

# Central Nervous System

## **OVERVIEW:**

In this activity, students will explore the properties of the central nervous system and experience how the brain causes the body to react in different situations. Students will complete various activities in which students will observe each other and record their findings.

Additionally, students will design and present various experiments exploring student reaction to various stimuli.

## **CONCEPTS:**

### **National Science foundation Standards:**

#### **Standard A: Science as Inquiry (Abilities Necessary to do Scientific Inquiry)**

- Ask questions that can be answered through scientific investigations.
- Design and conduct a scientific investigation.
- Use appropriate tools and techniques to gather, analyze, and interpret information.
- Communicate scientific procedures and explanations.

#### **Standard C: Life Science (Structure and Function in Living Systems)**

- Cells as the fundamental unit of life.
- Levels of organization in living systems for structure and function, e.g., cells, organs, tissues, organ systems, whole organisms, and ecosystems.
- Life functions in cells.
- Specialized cells, tissues, and organs and their functions.

## **Benchmark 1: The Nature of Science**

### **A: The Scientific World View**

- Scientists differ greatly in what phenomena they study and how they go about their work. Although there is no fixed set of steps that all scientists follow, scientific investigations usually involve the collection of relevant evidence, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected evidence.

## **Benchmark 6: The Human Organism**

### **C: Basic Function**

- Organs and organ systems are composed of cells and help to provide all cells with basic needs.
- Interactions among the senses, nerves, and brain make possible the learning that enables human beings to cope with changes in their environment.

### **D: Learning**

- Some animal species are limited to a repertoire of genetically determined behaviors; others have more complex brains and can learn a wide variety of behaviors. All behavior is affected by both inheritance and experience.

**OBJECTIVES:****Students will:**

- Understand the general organization of the human nervous system.
- Identify the components of the central nervous system.
- Identify the four parts of the brain
- List the two main parts of the central nervous system and their basic functions.
- Understand and recognize the differences between a response and stimulus
- Recognize that not all students will react the same way to the same stimulus.

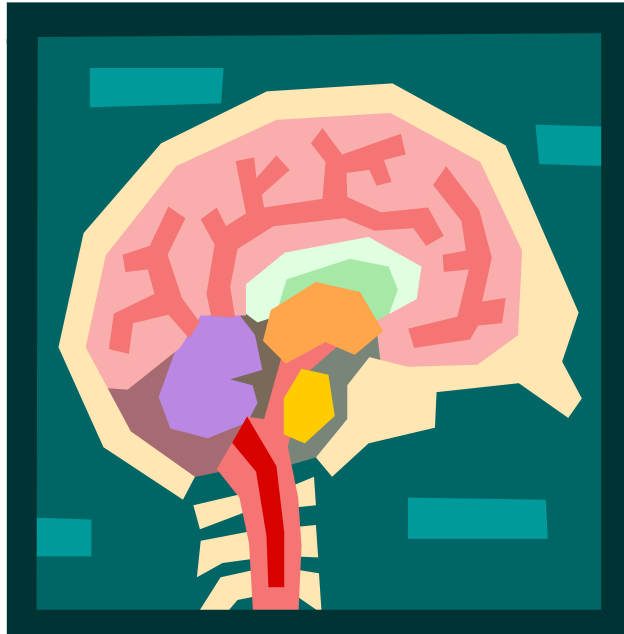
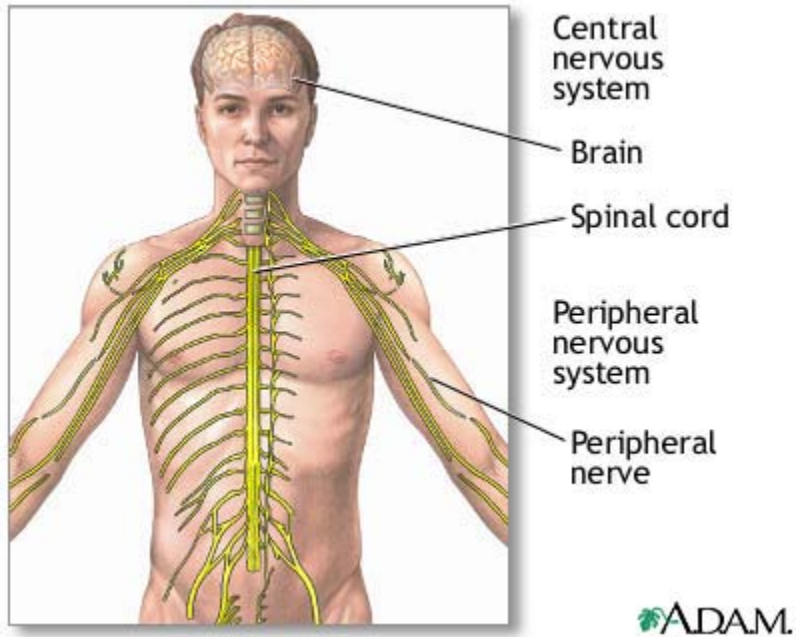
**PROCEDURES:**

