Reaction Time: *"Catch a Ruler"*

GOAL

The goal of this unit is to introduce students to neurotransmission in the context of a reaction time experiment that demonstrates the concept of gravity and the reaction of the nervous system.

Set-up:

-A book
-Paper
-Ruler
-Reaction Time poster
-Dry erase marker
-Student Worksheet "Reaction Time Part I"

PROCEDURE

Engage (10 minutes) Introduce Gravity

• With the help of a student volunteer, demonstrate to the class how a ruler can be dropped and caught. Ask students, "What made the ruler fall?"
• Get students to think critically about what draws objects toward the earth. What is gravity and how does it affect falling objects?

Explore (10 minutes) Galileo's Law of Free Fall

• Hold a book and a piece of paper (not crumpled) high above the floor. Ask students to make a hypothesis about which object will hit the floor faster. Do all objects fall at the same speed every time? Drop and retrieve the paper and book.
• Crumple the paper and then ask the students to guess which one will reach the floor first. Drop the book and paper again.
• Discuss air resistance. At their desks, have students compare a heavy and a light object and make predictions about which object will fall faster.

Explain (20 minutes) Reaction Time Sequence

• Introduce Galileo's Law, which states that all objects fall at the same speed despite their mass (neglecting air resistance).
• Bring out the ruler again and ask a student volunteer to come up to the front of the class. Instruct the student to catch the ruler as it is dropped.

PROCEDURE

• After the ruler is caught, ask student:

"Why was the ruler caught in the middle (after a lag period) rather than at the end (instantaneously)?

"What causes this hesitation?"

“What had to happen in my body for me to catch the ruler?”

• Have students predict the sequence of events involved in the reaction time pathway.

• Ask students what had to happen for you to grab the ruler after it dropped.

• Demonstrate visually the process using the REACTION TIME POSTER. Use the dry erase marker to draw the reaction pathway:

The eye sees the ruler drop.
The eye sends a message to the visual cortex.
The visual cortex sends a message to the motor cortex.
The motor cortex sends a message to the spinal cord.
The spinal cord sends a message to the hand/finger muscle.
The finger muscle contracts to catch the ruler.

Evaluate (5 minutes) Reaction Time Sequence Worksheet

• Distribute the worksheet and have students complete the top portion by writing the 5 key words from the word box in the correct order.

• Have students complete the lower portion of the worksheet. They must write a short paragraph detailing the reaction sequence listed above (there are 6 components).

• Collect student work and select students to share their paragraphs during the following lesson.

“The process that allows me to catch the ruler is like the game, ‘Whisper Down the Lane’ only it all happens inside my body. First, I see the ruler with my eyes. Then, my eye sends a message to the back of my brain to the visual cortex. The visual cortex sends a message to the motor cortex in the middle part of the brain. The motor cortex sends a message down my spinal cord, and the spinal cord sends the message all the way down my arm to the muscles in my fingers. The message tells my finger muscles to contract so I can catch the ruler, and I do! Also, it all happens in an instant.”

- **Key Cognitive Skills:**
  Predicting, Observing, Questioning, Hypothesizing & Sequencing

- **Vocabulary Terms:**
  Constant
  Galileo
  Rate
  Neuron
  Nervous System

- **Specific Outcomes:**
  - Students will understand the basics of Galileo's law of free fall and how it relates to the determination of reaction times.
  - Students will understand the sequence of events that take place in the body and the neural pathway traveled during the reaction process.
  - Students will make observations of behavior and a law of nature.
  - Students will be introduced to gravity and body structures.
  - Students will practice systems thinking (the nervous system).

