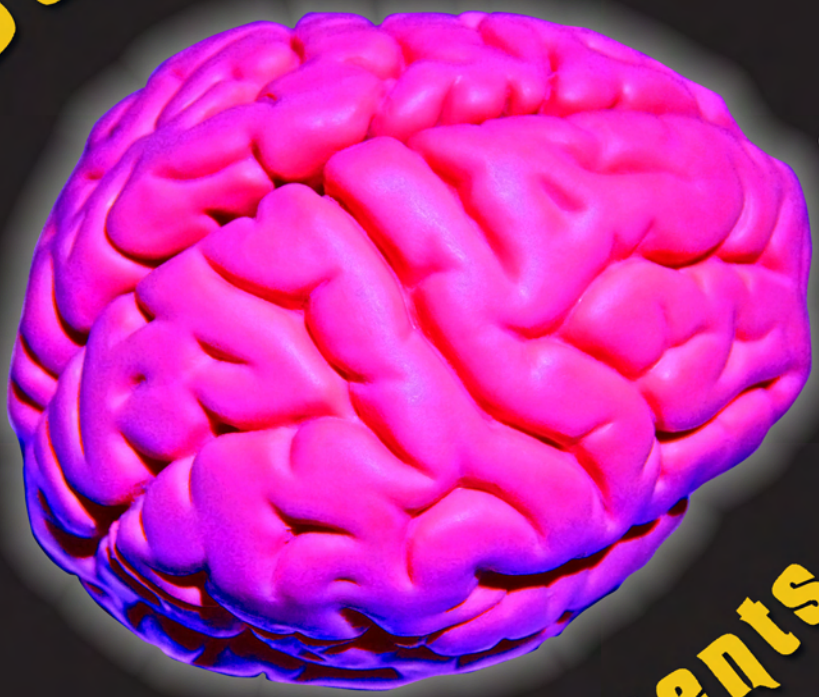
Teacher's Guide
Grades 4 – 12

"Weird Al" Yankovic



presents

AL'S BRAIN

A 3-D Journey through the Human Brain

FREE EXHIBIT!

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Newspapers In Education
The Seattle Times
Inspiring Students To Learn

Do the Puyallup Fair The Big Fantastic
SEPT. 11–27

PACIFIC SCIENCE CENTER

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Introduction

Many people in our community consider Washington state's largest event, the Puyallup Fair, the last hurrah to summer. This year the Fair will be featuring Al's Brain. This free exhibit next to the Planting Patch will take you on an interactive journey through the human brain. There is a 3-D movie in the "Brainitorium" featuring "Weird Al" Yankovic that provides entertaining educational material, as well as interactive Brain Power exhibits from the Pacific Science Center. Since each student receives a complimentary gate ticket to the Fair, teachers may consider offering extra credit to students who bring back the Passport stamped at this exhibit and other educational sites at the Puyallup Fair.

PACIFIC SCIENCE CENTER

This guide explores the brain through hands-on, inquiry-based activities and lessons for all grade levels. All of these lessons are written to be used with content that will appear in The Seattle Times on September 10, 17 and 24 and are aligned to Washington state science standards.

The guide will appear on both the Newspapers In Education Web site (seattletimes.com/nie) and the Puyallup Fair's Web site (thefair.com) in September. To enroll in The Seattle Times Newspapers In Education program and receive free online newspapers, lesson plans and curriculum guides, as well as the in-paper content for this guide, please e-mail nie@seattletimes.com.

Below you will find a list of the Washington State Science Essential Academic Learning Requirements included in this guide.

Grades 4 – 5
SYS- A, B; INQ- A,B, C, D, E, F, H; LS1- B, C

Grades 6 – 8
SYS- A; INQ- A, B, C, D, E; LS1- F; LS3- G

Grades 9 – 12
SYS- B; INQ- A, B, C, D, E
Math 8.5 H, D; A1.8.A, A1.6.B, A1.6

Note to Educators

Newspapers In Education
The Seattle Times
Inspiring Students To Learn

Activities in this guide are built on knowledge and information provided in the e-Edition of The Seattle Times on September 10, 17 and 24. On each Thursday, you will find a full page of brain-related content in the newspaper. You can visit the Newspapers In Education Web site (seattletimes.com/nie) to find the exact location of these pages in the newspaper. Have students take notes from the in-paper content each week to use in combination with this guide. Teachers are encouraged to modify the guide to fit their individual classroom needs. You can easily use the Five E's to structure these lessons.

