Teaching Materials

Nothing to Rave About:
Episode One

©2003 Rice University

The Reconstructors® is a product of the Center for Technology in Teaching and Learning, Rice University and is funded by the Science Education Drug Abuse Partnership Award, R25DA15063, from the National Institute on Drug Abuse, National Institute of Health.
Episode One Briefing: Contents

OVERVIEW

We hope that you and your students extend The Reconstructors® adventures with activities designed to cover related learning objectives. The activities described in the teaching package are intended for use both before and after students have “played” Episode 1: Nothing to Rave About of The Reconstructors®. The files may be printed for classroom use ONLY.

Feel free to adapt these activities to your own classroom needs. Another resource that we suggest is the National Institutes of Health (NIH) web site at http://www.nih.gov. For specific information on drugs, go to the National Institute on Drug Abuse at http://www.nida.nih.gov. This site contains some excellent resources and teaching materials.

If you have specific questions, please contact us.

The Reconstructors Team
reconstructors@rice.edu

EPISODE BRIEFING

Synopsis of Episode (for Teachers) ......................................................... 3
National Science Education Content Standard Correlations ..... 4
Vocabulary Terms ............................................................................. 5
Mission Log ..................................................................................... 7

EPISODE DEBRIEFING

Activity 1 Drug Beat .......................................................................... 9
In this activity, the student will conduct an experiment to learn how two common drugs affect the heart rate of an invertebrate animal.

Activity 2 Brain Base ....................................................................... 19
The student will learn about different parts of the brain by creating an image database on the different activities controlled by the brain.

Activity 3 It’s All in Your Mind......................................................... 26
In this activity, the student will carry out a demonstration in order to understand the concept of sensory perception.
Episode One Briefing: Nothing to Rave About Synopsis

This synopsis is provided as an overview for TEACHERS. We advise teachers NOT to hand this out to the students prior to playing the adventure since much of the suspense will be eliminated.

It is 2253, eleven years after a plague killed millions and caused the collapse of civilization. The student is a member of the Reconstructors, an elite team charged with safeguarding public health in this dark time. The student’s mission is to uncover why there has been a dramatic increase in the number of teens admitted to the emergency room. Many of these teens had been partying at Buzzko, a local dance club, prior to becoming ill.

Helios, a worried Buzzko employee, has secretly hidden a package near the club. Its contents may contain the answer to the mysterious teen illnesses. The student and Eureka, the medical information robot, are sent by Alpha, the Reconstructor leader, to retrieve the package. After navigating through an interactive maze of streets, the two find an unconscious teen lying in an alleyway. A scan reveals that his name is Rune. His blood pressure and body temperature are elevated, and he has an accelerated heart rate just like the other sick teens have had.

Rune is transported to the hospital by emergency medical services. Eureka and the student find the package stashed in a dumpster and take it back to the Online Reconstructor Base (ORB). Inside the box are two kinds of pills, a vial of liquid, and a note from Helios. The note states that the package contains drugs from Club Buzzko; youth take certain ones so that they can dance longer.

Beta, the chief science officer, thinks that the drugs might be stimulants, which can make a person feel full of energy and which can increase heart rate. Beta and the student test the drugs on water fleas (Daphnia) to see if any of the substances make the animals’ hearts beat faster. Two different graphs of the heart rate data are generated because of a computer glitch. The student must select the correct graph and analyze it to determine that both types of pill (designated Drug B and Drug C) appear to be stimulants.

Delta, the robot scout, presents information on different stimulants, their properties, their historical roots, and the parts of the brain they commonly affect. Next, Delta and the student go to the hospital to talk to Rune. They discover that Rune took some pills similar to the ones that Beta and the student tested. Delta surmises, based on Rune’s description of the drug’s effects, that the drug he took had both stimulant and hallucinogenic properties. Delta checks the student’s knowledge of these types of drugs by having him/her perform an interactive stimulant/hallucinogen sorting exercise.

