

Brainworks

Grades: 4th -12th

Duration: 50 minutes

Program Description

Learn the anatomy and physiology, or structure and function, of the brain while comparing and examining a human and sheep brain. The students will learn the interrelationship of the peripheral nervous system to the central nervous system. Your students will touch a real humans brain. The students will participate in activities that will test their reaction speed and their memory. The students will test the relative response of each other to selected stimulus to discover how the concentration of nerves in their arms varies.

Louisiana GLE:

Grade 4 Science

- 2.Pose questions that can be answered by using students' own observations, scientific knowledge, and testable scientific investigations (SI-E-A1)
- 3.Predict and anticipate possible outcomes (SI-E-A2)
- 7.Use the five senses to describe observations (SI-E-A3)
- 13.Identify and use appropriate safety procedures and equipment when conducting investigations (e.g., gloves, goggles, hair ties) (SI-E-A7)
- 42.Describe how the organs of the circulatory and respiratory systems function (LS-E-A5)

Grade 4 English Language Arts

- 34.Adjust pacing to suit purpose, audience, and setting when speaking
- 35.Interpret, follow, and give multi-step directions
- 37.Demonstrate active listening strategies, including asking questions, responding to cues, and making eye contact
- 38.Adjust speaking content according to the needs of the audience

Grade 5 Science

- 15.Identify the cell as the basic unit of living things (LS-M-A1)

Grade 5 English Language Arts

- 32.Adjust diction and enunciation to suit the purpose for speaking
- 33.Use complete sentences and standard English grammar, diction, syntax, and pronunciation when speaking
- 35.Restate or describe oral directions/procedures for tasks
- 36.Adjust volume and inflection to suit the audience and purpose of presentations
- 38.Demonstrate active listening strategies
- 39. Deliver formal and informal presentations for a variety of purposes, including:
 - book reports
 - personal experiences
 - explanations of projects (ELA-4-M4)
- 41. Participate in group and panel discussions

5th- 8th Grade Science as Inquiry

1. Generate testable questions about objects, organisms, and events that can be answered through scientific investigation (SI-M-A1)
2. Identify problems, factors, and questions that must be considered in a scientific investigation (SI-M-A1)
4. Design, predict outcomes, and conduct experiments to answer guiding questions (SI-M-A2)
10. Identify the difference between description and explanation (SI-M-A4)
11. Construct, use, and interpret appropriate graphical representations to collect, record, and report data (e.g., tables, charts, circle graphs, bar and line graphs, diagrams, scatter plots, symbols) (SI-M-A4)
12. Use data and information gathered to develop an explanation of experimental results (SI-M-A4)
16. Use evidence to make inferences and predict trends (SI-M-A5)
23. Use relevant safety procedures and equipment to conduct scientific investigations (SI-M-A8)
25. Compare and critique scientific investigations (SI-M-B1)

Grade 7 Science

9. Relate structural features of organs to their functions in major systems (LS-M-A5)
10. Describe the way major organ systems in the human body interact to sustain life (LS-M-A5)

Grades 9-12 Science as Inquiry

2. Describe how investigations can be observation, description, literature survey, classification, or experimentation (SI-H-A2)

Biology

32. Analyze the interrelationships of organs in major systems (LS-H-F1) (LS-H-E3)
33. Compare structure to function of organs in a variety of organisms (LS-H-F1)
34. Explain how body systems maintain homeostasis. (LS-H-F2)
35. Explain how selected organisms respond to a variety of stimuli (LS-H-F3)
36. Explain how behavior affects the survival of species (LS-H-F4)

Key Terms:

Central Nervous System: The portion of the vertebrate nervous system consisting of the brain and spinal cord.

Cerebellum: a large portion of the brain, serving to coordinate voluntary movements, posture and balance.

Cerebrum: The large rounded structure of the brain occupying most of the cranial cavity, divided into two cerebral hemispheres that are joined at the bottom by the corpus callosum. It controls and integrates motor, sensory, and higher mental functions, such as thought, reason, emotion, and memory.

Formaldehyde: A colorless, potentially carcinogenic gas having a sharp, suffocating odor. It is used in making plastics and, when dissolved in a solution of water and methanol, to preserve biological specimens. Chemical formula: CH_2O .

Formalin: a 10% solution of formaldehyde in water; used as a disinfectant or to preserve biological specimens

Frontal Lobe: The largest and forwardmost lobe of each cerebral hemisphere, responsible for the control of skilled motor activity, including speech. Mood and the ability to think are also controlled by the frontal lobe.

Medulla Oblongata: The lowermost portion of the vertebrate brain, continuous with the spinal cord, responsible for the control of respiration, circulation, and certain other bodily functions.

Occipital Lobe: The rearmost lobe of each cerebral hemisphere, containing the main visual centers of the brain.

Olfactory Bulb: the enlarged terminal part of each olfactory lobe from which the olfactory nerve originates

Optic Chiasm: the crossing of the optic nerves from the two eyes at the base of the brain.

Parietal Lobe: The upper middle lobe of each cerebral hemisphere, located above the temporal lobe. Complex sensory information from the body is processed in the parietal lobe, which also controls the ability to understand language.