- Allow 3 hours to complete the lecture and activities.
- Once the students have settled into class, make a loud noise without warning.
- Have students share their reactions and reactions observed of others.
- Introduce the terms stimulus and response.
- Present the background information: The Central Nervous System
- Complete Activities 1-4: (see Part A) “Jurassic Park,” “Scratch and Sniff,” “Meter Stick,” and Reading Orally
- Allow time for students to examine the models.
- In small groups, provide time for students to design and present their own experiments.
- Follow up activities with discussion questions (see Part B). These questions can be used for assessment purposes.

**MATERIALS:**

- Transparency master: The Central Nervous System
- Human brain (whole)-model
- Human skull-model
- A slice of human brain-model
- Spinal cord-model

## Background: The Brain



(Once the students have settled into your class, make a loud noise without warning, causing students to exhibit reflexes. What kind of reactions did they have?) All these reactions are involuntary and are called *reflexes*. Nerves or nerve impulses in the body's nervous system cause these reflexes to occur. Reflexes are one important feature of the human central nervous system.

The central nervous system is made up of the *brain* and the *spinal cord*. It is the body's control center which mainly organizes incoming information from sensory organs and receptors, and issues outgoing commands to various parts of the body.

The brain is the most complex matter in the universe. It has 100 billion cells. 75% of a brain cell is made of water which constitutes 75% of brain weight. The brain has four major parts:

- **Cerebrum:** handles most sophisticated functions of the brain (processes visual images, thinking and planning)
- **Cerebellum:** Essential for coordination of movement
- **Brain Stem:** Contains nerves that control vital life processes that are not consciously controlled (breathing, digestion, heart rate, etc)
- **Hypothalamus:** This is the body's center for emotions and instincts such as pleasure, hunger and thirst. It also maintains body temperature and water balance.

The spinal cord is a cable of nerve tissue that extends from the brain stem down the back. Nerve impulses from the body and brain run up and down it. It is an important component in making reflexes occur and is surrounded and protected by the backbone.

Reflexes can be referred to as "special" responses. They produce rapid, involuntary movement or response. They are important in times of danger i.e. your reaction to the loud noise at the beginning of class. Reflexes are very fast because they involve few neurons. Many reflexes never reach the brain; they sometimes travel only as far as the spinal cord.

### IMPORTANT FACTS TO REMEMBER

- The brain is a very delicate part of the central nervous system.
- Skin cells die and get replaced fast; red blood cells die every 40 days or so; you can never replace or make brain cells once they die. They are irreplaceable.
- Shaking a baby can cause brain damage: the brain sit inside the skull loosely
- Always wear a helmet when riding a bike or a RTV to protect your head against any head injury.

### ACTIVITY:

#### Part A:

#### Activity 1: Jurassic Park

#### Materials:

- Jurassic Park Movie
- Student Response Sheet

**Directions:**

- Have the students watch the Jurassic Park movie clip without any sound.
- Designate a student to observe the other students while watching the movie clip and make note of any response and the stimuli that caused the response.
- Now watch the clip again, but this time with sound.
- Designate another student to observe the other students while watching the movie clip with the sound on and make note of any response and the stimuli causing the response.
- Discuss the differences in the two responses and reasons for the difference.

**Activity 1 Explanation:** Watching the clip with the sound on is bound to illicit more responses than watching without any sound because you are using two senses-sight and sound.