Back at the ORB lab, Beta states that she is pleased with how well the case is going. The teen health mystery should be solved soon. Her conversation is disrupted when she notices a puddle forming on the floor next to the door. When she opens the door, water rushes in, and the lab begins to flood.

END OF CURRENT EPISODE
### Episode One Briefing: Correlation with Standards

**National Science Education Content Standard Correlation**  
**Grades 5-8**

<table>
<thead>
<tr>
<th>Instructional Objective</th>
<th>Science Content Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Identify which parts and functions of the brain are affected by stimulants.</td>
<td>Standard C: All students should develop understanding of structure and function in living things.</td>
</tr>
<tr>
<td>• Distinguish the physiological effects of a stimulant and a hallucinogen.</td>
<td>Standard A: All students should develop abilities necessary to do scientific inquiry.</td>
</tr>
</tbody>
</table>
| • Interpret data and draw conclusions from virtual experiments on the effects of certain drugs on heart rate. | Standard A: All students should develop understandings about scientific inquiry.  
Standard E: All students should develop understandings about science and technology. |
| • Recognize that certain substances are abused stimulants and hallucinogens. | Standard F: All students should develop understandings of personal health. |
Episode One Briefing: Vocabulary Terms

Students will encounter all of the words below while playing Episode One: Nothing to Rave About. The definitions are contained within the adventure in the InfoArchives, available through the folder icon on the toolbar. Teachers should also alert the students to the ability to click on the hot-linked words in the game. After the game, teachers may want to review the new vocabulary words with the students.

addiction – a disease in which a person compulsively performs a behavior even when there are negative consequences.

amphetamine – a stimulant made in the laboratory. Also known as “speed.” Can be used medically to treat narcolepsy (a sleep disorder), attention deficit hyperactivity disorder, and obesity.

attention deficit hyperactivity disorder (ADHD) - a condition in which someone has difficulty paying attention, sitting still, and controlling impulses.

caffeine – stimulant naturally found in coffee.

cocaine – a stimulant derived from the coca plant. It is addictive and can be injected or snorted. As a crystal form, “crack,” it can be smoked.

Daphnia – small, aquatic invertebrates closely related to shrimp and lobsters.

ephedra – a stimulant naturally found in some plants. Until 2004, it was an ingredient in energy bars and drinks. It was removed from the market because it was linked to heart palpitations, arrhythmias, seizures, and death.

hallucinogen - a drug that can alter mood, distort the five senses, and change perception of time and space.

hallucination – An experience of seeing or hearing something that does not exist.

LSD – a powerful hallucinogen derived from lysergic acid and found in ergot, a type of fungus. In addition to producing hallucinations, some of which can be terrifying, it can cause disturbing thoughts and feelings. Some users experience flashbacks, reliving the drug-induced hallucinations.

magic mushroom – a mushroom that contains a hallucinogen, such as psilocybin. Its effects are similar to those of mescaline and LSD.
methamphetamine – a powerful stimulant related to amphetamine. It is addictive and has limited medical uses. Street names include crank, meth, speed, ice, and crystal.

mescaline – a potent hallucinogen found in the peyote cactus. Native peoples in Mexico and in the southwestern US use it to induce visions during religious ceremonies.

nicotine – a mild but very addictive stimulant found in tobacco.

obesity – an excessive amount of body fat.

organ – a complex structure, such as the eye or heart, that performs a special function. An organ is made up of different kinds of cells.

prescription – written instructions from a licensed health professional that authorize the purchase and use of a particular drug to treat a medical condition.

PCP – an addictive hallucinogen which can cause feelings of detachment, paranoia, and violent behavior. Street names include angel dust, wack, and ozone.

spinal cord – a bundle of nerves running inside the backbone. The spinal cord carries information between the brain and the body. It also coordinates most reflexes.

stimulant – a substance that increases feelings of alertness. It can also increase body temperature, heart rate, breathing rate, and blood pressure.

vital sign – an indicator of general health, such as heart rate or blood pressure.
**Teacher Version**

TEACHER DIRECTIONS: Ask students to complete the right-hand column as they move through the game. Answers are provided here, but page 8 has a master that can be copied for students as a handout.

