



Teacher Guide

Bead Neuron

lesson idea originated from Eric Chudler's [Neuroscience for Kids](https://faculty.washington.edu/chudler/neurok.html) site at <https://faculty.washington.edu/chudler/neurok.html>

Grade Level 5-12

**Lesson Length
1 class period**

Lesson Summary: Students will make bead neurons and use them as models to understand the specialized cellular structure and function of neurons and how neurons communicate with each other.

Standards Alignment

Next Generation Science Standards

- 4-LS1-2. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.
- MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
- MS-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
- HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
- HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
- **Framework for K-12 Science Education:** Science & Engineering Practices 2,6,8

National Science Standards – Project 2061: Atlas of Science Literacy reference

- a) Cells: Cell functions – basic needs and basic functions (p. 73, Atlas Vol. 1)
Research on student learning: “Preliminary research indicates that it may be easier for students to understand that the cell is the basic unit of structure (which they can observe) than that the cell is the basic unit of function (which has to be inferred from experiments.” (p.72, Atlas Vol. 1)
- b) Models – uses of models and limitations of models (p.93, Atlas Vol. 2)
Research on student learning: “Prior to instruction, or after traditional instruction, many middle- and high-school students continue to focus on perceptual rather than functional similarities between models and their referents, and think of models predominantly as small copies of real objects. Consequently, students often interpret models they encounter in school science too literally and unshared attributes between models and their referents are a cause of misunderstanding. Some middle- and high-school students view visual representations such as maps or diagrams as models, but only a few students view representations of ideas or abstract entities as models.” (p.92, Atlas Vol. 2)

Objectives—Students will be able to

- make a model of a neuron
- identify the parts of the neuron and describe their function(s)
- discuss neuronal communication
- discuss how neuronal communication can be altered

Assessment Options

- Discuss within a group the structure and function of neurons; how neurons communicate and how neuronal communication can be altered
- Present to the class their group discussion.



Materials

See student guide for detailed materials list and construction steps.

Procedures

Engage – Making the bead neuron model

1. Ask students to work in groups of 2 or 3.
2. Allow 20-30 minutes for students to make the bead neuron following instructions in the student guide.
3. To maximize time, students who finish their bead neuron ahead of the group can help other students.

Explore

1. Ask students to think of how neurons would look inside the brain and how they would "talk" to each other.
2. Instruct students to put their bead neurons on the floor.
3. Ask students how the neurons should connect to each other.

Explain and develop questions

1. Ask students to assess if their network of bead neurons is an accurate model. Ensure that axons are near dendrites.
2. Discuss how neuronal communication occurs.
3. Solicit student questions on what happens to the chemicals after they are released.

Elaborate

1. Request that students develop 1-2 questions about how neuronal communication can be altered.
2. Ask students what happens when external factors are introduced such as drugs.

Extensions to the activity

1. Direct students to build a neural circuit that includes a sensory input and a motor output.
2. Lead students in a discussion of how the circuit can be modified.

Take Home Points

- Neurons have special parts that are important for sending and receiving messages or signals.
- Neurons use chemical and electrical messages to communicate.