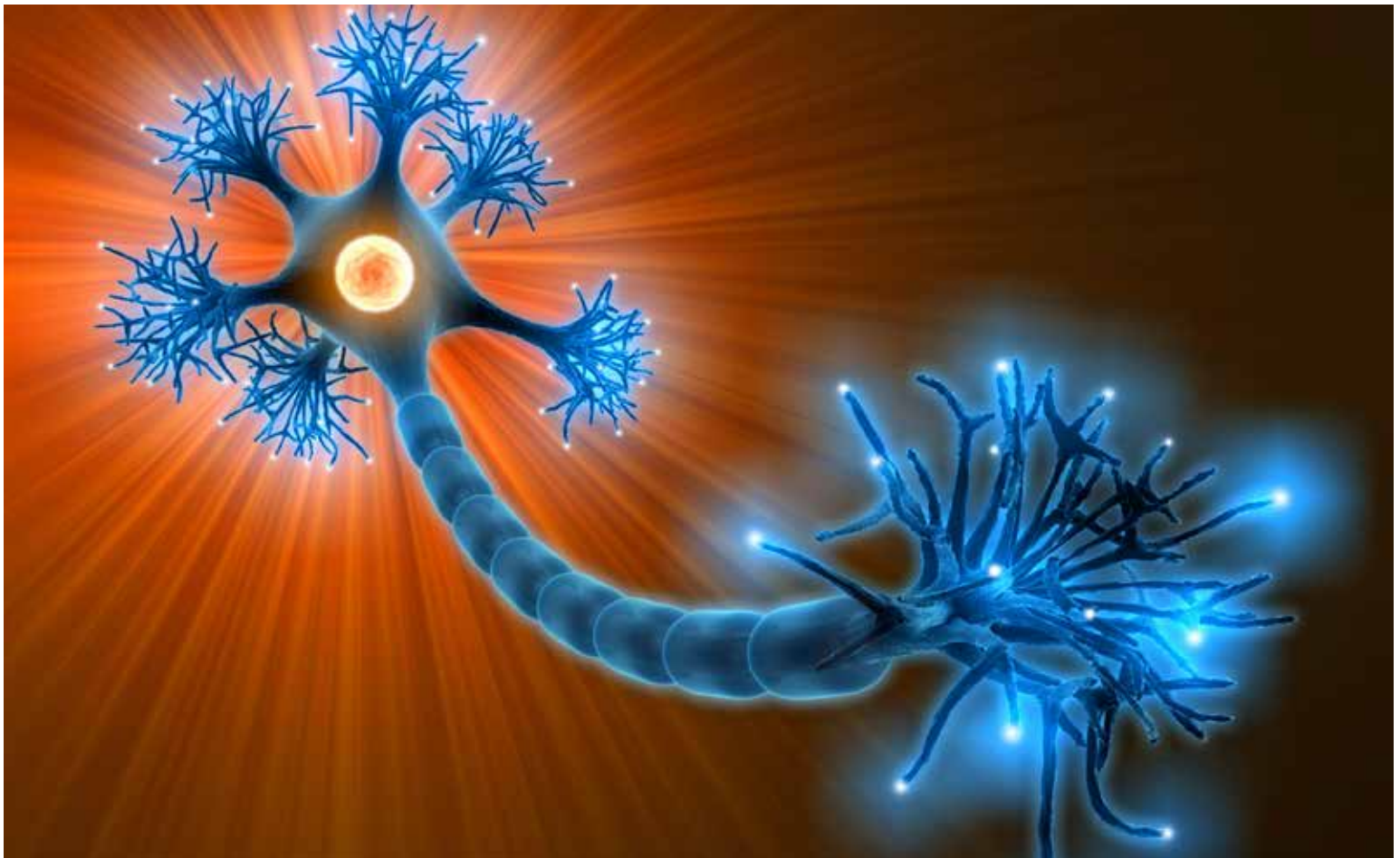
Activity Packet



National Drug Facts Week occurs annually on the last week of January. While drug prevention, healthy decision making, and healthy living concepts are critical teaching topics throughout the year, NDFW is a time to highlight the importance of these challenges. NDFW brings together teens and scientific experts to discuss the myths about drug use and addiction. During this week, youth are encouraged to conduct community events and share their success stories. NDFW is sponsored by the National Institute on Drug Abuse (NIDA).