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the mission set in the present, past, or future?</td>
<td>future</td>
</tr>
<tr>
<td>Who is the leader of the Reconstructors?</td>
<td>Alpha</td>
</tr>
<tr>
<td>What is the mystery that the Reconstructors need to solve?</td>
<td>They need to find out why there has been a dramatic increase in the number of teens admitted to the emergency room.</td>
</tr>
<tr>
<td>Which three vital signs are elevated in Rune and in the other teens that have become ill?</td>
<td>heart rate, blood pressure, and body temperature</td>
</tr>
<tr>
<td>Who is the Chief Science Officer?</td>
<td>Beta</td>
</tr>
<tr>
<td>Which drugs increased heart rate in the <em>Daphnia</em> experiment?</td>
<td>drugs B and C</td>
</tr>
<tr>
<td>According to Beta, what type of drug can increase heart rate and make you feel full of energy?</td>
<td>a stimulant</td>
</tr>
<tr>
<td>Name five stimulants.</td>
<td>caffeine, nicotine, cocaine, amphetamine, and methamphetamine</td>
</tr>
<tr>
<td>What are some specific brain areas that stimulants can affect?</td>
<td>the cerebral cortex, hippocampus, nucleus accumbens, amygdala, and brain stem</td>
</tr>
<tr>
<td>What are hallucinogens?</td>
<td>drugs that can affect your sense of time and can change how things feel, taste, smell, sound, and look to you</td>
</tr>
<tr>
<td>What are four examples of hallucinogens?</td>
<td>LSD, mescaline, PCP, magic mushrooms</td>
</tr>
<tr>
<td>What happens to the lab that Beta and Eureka are in at the end of the story?</td>
<td>It starts flooding.</td>
</tr>
</tbody>
</table>

**Conclusions:** Teens in Neuropolis are becoming ill from a drug that can act like a **stimulant** and a **hallucinogen**.
**Episode One Briefing: Mission Log**

Name: ______________________  Class: __________  Date __________

**STUDENT INSTRUCTIONS:** Record your observations by correctly answering the following questions as you play The Reconstructors® Episode 1: Nothing to Rave About.

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the mission set in the present, past, or future?</td>
<td></td>
</tr>
<tr>
<td>Who is the leader of the Reconstructors?</td>
<td></td>
</tr>
<tr>
<td>What is the mystery that the Reconstructors need to solve?</td>
<td></td>
</tr>
<tr>
<td>Which three vitals signs are elevated in Rune and in the other teens that have become ill?</td>
<td></td>
</tr>
<tr>
<td>Who is the Chief Science Officer?</td>
<td></td>
</tr>
<tr>
<td>Which drugs increased heart rate in the <em>Daphnia</em> experiment?</td>
<td></td>
</tr>
<tr>
<td>According to Beta, what type of drug can increase heart rate and make you feel full of energy?</td>
<td></td>
</tr>
<tr>
<td>Name five stimulants.</td>
<td></td>
</tr>
<tr>
<td>What are some specific brain areas that stimulants can affect?</td>
<td></td>
</tr>
<tr>
<td>What are hallucinogens?</td>
<td></td>
</tr>
<tr>
<td>What are four examples of hallucinogens?</td>
<td></td>
</tr>
<tr>
<td>What happens to the lab that Beta and Eureka are in at the end of the story?</td>
<td></td>
</tr>
</tbody>
</table>

**Conclusions:**
Teens in Neuropolis are becoming ill from a drug that can act like both a ________________ and a _________________.

*The Reconstructors®  8  Nothing to Rave About: Episode 1*
ACTIVITY 1: DRUG BEAT

In this activity, the student will conduct an experiment to learn how two common drugs affect the heart rate of an invertebrate animal.