For more information about neuroscience and additional teaching materials, please visit **http://faculty.washington.edu/chudler/books.html**

Materials:

You will either need to make clay (using the recipe that will be in The Seattle Times on September 10, 2009) or provide clay or Play-Doh to your students. Each group will need a little more than three cups (see lesson steps for details). Each group will also need something like a plastic knife to cut through the clay, as well as tape and toothpicks.

Lesson Steps:

Start by asking your students, "What are all the things the brain does for us?" Discuss the different parts of the brain that are featured in the September 10, 2009, newspaper. As a class, have students make a T-chart with the names of the parts of the human brain on the left side and the functions that are associated with those parts on the right. They should copy this chart into their notebooks.

Discuss which parts of the brain you could see if your head were see-through and put stars next to those parts in the chart.

Break students into groups of two to four people.

Each group will be given clay that represents the human brain. This should be measured at three cups of clay per group. Three cups is the approximate size of a real brain.

Encourage your students to examine the clay. How soft or hard is it? Do they expect the brain to be as soft? What do humans have to protect our brains?

Get students to use models and diagrams of the brain to form their own "model brains." These brains should at the very least include the cerebellum, the brain stem and the cerebral cortex and show that the brain is really two halves that are connected.

Have students determine where the parietal, occipital, frontal and temporal lobes are on their clay brains. These should be labeled by inserting toothpicks with the names of the regions taped to them.

Students should also make a model of a cat brain. Provide students with one tablespoon of clay and an image or model of a cat brain. They can compare the size of the two brains and talk about why they are so different and what that means or doesn't mean in terms of evolution and intelligence. Have them predict how large a chimpanzee brain is.

9–12 Extension

If time permits, give each group one cup of dough as well as an image of a chimpanzee brain and have them construct this brain. Does this chimpanzee brain look similar to ours? What is different?

Think about animals at the Puyallup Fair. How is each brain different? Look at the brain-to-eye ratio of each animal. Which animals have larger brains than eyes? Which have larger eyes than brains?

Extension

Each person in the group should "claim" one of the lobes and then research that lobe and write one to three paragraphs (grades 4 – 8) or one to three pages (grades 9 – 12) about what the lobe is, where it's located and what it controls. They should also find an article in The Seattle Times where someone is using this lobe and describe how the lobe is being used. Last, have students come up with three examples of things they did at the Puyallup Fair that used this very lobe.

Materials:

Pencil, paper, diagram of the brain that includes the parietal lobe, The Seattle Times.

Lesson Steps:

Ask students, "Why do we test the temperature of a pool with our fingers and not with our elbow? How do messages about temperature get to our brain?"

Have students rub their hands together at a rapid rate until their palms feel warm. Point out the parietal lobe on a model or diagram of the brain and let them know that this very activity is stimulating their parietal lobes.

Explain that students will be testing their parietal lobes by pressing different numbers of fingers (1, 2 or 3) on each other's backs and hands. Demonstrate with a willing student how to systematically place varying numbers of fingers on their partner's back, then on their partner's hand (which is held behind their back).

Students will then break into pairs to test each other's parietal lobes. Students should vary the number of fingers they use and how far apart their fingers are from each other. First they will use two fingers close together and then try two fingers further apart on the other student's back. The partner should report how many fingers he or she feels each time. Then the student should test this on their partner's hand while the partner has their hand behind their back. Remind students to give firm, but not painful, pressure. Give them two minutes to do this and then have them switch roles.

Ask students to write down what the challenges were in distinguishing between touches. Was it easier to tell the number of fingers that were placed on your back or on your hand? Was it easier when they were closer together, further apart or somewhere in the middle? Predict why this might be.

Now that the students have tested their parietal lobes, explain that the parietal lobe processes skin sensations of pain, pressure, temperature and texture. Have students break into groups to create a list of specific things the parietal lobe controls. Allow two minutes to complete this list, then have them share their items and compose a class list that goes into their notes.