“Messing with the Message” provides a framework for youth to learn more about the effects of drugs on their brains. They will more closely examine the effects drugs have on the messages their brains send and receive every day. Through the main activity and supplemental lesson, youth will gain an understanding of the effects of drugs on the brain. “Messing with the Message” is especially designed for middle school youth, although could be adapted for other grade and skill levels.

The program is designed to acts as a gateway for youth to engage in National Drug Facts Week activities. Test participants’ knowledge by taking the NDFW quiz as an additional activity or as a take home supplement. The NIDA site at: <http://teens.drugabuse.gov/national-drug-facts-week>.





Messing with the Message



Making the Connection

The human brain is a small part of your body but it can perform more jobs than the most powerful computer! Your brain directs almost everything you do; it is the command center of your body.

Your brain helps you to see and hear, smell and to taste, remember how to count, and recognize family members. It controls what we call voluntary actions (those you consciously initiate) such as throwing a ball, and involuntary actions (those that unconsciously happen) such as breathing and reflexes. Your brain also controls your emotions and behaviors.

Your brain has the ability to focus on the messages around us. Sometimes that focus to attention is disrupted by things in our environment such as our friends poking us during a quiet time in class. This disrupts our thinking and makes us change our focus. It also irritates our teachers! Sometimes that message is disrupted by the substances we put into our bodies such as drugs, alcohol and tobacco.

Every second your brain is sending and receiving millions of messages. These messages are sent by special cells in the brain called neurons. Through the next two sections of the activity, youth will learn about neuron cells in the brain, how they send messages between cells, and the effects of drugs on those messages.

The first component of the activity helps youth visualize the cells in the brain responsible for sending and receiving messages, neurons. Through the building of the neuron cell youth will have a tactile model they can reference when the action phase in section two is added. The activity as a whole is designed to engage multiple learning styles. The youth see the picture of the neuron, build their own model, label the parts, play a reinforcing kinetic game to learn about sending the message, and then process how the information can help them make better decisions.

DRUGS – Reference to other drugs includes those drugs not permitted by law (illegal) and lawful drugs (prescription or over-the-counter) which are obtained or used illegally unless otherwise specified.

Objectives:



Participants will:

- Understand the effects of drugs on the brain.
- Experience how drugs can alter the messages sent within the brain.
- Identify potential consequences of drug use.
- Engage in discussion and planning to teach others the effect of drug use.

Time Needed

45 minutes

Suggested Age Level

Middle School Age Youth –

Lessons may be adapted for a variety of age and skill levels.

Materials Needed

- Large 8" or 9" paper plates, (one per student or team)
- Small 6" paper plates
- Hand wipes or paper towels
- Sugar cookies (best if ordered from a grocery bakery) - to represent the cell body
- White icing - to represent the cytoplasm
- Plastic spreaders
- Various candies (or large sprinkles) - to represent organelles
- Pull-apart red string licorice - to represent dendrites and axons
- Mini-marshmallows - to represent myelin
- Colored pencils or markers for labeling each neuron part, or toothpicks, notecards, tape and pencils for labeling.
- Plastic bags for students to take neuron model home (This is a great step to engage the learner in teaching what they learned.)
- Balloons
- Pipe Cleaners – Optional – depending on which model constructed (See Appendix A).



Messing with the Message



Experience the Activity

Step 1.

Build your neuron.

As an aid, hand out the neuron diagram (or post in front of the room) so the participants can model their edible neuron. The building of the neuron can be done in pairs or as individuals.

Step 2.

Start with the cell body (the cookie). Frost the cookie to represent the cytoplasm of the cell. Explain this is the fluid that fills the cell where all of the organelles and nucleus are found. The youth can think of these as similar to the organs in their body, each one has a specific role and function in the cell. The organelles can be represented by the large sprinkles or candy added on top of the frosting.

Step 3.

Each participant is given two pieces of string licorice. The first piece will be used to make the dendrites. To do this, participants will break the string into 3-4 short pieces and place the end of each short piece into the cytoplasm (icing) at the top of the cookie. This makes the neuron appear as if it is having a bad hair day! The other longer piece is placed at the bottom of the cookie with one end in the cytoplasm (icing) and the other extending off of the plate. This piece of licorice represents the axon of the neuron.

Step 4.

This is a good time to define and explain the basic processes in the neuron. An analogy of a telephone receiver works well to describe the dendrites and axon. A telephone has an earpiece to listen through (the receiving end, or dendrites) and a mouthpiece to speak into (the sending end - i.e., the axon). For more advanced students, the composition of the dendrites and axons can be elaborated upon, and the concept of the myelinated axon can be introduced.