Peripheral Nervous System: The nerves outside of the central nervous system that make up part of the vertebrate nervous system.

Pons: A thick band of nerve fibers in the brainstem of humans and other mammals that links the brainstem to the cerebellum and upper portions of the brain. It is important in the reflex control of involuntary processes, including respiration and circulation. All neural information transmitted between the spinal cord and the brain passes through the pons.

Spinal Cord: The thick column of nerve tissue that extends from the base of the brain about two thirds of the way down the backbone. As part of the central nervous system, the spinal cord carries impulses back and forth between the brain and other parts of the body through a network of nerves that extend out from it like branches.

Temporal Lobe: The lobe of each cerebral hemisphere lying to the side and rear of the frontal lobe. The temporal lobe controls hearing and some aspects of language perception, emotion, and memory.

Connections to Permanent Exhibits: These exhibits are found in the BodyWorks Gallery.

Strobe Wheels: Just like hub caps on your car, these simple exhibits help explore how the eye interprets rotating motion.

Reversing Words: Mirror images of some words still look the same.

Anamorphic Images: Twisted and distorted images start making sense with some simple cylindrical mirrors. This exhibit shows our brain's dependence on pattern recognition.

The Never Ending Hallway-Look inside the big blue box. What do you see? Is it real or an illusion? Why?

Moire Patterns: Put one piece of transparent material with a pattern on it over another. Do you see a new pattern.? Move the material slightly, what kind of changes appear in the pattern?

Pretty Lady?: Is she young or old? This puzzling image can be both, it depends on your point of view (literally).

Face or Vase: What do you see? Close your eyes, look again. Is it the same?

Tessellations: A tessellation is a repeating pattern composed of interlocking shapes (usually polygons) that can be extended infinitely. What changes take place in this tessellation?

Circles and Squares: Which circle is larger? Which square is larger? Check your answer

Art or Math?: For some, Mathematics is art -- it is the symmetry and patterns that characterize Escher's artwork at the very boundary of science and art.

Trace Me: Try to run the stylus along the outline only guided by the mirror. Is it easy or hard? Why?

Genetic Traits: This exhibit describes nine genetic traits. What form of each of these traits do you have?

Impossible Shapes: Clever drawings of geometrical shapes that the eye takes for granted, once examined, are quickly found to be impossible to exist in nature.

Zoetrope: A strip of cartoon images inserted into a cylinder is animated when you turn the cylinder. Your students may draw their own cartoon strips to animate.

Step Test: Measure your heart rate before and after stepping up and down on a stool and compare the effect to standards for the exercise.

Grip Strength: Measure your grip strength.

Balance: Grip the handle, get your balance, and then let go. How long could you balance? Challenge a friend. What occupations do you suppose depended on a good ability to balance?

Blood Pressure: Check your blood pressure

Reaction Speed: Measure the time it takes to press a button after a light flashes.

Netmania: See how many soccer balls you can block.

Jump Test: Find your vertical leap.

Blood Pressure: Find your blood pressure with this exhibit.

Beating Heart: Grasp the two electrodes of a pulse sensor, a realistic rubber heart starts beating synchronously.

Pitch Speed: A radar monitor measures the speed of your pitch. Have a contest with your friends

Lungs: Expand and contract the chest cavity on a model to see how the lungs react.

Hunting for a Vowel: Transform the “blat” of a duck call into recognizable vowel sounds by feeding it into various artificial larynx sections.

Build a Skeleton: Take apart a colorful layered puzzle of the human body and replace the organs, bones, and muscles one layer at a time.

Artificial Joints: What kind of joints do you see in this exhibit? Where are they located?

Mr. Torso: Remove and replace the internal organs of a plastic model. Where is your liver, stomach, heart?

Web Resources:

Wikipedia, List of regions in the human brain
http://en.wikipedia.org/wiki/List_of_regions_in_the_human_brain

National Institutes of Mental Health
<http://www.nimh.nih.gov/>

Neuroscience for Kids Eric H. Chudler
<http://faculty.washington.edu/chudler/introb.html#bb>

NIEHS Kids Page Parts of Your Brain and What They Do!

<http://www.niehs.nih.gov/kids/brain.htm>

Pre-Visit Activities:

Take a Tour of the Brain-MSNBC

Using this website have your students identify the parts of the brain and also find out about memory, sensory stimulation, and fear. This is applicable for all grades.

The interactivity is found on-line at the following link:

<http://www.msnbc.com/modules/brain/brainmap.swf>

Post-Visit Activities:

Systems of the Body-Science Net Links-AAAS

This is a lesson on the circulatory, respiratory, nervous, digestive, and skeletal systems of the human body. A lesson plan is given at this website and it uses an on-line computer interactivity called "All Systems Go!". There is even a quiz at the end that students can do on the computer and print out. This lesson is applicable for grades 4th – 7th grade.

The lesson plan may be found at the following link:

http://www.sciencenetlinks.com/lessons_printable.cfm?DocID=385

How a Neuron Works (10th grade)

Using the flash video the student individually or as a group identify the steps require to pass an action potential along a series of neurons. This video is applicable for 10th grade students.

The video may be found at the following link:

http://science.education.nih.gov/supplements/nih2/Addiction/activities/lesson2_neurotransmission.htm