Explanation:

There are nerves in our skin that send information to the parietal lobe and back again. On our backs, these nerve endings are spaced apart somewhat so that we might not feel the difference between one finger and two fingers placed very close together. Other parts of our bodies, like our hands, the soles of our feet or our lips, have nerve endings that are spaced very close together, so that the parietal lobe can receive more accurate information about how many fingers might be creating the pressure.

Extension

Have students search The Seattle Times for articles that involve the parietal lobe. They should write down how the people in the article are using their parietal lobes and what other lobes they may be using. What have students experienced at the Puyallup Fair that may have used their parietal lobes?

How does the brain impact your senses?

Chapter 2
Lesson 1

Materials:

Blindfolds, plates, freshly cut slices of raw potato (three to five per student), scent samples (three to five per pair of students: vanilla extract, peppermint, peanut butter, cinnamon, lemon peel, coffee, etc.)

Lesson Steps:

Ask students how we know if food is safe to eat. If students say, "smell it," then ask, "What would happen if we weren't able to smell?"

Tell students to try this activity to see if they can trick their taste buds. Put students in groups of two and provide each pair with a plate of six to ten potato slices, three to five scent samples and a blindfold.

Students will take turns performing the taste test as follows:

1. Put on the blindfold to help focus your senses of taste and smell.
2. Pinch your nose and taste one slice of raw potato. Note the flavor.
3. This time, instead of holding your nose, have your partner hold one of the sample scents under your nose for you to smell while you taste the next potato slice. Note the difference in flavor. Repeat with all scents and then switch with your partner.

Discuss what the students discover about the relationship between taste and smell. Why might your sense of taste seem weaker when you have a cold? Explain that taste and scent are linked together in our brains.

Explanation:

What we call "flavor" in the food we eat is actually the brain interpreting a mixture of sensations: smell, texture and taste. In fact, about 70 – 75% of what we interpret as taste actually comes from our sense of smell. Our taste buds can interpret only four basic tastes – bitter, sweet, salty and sour. A person's sense of taste can often be confused by comments or suggestions from other people or by mixed signals sent to the brain. For example, your students may have mistaken the potato for an apple, because they look and feel similar to one another.

**Some people may be allergic to potatoes. In that case, use another bland food, like crackers or rice cakes. (Potato works well because it looks and feels like an apple.) You may choose any number of smells, but try to have a variety of sweet, spicy, bitter and salty.*

Extension

Have students predict and explore how different variables affect flavor. They should consider the temperature, texture and sound (snap, crackle, pop) of the food they eat. What flavors did they experience at the Puyallup Fair this year? Do they think this flavor was experienced because of taste alone or a combination of taste, smell, texture and temperature?

How does having a sense of smell help humans survive?

How does the brain impact your senses?

Chapter 2
Lesson 2

Materials:

Pencil, paper, diagram of the brain that includes the parietal lobe, printed optical illusions, The Seattle Times.

Suggestion: There are many optical illusion images on the Internet. These can easily be found by typing "optical illusions" into a search engine.

Lesson Steps:

Distribute optical illusion images, one to each student.

Ask students to examine the first image, then share what they see when they first look at the image.

Have students look again for a longer period of time. Do they see any other images in the picture? If not, guide them to see other interpretations of the image.

Repeat these steps with different optical illusions. Why do they think they immediately interpret the picture to have one image over another? How do our past experiences guide what we see? Discuss the role your brain plays in interpreting what you see with your eyes.

Extension

To make it more challenging for high school students, you could use the "Vanishing Leprechaun" puzzle. The puzzle and its explanation are available on this Web page: http://www.davescove.com/teasers/index.htm

Chapter 3
Lesson 1

What can you do to give your brain a workout?

Materials:

A ruler for each pair of students, a wall.

Lesson Steps:

Ask students what the best way is to become skilled at a physical activity. Discuss what a reflex is and what it does. (They help us stay safe and alert.) Do our reflexes get better over time?

Students will be measuring their reaction times with this simple activity.

Have the students break into groups of two. At this point, students should set up the scientific method on their papers, including the name of the experiment, a question, a hypothesis, instructions and a table. You can either provide a worksheet with blanks to fill in or have them create their own. I would suggest having a worksheet for grades 4 – 8 that has the instructions already typed and a table formatted. Discuss with students why we only use one variable at a time while conducting an experiment and why it is important to clearly report your methods and procedures.

