

## Different Brains

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Recommended as first YTA lesson

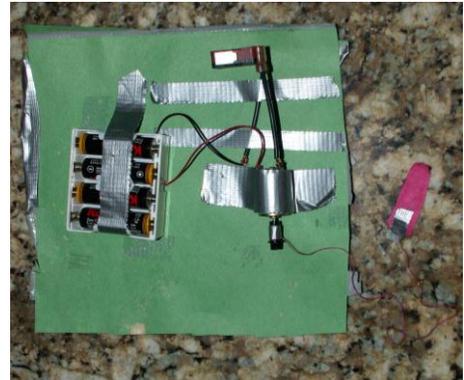
### Materials:

Traced figure of body, about the size of a child  
White board or other writing surface  
Motor for toy models (Radio Shack or hobby store), Electrical Switch, and Battery Pack  
Scissors  
Clay to make neurons  
Model of brain (if available)  
Handout for each child with:  
Picture(s) of actual whole brain  
Picture(s) of actual neurons, with cell body and long processes



### Preparation before the lesson:

Before the first time this lesson is given, make a "turtle" by connecting a battery pack to a toy model motor through a switch. Connections can be made by simply wrapping wires around terminals. Attach a string with a red "tongue" at the end to the motor (See picture to the left). Wrap the "turtle brain in construction paper so that the tongue sticks out one end, and the switch can be pressed to pull in the tongue. For subsequent Different Brains lessons, just replace the top piece of construction paper for a new dissection. Alternatively, another apparatus where the key to its operation needs to be dissected (see below) can be used.



### Key words/phrases for discussion:

Brain, neuron, axon, signal, muscle

- 1) Ask the children, "what is a brain?" In the ensuing discussion stress that a brain allows something to "think". Ask them, "does an ant have a brain?", and discuss how we can tell.
- 2) Lead the students to the conclusion that "one way we can tell if something has a brain is that it responds to a stimulus, like an ant responds to a stomp of the foot on the ground next to it. Ask the children if they, as scientists, agree with this rule. Write the agreed to rule on the board.
- 3) Take out the "turtle" and explain that this turtle's enemy is an elephant that always steps on its tail before it tries to eat the turtle's tongue. Imagine an elephant coming along and stepping on the tail. Demonstrate that the turtle pulls in its tongue when pressure is applied to the turtle at the location of the tail (electric switch). Ask the students, "does the turtle have a brain?" Have them use their prior rule written on the board. Ask the children how we should study the brain, figure out how it works. Conclude that a dissection is in order and use scissors to dissect the turtle's brain and explain to the children how the "brain" works. Guide select children to explain the operation of the turtle's brain.

- 4) Put your head on the table and have a volunteer step on your foot. Ask the children, "how did the stamp on my foot cause my mouth to say, Ow!?". Through discussion conclude that you must have a brain since a stimulus caused a response. Ask the students how we can figure out how the human brain works. Conclude that a dissection is in order. Of course we cannot dissect a live brain but inform the children that scientists have studied the human brain for thousands of years.
- 5) Show a model of the brain if one is available, and then show pictures of the real brain out of the skull. After viewing, note that this does not help us understand how the stamp on the foot resulted in the reflex actions. Discuss how scientists cut the brain into small pieces and looked under a microscope. Show pictures of real neurons in the brain and note that these cells have processes like wires that can go from one brain region to distant regions. Discuss how neurons might be the way that one part of the brain can communicate with other parts, i.e. using these processes called axons. Draw a neuron on the board with a cell body containing the DNA (instructions for the cell) a long axon that can transmit information using electricity.
- 6) Have the children make neurons out of clay, including a cell body and long axon for each neuron.
- 7) Using the traced body cut out of construction paper, tell the students that this body is a creature created by you, but you forgot the brain. Tell the students that this creature cooks a lot so he needs to have a brain that moves his arm muscles to pull his arm away if he ever touches a hot surface with his fingers by mistake. Make the muscle in the arm that will pull the arm back if activated by neurons and guide them through the rest. Initially guide the students to make a two neuron reflex; sensory neuron in skin connects to motor neuron in spinal cord, which connects to the muscle in the arm. Once built, have some of the children describe the events after the hot surface is touched. Have the children focus on the movement of the "signal" through and across neurons, eventually activating the muscle.
- 8) Tell the students that the creature sometimes feels a puff of air on his head about 20 seconds before the heat burns his hand. Guide the students to bring the signal of a puff to the part of the brain located in the head (cerebrum) using sensory neurons, because this is where thinking occurs. When the creature feels the puff it will think, "hmmm, every time I feel this puff of air my hand touches something really hot. So since I have felt the puff of air again, I will pull my arm away now". Then the students need to build neurons going down from the cerebrum to the neuron in the spinal cord that will go to the arm muscle to pull it away. Have a number of children describe the movement of the signal after a puff of air on the head, or after touching a very hot stove with the finger.
- 9) Ask students to name some of the additional things a body would need to do, and note that it will take many more neurons to do all of these things. Ask the children how many neurons are in the human brain, eventually communicating that there are 10-100 billion neurons in this brain.
- 10) Ask the students why humans have so many neurons in the brain in their head. Note it is so they can be great "thinkers."

### Different Brains lesson highlights checklist

- Introduce goals of YTA: We need more science and technology professionals
- Conclude that one rule for establishing a brain exists is stimulus  $\Rightarrow$  response = brain
- Establish turtle has a brain, and perform dissection
- Establish YTA instructor has a brain
- Review brain models and pictures of real brain and neurons
- Make clay neurons
- Create simple spinal reflex: Sensory neuron, motor neuron, and muscle
- Create neuronal circuit to elicit reflex from puff of air to face
- Discuss all the things a brain has to do and the # of neurons necessary to do these things