Background

In Episode One, the student performs a virtual experiment on a Daphnia (water flea) to test the effects of drugs obtained in the story line. Two of the three drug samples increase heart rate, a response expected from stimulants. In the following activity, the students will test two common drugs with stimulant and sedative properties.

Alcohol and caffeine are just two of the drugs that many people use with little or no knowledge of the potentially toxic effects on their bodies. Alcohol is a very powerful sedative. Other sedatives include barbiturates, tranquilizers, quaaludes, and Valium. Sedatives are used to relieve anxiety, but they can also reduce heart rate, relax muscles, and slow breathing rate. On the other hand, nicotine and caffeine are stimulants. The common effects of stimulants are increased heart rate, blood pressure, and breathing rate.

Both stimulants and sedatives can affect heart rate. In this experiment, the students will use a solution of alcohol and a solution of caffeine to test the effects of each of these drugs on the heart rate of Daphnia, a small invertebrate crustacean also known as a water flea.

NOTE: Daphnia is a good subject because:

- Stimulants and sedatives affect the heart rate of a Daphnia and the heart rate of a human in a similar way.
- One can easily see the beating heart in a live Daphnia.
- Using a microscope, a Daphnia’s heart rate can be determined.
Learning Objectives

The student will:
1. Conduct an experiment with two common drugs to determine their effect on *Daphnia*.
2. Determine whether the drugs are sedatives or stimulants by looking at their effect on heart rate.

Materials

1. Solutions of caffeine and alcohol
   a. Caffeine. 100 ml of regularly-brewed coffee (suggested dilution).
   b. Alcohol. 10 ml of gin in 90 ml of water (suggested dilution).
2. Droppers (one per solution)
3. Culture of *Daphnia* (can be ordered from Carolina Biological Supply Company – http://www.carolina.com)
4. Light microscopes
5. Microscope slides (depression without a cover slip)
6. Timers for each group

Optional Materials

You can provide other drugs. Some ideas include:
- Nicotine. Soak two cigarettes in about 200 mL of water overnight.
- Aspirin. Crush two or three non-buffered tablets in 100 mL of water.
- Sleeping pills. Crush two or three in 100 mL of water.
- Diet pills. Crush two or three in 100 mL of water.

Procedure

1. Before class, prepare all the drug solutions and obtain *Daphnia* in their culture medium.
2. Make a transparency of the sheet *Drug Beat: The Effects of Drugs on Daphnia Heart Rate*.
3. Designate a “holding station” for the used *Daphnia*. After the students are finished with the *Daphnia*, they can place their slides in a designated place. You can rinse them off later. The *Daphnia* should not be reused.
4. Separate the class into groups of three or four students.
5. Distribute the *Drug Beat Student Activity Sheets*.
6. Explain to the students that they will be testing the effects of two common drugs on the heart rate of the *Daphnia*, a water flea.
7. Give a brief description of each of the drugs and the *Daphnia*. Instruct students to write this information down in the information section of the *Drug Beat: Experimental Write-up* handout.
8. Ask the students to perform the experiment and complete the student activity sheet.
9. **The Experiment.** NOTE: As written, each group will receive one *Daphnia* for each drug they test. However, *Daphnia* can be expensive. Adaptations can be made to decrease the number of *Daphnia* used, such as giving each group one *Daphnia* and one of the two drugs to test. Below are the directions for an experiment in which each group will test both drugs (alcohol and caffeine).

10. Give each group one slide containing one *Daphnia* in a drop of culture water.

11. After the students count the basal heart rate, drop one to two drops of one type of drug (stimulant or sedative) on each group’s slide. Only the instructor should distribute the drugs due to the dangerous nature of these substances.

12. Have the students count the affected heart rate; then use the transparency of *Drug Beat: The Effects of Drugs on Daphnia Heart Rate* to compile all the data from the class. Record the class average.