Advanced Content Resource

<http://science.education.nih.gov/supplements/nih2/Addiction/default.htm>

Step 5.

Next have youth use the mini-marshmallows to represent the myelin, which will wrap around the axon (licorice). An insulated electrical cord works as a good visual. Myelin is a fatty-like substance that wraps around the axons to keep the electrical current moving down the axon.

Building a Neuron

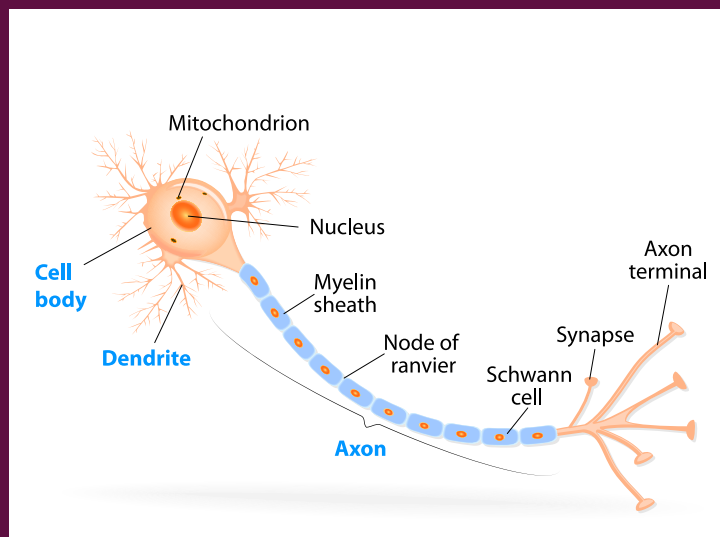


The neuron cell being built acts as a physical representation of the transmitting and receiving system in the brain. This can be related to the way people communicate. Through verbal communication the person sending the message, the transmitter, says the message. The person listening, the receiver, gets the message. The transmitting of messages in the brain can be thought of as a conversation but instead of using words the brain uses chemicals called neurotransmitters to send its messages. By creating a neuron model, students will gain an understanding of the parts of the neuron and its function in sending and receiving messages.

Depending on the age of the group, the level of detail used to describe the neuron can be adapted to match the level of understanding. For this lesson, the most important component will be what happens between the neurons in the synapse. If time allows, spending more time learning about each individual component of the neuron cell is an excellent way to deepen the learning of participants.

Ease of Teaching Tip

Additional online activities can be found at: The Science of Addiction: Genetics and the Brain (<http://learn.genetics.utah.edu/content/addiction/>).





Messing with the Message



Step 6.

After the students have created their model they will label each part of the neuron on their paper plate. Labeling may be done in a number of ways depending on the size of the neuron (cookie) on the paper plate. Using colored pencils or markers, students may label the neuron parts directly on the paper plate. Students may also construct “flags” from note cards, toothpicks and tape to label each neuron part. Labeling the neuron is an important step in the process.

Step 7.

Students can make a simple circuit by connecting their axon to the dendrite of a neighboring student’s cookie. Leave a gap between the axon and the dendrite, representing the synaptic space. This serves as a launch point for a discussion of the synapse, transport of chemical neurotransmitters from the cell body down the axon to the synapse, and release of chemical neurotransmitters in response to a change in electrical potential of the membrane.

Step 8.

The impact of drugs such as cocaine on this process, and the physical changes the neuron undergoes can now be introduced and explained.

To learn more about the concepts of communication in the brain visit: Drugs, Brains, and Behavior: The Science of Addiction (<http://www.drugabuse.gov/publications/drugs-brains-behavior-science-addiction/drugs-brain>).

Ease of Teaching Tip

If it is not possible to bring food for the group being instructed, a low cost alternative using pipe cleaners may be substituted. You will need five different colors of pipe cleaners to represent the different parts of the neuron.

Processing Questions



Processing and Generalize - These are examples of questions which can be asked to deepen the learning and help the intentional review and application of the information you just covered.

Share:

- What did you just create?
- How are the dendrites and axon in your model like a telephone?
- How did your neuron model communicate with other neurons?

Process:

- What was the best part about making a neuron model?
- Why would it be important for a neuron to have all of its components?
- What do you think might damage a neuron in your brain?