PROJECT 2061 BENCHMARKS FOR SCIENTIFIC LITERACY

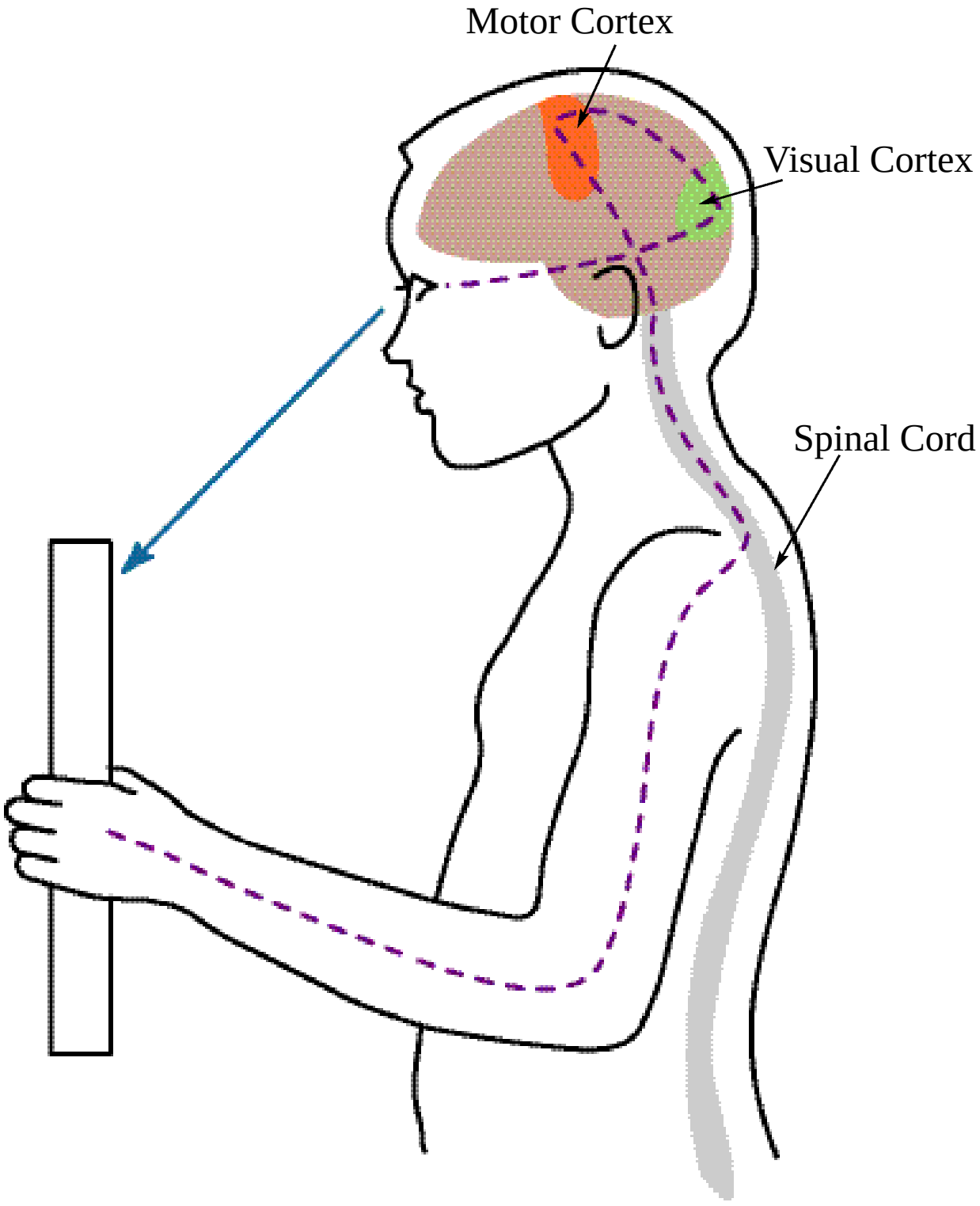
1C The Scientific Enterprise
Science is an adventure that people everywhere can take part in, as they have for many centuries.

4B The Earth
Things on or near the earth are pulled toward it by the earth's gravity.

6C Basic Functions
The brain gets signals from all parts of the body telling it what is going on there. The brain also sends signals to parts of the body to influence what they do.

11A Systems
In something that consists of many parts, the parts usually influence one another.

Reaction Time Poster



Name: _____
Date: _____

Brain Explorers
Reaction Time Part I Student Worksheet

Word Box

Visual Cortex Muscle

Eye

Spinal Cord Motor Cortex

The words in the word box name the parts of your body involved in creating a response (ex. catching a falling object). Put the words in order according to how they are used in the body.

1. _____
2. _____
3. _____
4. _____
5. _____

Now use these words, in the proper sequence, to write a paragraph describing the process that allowed you to catch the ruler.

_____
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Name: _____
Date: _____

Brain Explorers
Reaction Time Part I **Teacher Rubric**

Word Box

Visual Cortex Muscle

Eye

Spinal Cord Motor Cortex

The words in the word box name the parts of your body involved in creating a response (ex. catching a falling object). Put the words in order according to how they are used in the body.

1. **Eye**
2. **Visual Cortex**
3. **Motor Cortex**
4. **Spinal Cord**
5. **Muscle**

Now use these words, in the proper sequence, to write a paragraph describing the process that allowed you to catch the ruler.

First, your eye sees the ruler. Then, your eye sends a message to the visual cortex, which sends a message to the motor cortex. The motor cortex sends a message to the spinal cord. The spinal cord sends a message to the muscles in your hand/fingers. Finally, your muscles contract to allow you to catch the ruler.

*Student responses may vary, but they must include the major components of the neural process.