13. Repeat steps 10-12 for the second drug.

14. Ask the students to complete the *Drug Beat Experimental Write-up*.

15. Have the students graph the class data.

**Extension Activities**

- **Visual Arts:** Make a flipbook of a heart beating. Use the flipbook to demonstrate slow and fast heart rates.
- **History:** Research the medical use of alcohol, nicotine, aspirin, and caffeine.

**Standards**

National Science Education Standards, Grades 5-8

- Science Content Standard A: All students should develop abilities necessary to do scientific inquiry.
- Science Content Standard F: All students should develop understanding of personal health.

**Books**

Web Sites

- Drugged-Out *Daphnia*
  http://www.wested.org/werc/earthsystems/biology/daphnia.html

- MEDLINEplus: About Your Medicines

Drugs and Alcohol: Caffeine
http://wso.williams.edu:8000/orgs/peerh/drugs/caffeine.html
The Effects of Drugs on *Daphnia* Heart Rate

<table>
<thead>
<tr>
<th>Drug A</th>
<th>Drug B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Number</td>
<td>Basal Rate (beats/min)</td>
</tr>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td></td>
</tr>
<tr>
<td>Class Average</td>
<td></td>
</tr>
</tbody>
</table>
ACTIVITY 1: DRUG BEAT

People generally believe that strong drugs require a prescription. However, in the course of common, everyday activities, we may encounter very strong drugs. In this experiment, you will see how common drugs can affect the heart rate.

Materials

- *Daphnia*
- light microscope
- timer or watch with second hand
- pencil or pen
- graph paper

Procedure

1. This experiment is done in groups.
2. Read through the *Drug Beat: Experimental Write-up Student Activity Sheet* and follow the instructions there.
Hypothesis:
If a drug is a stimulant, it will __________________________.

If a drug is a sedative, it will __________________________.
**Procedure and Results:**
For each *Daphnia*, you will need to obtain the starting heart rate and the heart rate after drug exposure.

1. Each group will get a slide containing one *Daphnia* in a drop of culture water. If the animal moves too much, carefully remove a little of the culture medium using the corner of a paper towel.

2. Place the slide under the microscope and count the *Daphnia*’s heartbeats for 10 seconds. Repeat three times and record the data below.

**Basal Heart Rate of Daphnia #1**

1st Count ________ 2nd Count ________ 3rd Count ________ 4th Count ________

3. To determine the average, add up the counts above and divide by 4.

**Average count/ 10 sec (add counts 1 through 4 and divide by 4)** ________

3. Now you have the average for 10 seconds. To get the average for **one minute** (60 seconds), multiply the average from above by 6.

**Beats per min (multiply average by 6)** ________

4. Record this number as the basal rate for *Daphnia* #1 in the summary table at the end of this section.

5. Your instructor will then place two to three drops of Drug A on the *Daphnia*.

6. Wait about one minute after the drug has been added so that the drug has time to take effect.

7. Determine the heart rate as above to calculate the affected rate for *Daphnia* #1.

**Daphnia #1 with Drug A**

1st Count ________ 2nd Count ________ 3rd Count ________ 4th Count ________

Average count /10 sec (add counts 1 through 4 and divide by 4) ________

**Beats per min (multiply average by 6)** ________

8. Record the average number as the affected rate for Drug A in the summary table.

9. After you have recorded the data, bring the *Daphnia* to the holding station.
10. Get a second *Daphnia* slide and measure the basal heart rate. Record it below.

**Basal Heart Rate of Daphnia #2**

1st Count ________ 2nd Count ________ 3rd Count ________ 4th Count ________

Average count (add counts 1 through 4 and divide by 4) ________

Beats per min (multiply average by 6) ________

11. Have your instructor add Drug B. Wait one minute, and count the *Daphnia*’s heart rate again. Record below.

**Daphnia #2 with Drug B**

1st Count ________ 2nd Count ________ 3rd Count ________ 4th Count ________

Average count (Add counts 1 through 4 and divide by 4) ________

Beats per min (multiply average by 6) ________

12. When you are finished counting, bring the *Daphnia* to the holding station.

13. Fill in the class averages for both drugs in the summary table.

### Summary Table

<table>
<thead>
<tr>
<th>Daphnia #</th>
<th>Basal Rate (beats/min)</th>
<th>Affected Rate (beats/min)</th>
<th>Change in Heart Rate (beats/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class Average, Drug A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class Average, Drug B</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

14. Using your graph paper, draw a bar graph of the class’ average data.
Episode One Debriefing: Student Activity Sheet

Answer the following questions:

What was the effect of Drug A on the Daphnias’ heart rate?