Generalize and Apply:

- How did making the cookie model help you in your understanding of a neuron?
- What do you think might happen in your brain if your neurons are damaged?
- Why would this information be important to you?



Messing with the Message



Experience the Activity

Step 1.

Remind the group in the first part of the activity that they created their own model of a neuron. One of the main roles of the neuron is to send and receive messages in the brain. The neurons they created normally work together to send and receive messages. When people use drugs, they can change the way messages are sent, received, and processed. Drugs can do this in a number of ways. Drugs may flood the space between the neurons, called the synapse, and they may imitate the brain's natural chemical messengers. For a more thorough discussion on drugs and their specific action on the brain, refer to resources found on the NIDA website such as: Drugs + Your Body on the NIDA for Teens website - <http://teens.drugabuse.gov/interactives-and-videos>.

Students will now participate in the telephone game to experience a simulation of the effects of drugs on their brains.

Step 2.

Ask your group to form a large circle. If you have a large group you may need to form more than one. Groups of around 15 work well.

Step 3.

Tell the youth they are now giant neurons. They are going to use their mouth, representing the axon terminal, to send a message. The message they will be sending uses sound as the vehicle to relay the message. In the brain, the message would be sent by specially-designed chemicals called neurotransmitters.

Next ask the group what will act as the receiver for the sound message? You may explain your ears will receive the message, representing receptors in the dendrite.

Step 4.

To model the transmission process, you are now going to play a game of telephone. Start with something simple and have the group try to get the phrase from one end of the circle to the other. The instructor should come up with the phrase to help prevent inappropriate phrases. An example could be "Using drugs will rewire your brain".

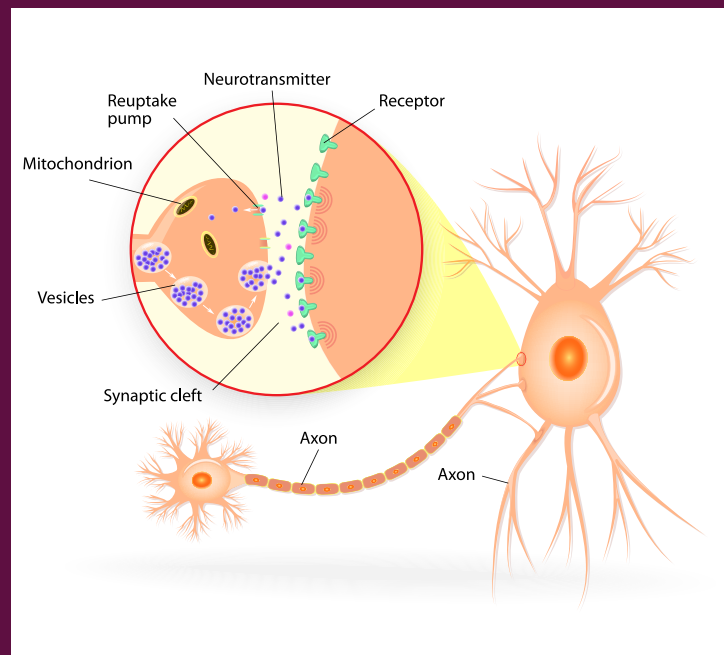
Ease of Teaching Tip

Instead of you explaining the rules, ask if anyone in the group has played the game. If someone has, ask for one of them to explain the rules for the rest of the group.

Transmitting a Message



The brain has billions of neuron and nerve cells working to pass messages back and forth. Think of the brain as your "mission control" coordinating everything you say, do, and feel. In the next part of the activity youth will act as the communication network in the brain. They will attempt to send a simple message from one neuron (a person) to another. Through the game they will experience the effect of drugs on the process of trying to send and receive messages.





Messing with the Message



Step 5.

Explain when a person uses drugs, the way the message is sent, received, and processed can be changed. For example, drugs like heroin and marijuana can turn on neurons because they act like natural neurotransmitters in your brain. Drugs are not the same as the chemicals in the brain so they cause abnormal or messed up messaging in the brain.

Step 6.

Participants will again play the telephone game with some modifications. This time while playing the game you are going to add a level of complication. While the neurons (youth) are attempting to send their message, they will also be distracted with the task of keeping one balloon up in the air the whole time the message is being sent. Make sure to reinforce that the goal is to get the message all the way around the circle.