Trials	Partner 1/Right	Partner 1/Left	Partner 2/Right	Partner 2/Left
1				
2				
3				
4				
Average				

For each trial students will record (in a table similar to the one above) the amount of inches the ruler drops from their right and left hands, as well as from their partner's right and left hands. You can choose how many trials they should do.

One student will place the ruler flat against the wall with the 12-inch mark at the top and the zero-inch mark at the bottom. Their partner should hold their finger level with the bottom of the ruler, about half an inch from the ruler.

Next, have the first student let go of the ruler. Their partner should try to stop it by quickly pressing it against the wall with his or her finger. Record how many inches the ruler falls. (The shorter the distance the ruler falls, the quicker the student's reaction time.)

Have the partners switch positions and repeat the procedure, completing at least three more trials. They should record all of their data in the table for each trial. Students should analyze their data from the chart and describe what happened to their reflexes as they completed more and more trials.

Students should conduct more trials to answer the following questions:

- If you switch hands, does using your less dominant hand make the activity harder/increase your reaction time?
- If you practice a few times (three or more trials) does your reaction time speed up?
- If you hold your finger farther away from the ruler, what happens to your reaction time?

9-12 Extension

After the students are done with their trials they should calculate the averages for each column in their table and then make a line graph for their data using inches for the y-axis and the trials for the x-axis. Different colors should be used to represent the data from the right-hand trials, the left-hand trials and the trials when the hands were further from the wall. Or, you can choose to have students graph only their right-hand trials.

Once their graphs are complete, students should write out an analysis in paragraph form of their data and what it tells them about their question and hypothesis. They should also tell what parts of the brain they used to conduct this experiment.

Explanation:

Human brains are divided into many parts that all work together. For this activity, you must use your occipital lobe to see where the ruler is, your frontal lobe to process how the ruler is moving, and your parietal lobe to feel the ruler.

Extension

In what parts of our lives do we need quick reflexes? Ask students to name some examples from the Puyallup Fair where they needed to have quick reflexes/reaction times. How do kids doing mutton busting need good reflexes?

See if your students can find some examples from today's newspaper that include reflexes.

Materials:

A piece of paper divided into three parts, a pencil and three large posters with ten unique pictures on each (30 unique items total).

Lesson Steps:

What is the best way students can memorize a list? What strategies do they use to help them memorize material for school?

Hand out the piece of paper divided into three parts, making sure each student has a pencil. Instruct students to put the paper and pencils down for now.

THE FIRST POSTER: Set a timer for 30 seconds. Tell students that you will be holding up a poster and they will have 30 seconds to look at the poster and memorize the items on the poster. Students should be silent while the poster is up and just after. When the time is up, put the poster away. Have students record on their papers all of the items they remember. Give them one minute for recording the images.

Now, ask students to raise their hands if they remembered 10 items, nine and so on. On average people tend to remember between six and seven items. Short-term memory is meant to serve us for several seconds to several minutes. What sense did students use during this exercise? What part of the brain is that connected to? Reveal the first poster for them to see which items they missed.

THE SECOND POSTER: Again set a timer for 30 seconds. This time you will hold up a new poster and read each item aloud while students look at the poster. When the time is up, hide the poster and let the students write down what items they remember. Again, discuss how many they remembered this time and discuss the use of sight and hearing.

THE THIRD POSTER: This time you will hold up a new poster for 30 seconds, but you will read the word for the item and have the class repeat this word out loud as they are looking at the poster. Do this for all 10 items throughout the 30 seconds, then put the poster down and have them write what they remember. Did students remember more or less this time? Why do they think that is? Could it be because they saw it, heard it and said it?

Explanation:

For the first poster, the students had the information passing through their occipital lobe only because they were just using their sight. For the second poster, they used their occipital lobe for sight and their temporal lobe for hearing. For the third poster, students used their occipital and temporal lobes for sight and hearing and also used Broca's area in the frontal lobe when they spoke. Broca's area coordinates the muscles required for speech.

Extension

Have students read a paragraph from the newspaper out loud to themselves tonight. After they are done reading, they should turn the paper over and write down everything they remember from the paragraph.

Have students write down three things they remember from the Puyallup Fair. Is this short-term or long-term memory? Why do they think they retained these three things in their long-term memory?

Discuss animals' memories. What do animals remember? How do their memories compare to humans'?