What was the effect of Drug B on the Daphnias’ heart rate?

Which drug(s) acted like a stimulant? How did you come to that conclusion?

Which drug(s) acted like a sedative? How did you come to that conclusion?

What are some sources of experimental error?
BRAIN BASE

In this activity, students will learn the names and functions of some parts of the brain and how these are affected by stimulants and hallucinogens.

Background

The brain has been called the most important organ in the body. It controls both voluntary and involuntary activity. The brain determines how fast your heart will beat, when and how you laugh, and if you can remember the capital of Florida. It not only determines who you are and what you think, but whether you are considered to be alive. A person is considered dead when their brain stops functioning, regardless of how healthy their other organs are.

The brain is a complicated network of neurons and support cells. One way to divide the brain is by function. Different parts of the brain have different functions. However, a single bodily activity may be controlled by many different parts of the brain. Also, each part of the brain has more than one function.

Below is a table of some parts of the brain that are affected by stimulants and hallucinogens.

<table>
<thead>
<tr>
<th>Brain Part</th>
<th>Function(s)</th>
<th>Effect of Stimulant</th>
<th>Effect of Hallucinogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>cerebral cortex</td>
<td>thinking, planning, decision-making, perception (sense of taste, touch, smell, hearing, vision)</td>
<td>altered thinking</td>
<td>altered thinking, altered sensory perceptions</td>
</tr>
<tr>
<td>cerebellum</td>
<td>balance, coordination, sense of time, movement</td>
<td>loss of coordination</td>
<td>altered sense of time, feeling that time is going faster than it actually is</td>
</tr>
<tr>
<td>brain stem</td>
<td>controls breathing, heart rate</td>
<td>increases breathing and heart rate</td>
<td>depressed breathing</td>
</tr>
<tr>
<td>hippocampus</td>
<td>learning and memory</td>
<td>learning and memory problems</td>
<td>learning and memory problems</td>
</tr>
<tr>
<td>amygdala</td>
<td>emotion, mood and energy</td>
<td>increased energy</td>
<td>altered mood</td>
</tr>
</tbody>
</table>
Learning Objectives

The student will:

- identify different parts of the brain.
- match the parts of the brain with the functions they control.
- know how stimulants and hallucinogens affect the brain.

Materials

- Brain Base: Parts of the Brain (two separate diagrams)
- Brain Base Student Activity Sheets
- poster board
- old magazines
- scissors
- glue
- paper
- markers

Procedure

1. Have the class bring in old magazines from home to cut up.
2. Make transparencies of the Brain Base Student Activity Sheet and both of the Parts of the Brain diagrams.
3. Hand out the two Parts of the Brain diagrams and the Parts of the Brain activity sheet.
4. Discuss the different parts of the brain that are labeled on the transparencies and the functions associated with each of them. (If a desired part of the brain is not labeled, please feel free to alter the image.)
5. Have the students fill in the Parts of the Brain activity sheet. They should write down the functions involved with each of these parts while you discuss them.
6. Ask the class to give examples of each of the brain functions under discussion. For instance, if the cerebellum is being discussed, movement is one of the functions, and running could be an example activity.
7. Discuss the effect of stimulants and hallucinogens on each part of the brain.
8. Separate the class into small groups.
9. Distribute the scissors, glue, magazines, poster board, and markers.
10. Explain that the Reconstructors would like to create an image database of the functions of these parts of the brain. The students’ job is to make a poster with images representing the functions of one of the parts of the brain and the effects produced by stimulants or hallucinogens on the brain part in question.
11. Assign each group a part of the brain to research.
12. Have the class make a poster of their assigned part of the brain. Ask students not to label their poster with the name of the brain part they have been assigned.
13. Have each group present the poster to the class, describing the images that have been glued on the poster board.