Explain that some drugs act to flood the synapse (the space between the cells where the chemical message is sent and received) with huge amounts of chemicals, changing the way the neurons work. This flooding messes with the messages our brains send. This is represented in our model by the balloon. The extra concentration it takes to keep the balloon in the air messes with the message being sent by the participants.

Step 7.

After the youth go through the game once, if time allows, have them try again increasing the difficulty. For example, some of the dendrites were harmed by the toxic drugs so they can only use one arm to keep the balloons in the air, etc. Again always go back to the end goal. Did they get the original message all the way around the circle?

Step 8.

Have the youth take home their neuron models to teach what they have learned to their parents / friends. Youth might consider a more formal presentation or show and tell activity as a 4-H club demonstration or demonstration for another organization.

After completing the “Messing with the Message” initial lesson, which introduces the concept of how the brain sends messages and the effects of drugs on that process, continue with the supplemental lessons included in this packet. These are designed to deepen and expand learning.

Processing Questions



Processing and Generalize - These are examples of questions which can be asked to deepen the learning and help the intentional review and application of the information you just covered.

Share:

- What is the goal of the telephone game?
- What part of the brain were you acting like when sending the message?

Process:

- Describe how the brain sends messages.
- How did the balloon act like a drug?
- What were the effects of the drugs (adding distractions) on your success of sending the message?
- Was it easier or harder to send the message with more distractions? Why?

Generalize and Apply:

- How might drugs affect things you want to do in real life?
- Why is it important to know what drugs can do to your brain?

Expanding the Activity

Youth should visit the NIDA web site to test their drug facts knowledge during National Drug Facts Week! The web site may be accessed at: <http://teens.drugabuse.gov/national-drug-facts-week>. In addition to the Drug Facts Quiz, there are a number of excellent resources designed especially for youth.



Messing with the Message – Supplemental Lesson The Human, Human Brain

Making the Connection

Our brains are divided into several different regions, each with a specific function. When we complete the daily tasks in our life, whether these are voluntary tasks or involuntary tasks, it requires different parts of our brains to be used or activated. The neurons in these regions start to fire. Remind students of their neuron model and let them know that neurons are inside their brains. By creating a human model of the human brain, your students will have the opportunity to see firsthand how their brains are activated and how drugs can mess with the messages our brains send and receive.

Preparing for the Activity

1. Use the diagram of the human brain with the different regions identified.
2. Using yarn or twine, create that shape on the floor of your classroom.
3. Prepare the Brain Informational cards for each youth, one card per youth, to represent the different regions of the brain. Sample informational cards are found at the end of the packet. Adjust the number of cards for your particular group size. The frontal lobe is larger than the occipital lobe, thus more students would hold frontal lobe informational cards.
4. Prepare drug fact cards. Samples are found at the end of the packet. Additional information concerning the effects of drugs on the different parts of the brain may be accessed from <http://teens.drugabuse.gov/educators/nida-teaching-guides/mind-over-matter>

Objectives:

Participants will:



- Relate brain function to their daily activities.
- Develop an awareness of the effects drugs have on those daily functions.

Time Needed

45-60 minutes

Materials Needed

- Picture/Model of human brain
- Yarn/Twine
- Brain Informational Cards
- Drug Informational Cards
- Large index cards or other paper for Informational Cards.
- Resource Materials





Messing with the Message



Experience the Activity- Part 1

Step 1.

Divide the students into different groups representing the different regions of the brain. Give each youth a Brain Informational card listing the designated brain region and functions of that region on the card in colored ink. Students can imagine that they are neurons in the brain ready to fire.

Step 2.

Arrange students on the floor model of your brain to represent the different regions.

Step 3.

Ask students to complete each of the following activities in succession:

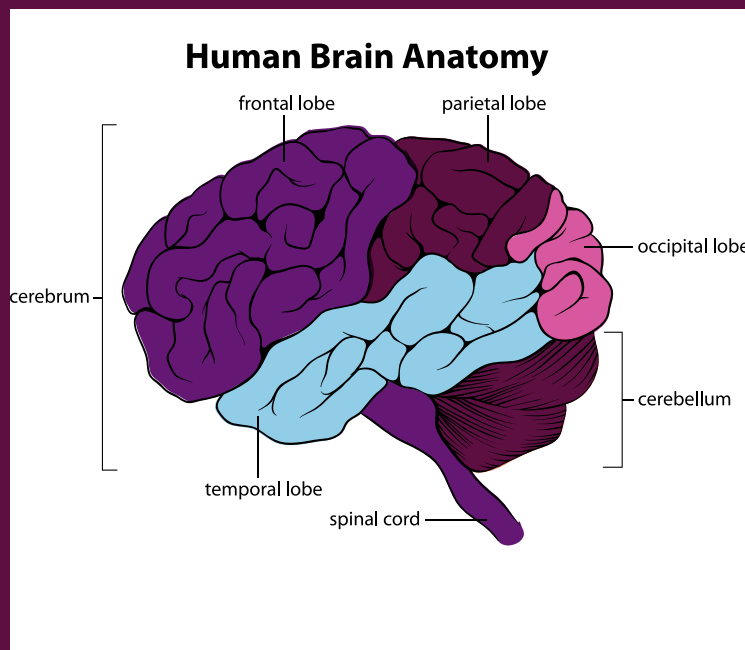
- a. Think about a special place you would like to be right now. Make a picture of this place in your mind. What does this place look like?
- b. Listen to the sounds in the room around you. What do you hear? How many different sounds can you detect?
- c. Clap your hands, one time, two times, three times. Play patty-cake with a partner.
- d. Run in place for ten seconds. Skip for 15 seconds. Do ten jumping jacks.
- e. Swallow three times. Blink your eyes at a friend. Feel the pulse in your arm.
- f. Think of a time when you were really scared. What did that feel like? What were you doing?
- g. Remember a fun time you had at you had last year. What were you doing? How did you feel? Who was with you?
- h. Find a spot on your arm and give yourself a little pinch!

Transition for Ease of Teaching Tip

With these tasks, you have activated, or “lit up” many different parts of your brain. A simple task such as clapping your hands requires the coordination of millions of nerve cells in your brain all acting together to get the signals to your hands to move. Let’s take a look at each of these tasks and see which areas of your brain they activated.

Ease of Teaching Tip

Depending on the age and knowledge of your students, you may make this next section as basic or as in-depth as you choose. You may discuss more specific regions in the brain and their functions with more advanced learners. The resources listed will guide you through a more detailed discussion.





Messing with the Message



Experience the Activity Part 2

Step 1.

While sitting in the Human Brain Model, and through guided discussion, students will review the different regions of the brain and the functions of each using their informational cards.

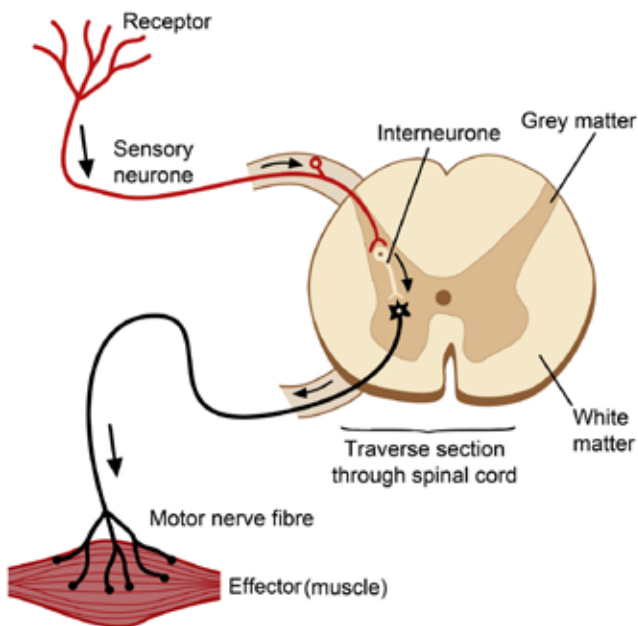
Step 2.

One by one, review each of the above tasks that the students just completed in Part 1 of the activity. As you are going through these tasks, ask students to stand up if they believe that specific task has activated their assigned region of the brain. Students should use their informational cards as a resource.

Step 3.

Students should begin to realize that specific parts of the brain are responsible for certain tasks that we perform every day. They should also realize that more difficult tasks require multiple parts of the brain to successfully complete them.

Spinal Reflex Arc



Processing Questions



These are examples of questions which can be asked to deepen the learning and help the intentional review and application of the information you just covered.

Share:

- What did you find interesting about being a part of the human brain?
- What tasks did you find more difficult?
- Which tasks were easier for you?

Process:

- When did your region of the brain have the opportunity to "stand up"?
- What surprised you when you stood up?
- What did you notice about the parts of the brain?