**Activity 2: Meter Stick****Materials:**

- Meter stick
- Student Response Sheet

**Directions:**

- One student holds a meter stick at the end.
- Another student holds his thumb and index finger on each side of the opposite end of the meter stick but without touching it.
- When the student holding the meter stick drops it, the other student closes his/her thumb and index finger to stop the fall.
- Measure the distance the meter stick dropped before it was stopped.
- Use the metric units.
- Repeat the activity with all members of your group, and record each response.

**Activity 2 Explanation:** People are different and will react in different ways to any stimuli. But the basic thing that will happen in each of these is that the information has to go from your eyes to the back of the brain, and then to the motor area in the front of the brain to activate the muscles in your arm in order to drop the meter stick. Your eyes produce electric impulses that go to the back of the brain.

### Activity 3: Reading Orally

#### Materials:

- Copy of statements to be read by students.
- Stopwatch
- Student Response Sheet

#### Directions:

- Ask 3 students to leave the room
- Ask someone to use a stop watch to time the people reading statements.
- Call in the student's one at a time.
- Record the time it took each student to read their passage.

**Activity 3 Explanation:** You will note that there will not be much difference in the time taken by the first 2 students, but the last one will take a longer time. The brain is incredible in that it can read fast even if the first and last letters are in place and the rest are jumbled.

#### Student #1: Read the following paragraph:

According to a research at an English University, it doesn't matter in what order the Letters in a word are, the only important thing is that the first and the last letter is at the right place.

The rest can be a total mess and you can still read it without any problem. This is because we do not read every letter by itself but the word as a whole.

#### Student # 2: Read the following paragraph:

Aoccdrnig to a rscheearch at an Elingsh uinervtisy, it deosn't mttar in waht oredr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer is at the rghit pclae.

The rset can be a toatl mses and you can sitll raed it wouthit a porbelm. This is bcuseae we do not raed ervey lteter by it slef but the wrod as a wlohe.

**Student #3: Read the following paragraph:**

Daoccrnig ot a searcher ta na Leingsh Inuevtisy, ti enosd't ttamer ni awht reodr hte Ttleers ni a rowd rea, het noly pirmotant hitng si hatt het ristf nda satl ttleer sit a eth grhit cplae.

The setr nac eb a atlot ssme nda ouy nac tllis dare it hitwout nay robemlp. Hits si cbuseae ew od otn dare rveye tleter yb ti lefs ubt eth odrw sa a lwoeh.

**Activity 4: Scratch and Sniff**

**Materials:**

- Scratch and Sniff Cards
- Student Response Sheet

**Directions:**

- Hand out scratch and smell cards to all the students.
- Without talking to anyone, or showing any reaction, scratch and smell the card, and turn it over and wait.
- Ask the following question. (Students can respond by raising their hand.)
  - Who smelled something?
  - Was it a good smell?
  - Was it a bad smell?
  - Were the cards different?
  - How could we show that? (Switch cards and smell)

**Activity 4 Background:** If you smelled something, it means that you have a gene that makes you smell the substance. The genes make olfactory cells in the nose and only 20 – 22% of the world's population can smell this substance. We are all unique but peer pressure can make 80 – 90% of people “smell” the substance

**Part B:**

**Ask the following questions and allow time for discussion.**

**Share:**

Share some of your responses to the stimuli in activities 1-4 with your friends.

**Process:**

Describe the work your nervous system did to detect these stimuli.