14. The class should try to guess the part of the brain that is represented.

Extension Activities

- *Visual Arts*: Make a model of the brain using clay.
- *History*: Investigate how the functions of different parts of the brain were discovered.

Standards

National Science Education Standards, Grades 5-8

- Science Content Standard C: All students should develop understandings of structure and function in living systems.
- Science Content Standard F: All students should develop understanding of personal health.

Books


Web Site

- Neuroscience for Kids
  [http://faculty.washington.edu/chudler/neurok.html](http://faculty.washington.edu/chudler/neurok.html)
BRAIN BASE

Alpha is creating an image database which will give examples of functions that the brain controls and will explain how drugs affect the brain. Help him create this database by cutting out magazine images of different functions controlled by the brain.

Materials

Student Activity Sheet  scissors
poster board  glue
old magazines  paper
markers

Procedure

1. Pick up all your materials.
2. As your teacher discusses the different parts of the brain, fill in the Parts of the Brain table. You will use this information to create your poster.
3. After you have been assigned a part of the brain, write it on the top of one side of the poster board. This is your title. You can write each of the names of the group members at the bottom of the poster board.
4. Using the Brain Base: Parts of the Brain diagrams, color in your assigned part of the brain using your markers.
5. Paste the diagram underneath your title. (The other side of the poster board should still be empty.) See example below.

6. Cut out images that represent examples of functions related to your assigned brain part. For instance, if the brain part is the cerebellum, the function involved can be movement, and an example could be running. Pictures that represent running include: a person running, a running shoe, a running shoe store, a track, or even the word ‘run.’
7. If you cannot find pictures that represent good examples, you can draw these images using the markers and blank paper.
8. On the top of the blank side of the poster, write the title “Image Database.”
9. About halfway down the poster, write “stimulant” and “hallucinogen.” Paste examples of the effects of these drugs below those words. For example, the cerebellum helps you to keep track of time. To show the effect of hallucinogens, you might cut a picture of a clock in two.
10. Paste the images that you cut out of the magazine underneath each title. Pictures can be arranged as a collage.
11. When everyone is finished, present the poster to the class. Have the class try to guess the part of the brain that your poster represents.
12. After all the guesses have been made, flip over your poster to show the answer.
BRAIN BASE
Parts of the Brain Diagram

cerebral cortex

brain stem

cerebellum
BRAIN BASE
Parts of the Brain Diagram

cerebral cortex
amygdala
hippocampus
brain stem
cerebellum
**INSTRUCTIONS:** The brain is the control center for your entire body. It controls everything from breathing to moving your muscles. For each of the listed brain parts, identify the functions that each controls and provide examples. The information on the cerebellum is provided as an example.

<table>
<thead>
<tr>
<th>Brain Parts</th>
<th>Function(s)</th>
<th>Examples</th>
<th>Effect of hallucinogens</th>
<th>Effect of stimulants</th>
</tr>
</thead>
<tbody>
<tr>
<td>cerebral cortex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cerebellum</td>
<td>movement</td>
<td>running</td>
<td>makes it seem that time is going by faster than it actually is</td>
<td></td>
</tr>
<tr>
<td>brain stem</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>hippocampus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>amygdala</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Activity 3: IT’S ALL IN YOUR MIND
The brain has the ability to accurately perceive what is going on in the body and in the environment. However, drugs can alter this perception and make what is fiction seem like fact. In this activity, students will learn about perception.

Background
Sensing the environment around us requires the coordination of three different parts of our nervous system: the sense organs, the nerves, and the brain. Sense organs, such as the eyes, ears, or temperature receptors in our skin, provide us with information about the world around us. The nerves carry information from the sense organs to the brain. The brain interprets the information delivered through the sensory nerves.