Generalize and Apply:

- How does the brain work together?
- What happens if one part of the brain become dysfunctional or stops working?
- Why would this information be important to you as you work in school or at home?

Transition for Ease of Teaching Tip

Your brain is an amazing organ working together as the command center of your life! Sometimes people make the choice to take drugs. Different drugs have effects on different parts of your brain and this can affect your thoughts, emotions and actions. As you could tell from your lesson on Transmitting the Message, taking drugs can mess with the message coming in and going out of your brain.



Messing with the Message



Experience the Activity Part 3

Youth can take turns reading the informational cards, on each of the selected drugs to determine which part of the brain is affected by this drug.

Step 1.

As students are still arranged in their human brain model, students will stand when their brain region is affected by each particular drug.

Step 2.

This lesson contains only a few examples of different drugs and their effects on different regions in the brain. For more detailed information on how drugs affect the different regions in the brain, or for more examples, access: <http://teens.drugabuse.gov/educators/nida-teaching-guides/mind-over-matter>

Sources:

Dana Alliance for Brain Initiatives & Center for Educational Outreach, Baylor College of Medicine, More Mind Boggling, www.dana.org/WorkArea/DownloadAsset.aspx?id=44477

Dana Alliance for Brain Initiatives & Dana Center. It's Mindboggling, www.dana.org/kids/lesson.cfm

National Institute on Drug Abuse, Mind Over Matter, The Brain's Response to Drugs Teacher's Guide, <http://teens.drugabuse.gov/educators/nida-teaching-guides/mind-over-matter>

Processing Questions



These are examples of questions which can be asked to deepen the learning and help the intentional review and application of the information you just covered.

Share:

- What types of human activities, emotions, behaviors are affected by these different chemicals?

Process:

- How does this relate to the tasks you did earlier in this exercise?
- When more than one area of the brain is effected by a drug, what are the consequences?

Generalize and Apply:

- How do drugs mess with the messages in your brain?
- How did this activity have an impact on your understanding of drug abuse?

Expanding the Activity

Youth should visit the NIDA web site to test their drug facts knowledge during National Drug Facts Week! That web site may be accessed at: <http://teens.drugabuse.gov/national-drug-facts-week>. In addition to the Drug Facts Quiz, there are a number of excellent resources designed especially for youth.



Frontal Lobe

Motor Functions

Higher Order Functions –

Thinking

Decision Making

Planning

Reasoning

Judgment

Impulse Control

Memory

The place where personality is formed

Meaningful and fluent speech

Temporal Lobe (Limbic System Structures)

Responsible for processing auditory information from the ears.

Auditory Perception

Memory

Speech

Emotional Responses

Visual Perception

Hearing

Selective Listening

Brainstem

The region of the brain that connects the cerebrum with the spinal cord

Automatic body functions:

Swallowing

Breathing

Sneezing

Heart beat

Eye movements

Spinal Cord

Pathway for nerve signals to and from the brain

Coordination of reflex actions, like jerking your hand away from something hot or moving your arm away when someone pinches you!

Cerebellum

Controlling balance and movement

**Remembering things that you already know how to do,
like running and jumping, reading and writing**

**Processing some types of memory. Remembering and thinking
about your memories, like thinking about your summer vacation or a happy memory.**

Occipital Lobe

Responsible for processing visual information from the eyes.

Important for you to be able to correctly understand what your eyes are seeing.

Visual Perception

Color Recognition

Parietal Lobe

Process sensory information that has to do with taste, temperature and touch.



Messing with the Message



The Human, Human Brain

Informational Cards – Drug Facts and your Brain

- Copy each informational card.
- Students will take turns reading about each of the drugs.
- As students notice that the part of the brain that they are representing is affected, they should stand up.
- Students will begin to see how the brain is affected by drugs and notice the different effects that has on their ability to function.