**Generalize:**

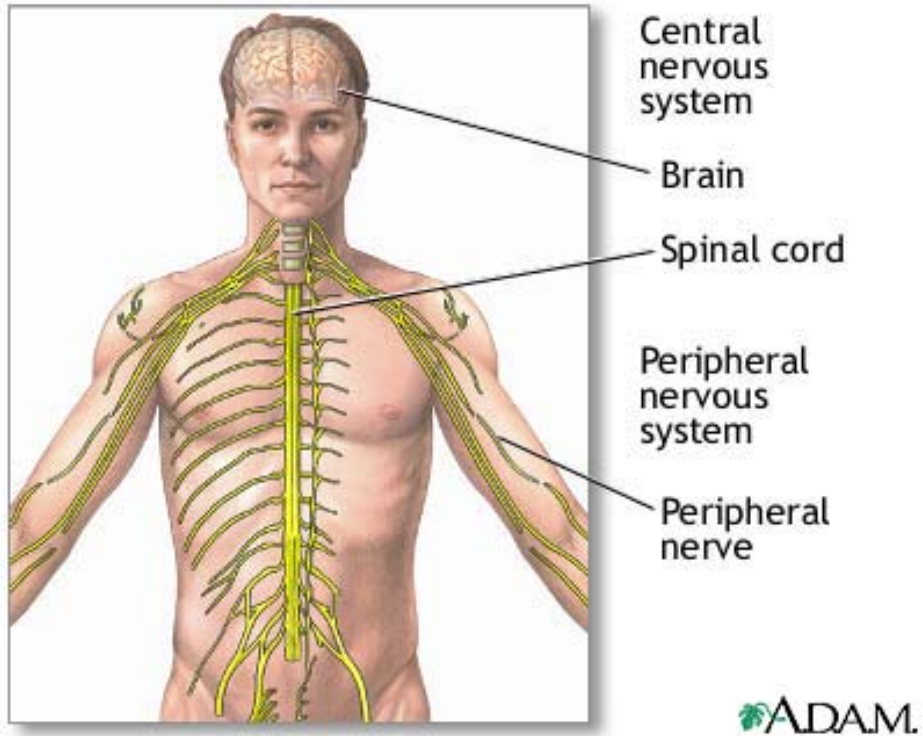
How do students' responses to stimuli differ? What controls these responses?

**Apply:**

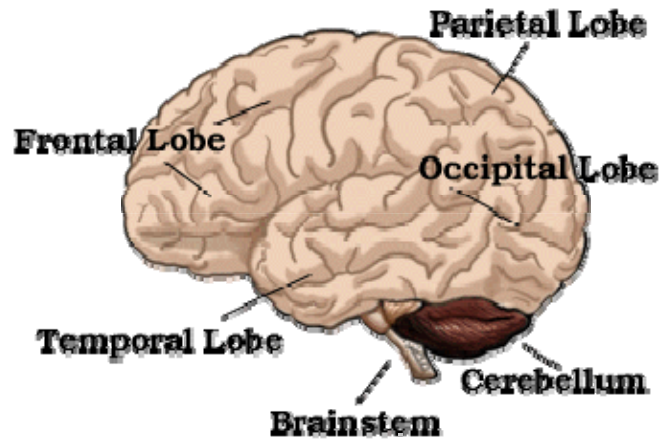
What steps can you take to protect your nervous system?

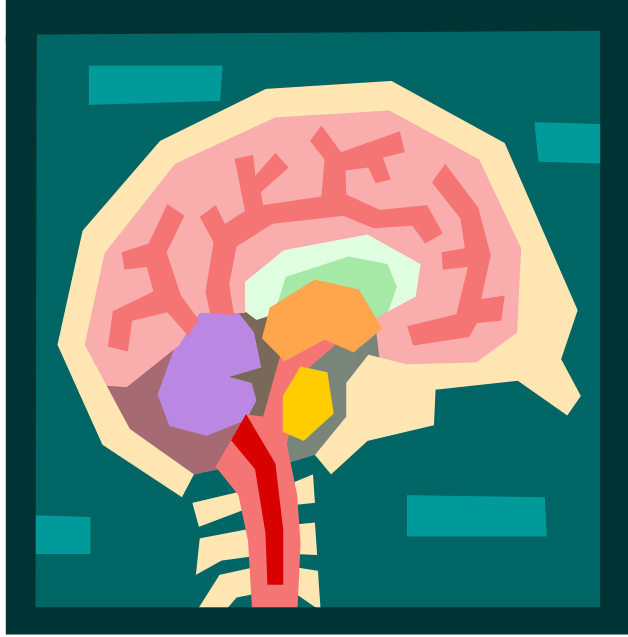
Transparency:

## The Central Nervous System



## The Brain





## Student Response Sheet

### Activity 1: Jurassic Park

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### Activity 2: Meter Stick

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### Activity 3: Reading Orally

STUDENTS	TIME
Student 1	
Student 2	
Student 3	

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### Activity 4: Scratch and Sniff

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