For example, temperature sensors in the skin of our fingers are sensitive to hot and cold. These receptors are connected to nerves which travel from the hand through the elbow and the spinal cord to the brain. Sensory information entering the brain through the brain stem arrives at a part of the brain called the thalamus. The brain almost instantly senses how hot or cold the thing that the fingers are touching is. The brain then interprets the physical information that it has received. This interpretation is called perception.

Some drugs, such as hallucinogens, can alter our perception of the world and our feelings. Some hallucinogens are very strong and some are weak. Strong hallucinogens, like LSD, can cause people to hear voices that don’t exist, see things that are not there, and feel things that are not real.

3,4-Methylenedioxymethamphetamine (MDMA or Ecstasy) is a drug with mild hallucinogenic properties. It can alter the brain’s perception of sight, touch and time.

This activity was adapted from the Mind over Matter Teacher’s Guide from the National Institute on Drug Abuse.
Parts of the Brain and What They Do

This image can be found at the National Institute of Mental Health website:
Learning Objectives
The student will:
1. discuss perception and the way that the brain is able to detect sensory information.
2. learn about the effects of hallucinogens on the brain’s ability to perceive.
3. participate in an activity that demonstrates sensory perception.

Materials
1. It’s All in Your Mind Student Activity Sheet
2. bowls (one per group)
3. ice cold water

Procedure
1. Discuss with your class the definition of sensory perception and the way that the brain is able to recognize various cues in the environment. Use the Parts of the Brain and What They Do handout to point out different brain areas involved in the perception of stimuli.
2. Divide the class into groups of three or more.
3. Each group should sit at a table with a bowl. Assign one student to put ice water in the bowl.
4. Ask each student to roll up his or her sleeve on one arm so the elbow is uncovered.
5. Have one or two students put their elbows into the bowl. Ask students to notice what their hand feels like.
6. Most students will notice that not only the elbow feels cold but also the fingers, even though their fingers are not touching the ice water.
7. Have each student fill out the activity sheet as you discuss the results with the class.
8. NOTE: The last question on the student sheet does not have a single right answer. Possibilities include not feeling cold that is actually there or feeling cold when the body is not actually exposed to cold.

Extension Activities
- Science: Research the areas of the brain associated with each sensory system.
- History: Investigate the history of the development of LSD.
- Science: Research how a hallucinogen interacts with the brain to cause its effects.
Standards

National Science Education Standards, Grades 5-8

- Science Content Standard C: All students should develop understanding of structure and function in living systems.
- Science Content Standard F: All students should develop understanding of personal health.

Books


Web Sites

1. The Physiology of Perception
   http://sulcus.berkeley.edu/FLM/MS/Physio.Percept.html
2. Neuroscience Tutorial
   http://thalamus.wustl.edu/course/
3. Mind Over Matter: Hallucinogens
   http://www.drugabuse.gov/MOM/HALL/MOMHALL1.html
4. Neuroscience for Kids
   http://faculty.washington.edu/chudler/neurok.html
Activity 3: IT’S ALL IN YOUR MIND
In this activity, you will learn about how the brain functions when sensing its environment.

Materials
1. It’s All in Your Mind Student Activity Sheet
2. bowl
3. ice water

Procedure
1. Get into groups of three or more.
2. Each group will sit at a table with a bowl. Have one person get ice water for the bowl.
3. Each person should roll up one sleeve and put his/her elbow into the ice water.
4. Each person should note how his or her elbow and fingers feel.
5. When everyone has had a chance to experience the effect, or when your teacher calls time, fill out the activity sheet.
Episode One Debriefing: Student Activity Sheet

IT'S ALL IN YOUR MIND

Data Sheet

Name: ____________________________________________

1. How did your elbow feel in the ice water?

2. How did your fingers feel?

3. If a hallucinogen affected the area of your brain interpreting cold information, how might your perception change?