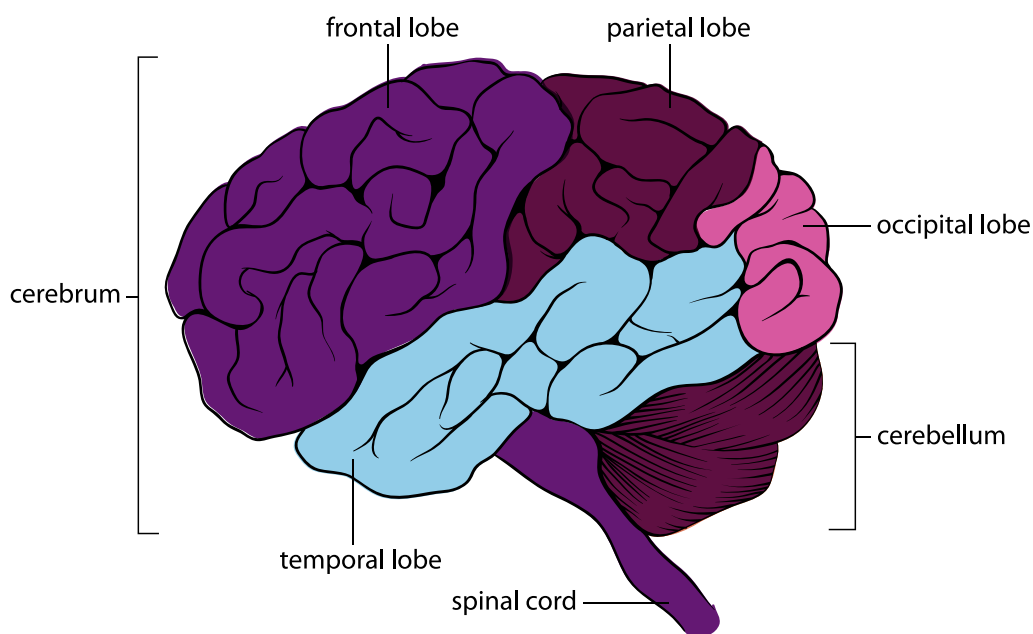
Action Steps:

1. Stand up if your part of the brain is affected by this drug.
2. Which of the activities that you did earlier in this lesson would be difficult to do under the influence of this drug?
3. What other types of activities would be impaired by this drug?
4. How would this drug affect your everyday life?

Resource:

National Institute on Drug Abuse, Mind Over Matter, The Brain's Response to Drugs Teacher's Guide, <http://teens.drugabuse.gov/educators/nida-teaching-guides/mind-over-matter>

Human Brain Anatomy



Marijuana

- Active ingredient is tetrahydrocannabinol (TCH)
- TCH binds to certain receptors in your brain.
- TCH interferes with functioning of the cerebellum.
 - The cerebellum is most responsible for balance, posture, and coordination of movement.
- TCH can affect the hippocampus which is found in the temporal lobe.
 - This involves your memory
 - TCH can permanently damage this part of your brain leading to permanent memory loss.
- TCH causes you to feel calm euphoria. It causes you to see, hear and feel things differently. Users may have slower reflexes.
- Long term marijuana use may produce changes in the limbic system.

Methamphetamine

- This is an addictive drug and is known as a stimulant.
- This drug is made illegally with inexpensive over-the-counter ingredients like drain cleaner, battery acid and antifreeze.
- Methamphetamine effects the cerebrum which includes the four lobes of the brain, the frontal, temporal, occipital and parietal lobes.
 - The cerebrum is involved in movement.
 - It can also cause swelling or bleeding in the cerebrum.
- Methamphetamine can cause short term effects such as increased physical activity, decreased appetite, increased respirations and body temperature, seizures and aggressiveness.
- Long term effects can include stroke, violent behavior, paranoia and addiction.

Steroids

- Anabolic steroids are like the male and female hormones in your body but are used by some people to increase muscle size.
- They are taken in a pill or they may be injected.
- This drug especially affects the cerebellum and temporal lobe.
 - The temporal lobe controls things like learning, memory and moods.
- When a person takes this drug, the messages sent to the brain are changed.
- This drug will decrease normal hormones your body produces.
- Taking steroids can impair your learning and memory.
- People may have mood swings, bad judgment, violent behavior, aggression and psychotic symptoms.

Opiates

- Opiates are powerful drugs that come from the poppy plant.
- They can be used to help a person not feel pain.
- Most of the drugs are used to control pain and when used as directed by a doctor are not harmful.
- But, when used incorrectly, they can be VERY addictive.
- Opiates include opium, heroin, morphine and codeine.
- Opiates attach to receptors in the brain.
- Opiates cause intense feelings of pleasure that is very brief followed by a period of relaxation.
- These feelings can lead to addiction.
- Opiates also work on the respiratory center in the brainstem which causes a slowdown in activity.
 - Too much of an opiate can cause the respiratory centers to shut down breathing causing a person to stop breathing and die.