

SCOPE, SEQUENCE, and COORDINATION

A National Curriculum Project for High School Science Education

This project was funded in part by the National Science Foundation. Opinions expressed are those of the authors and not necessarily those of the Foundation. The SS&C Project encourages reproduction of these materials for distribution in the classroom. For permission for any other use, please contact SS&C, National Science Teachers Association, 1840 Wilson Blvd., Arlington, VA 22201-3000.

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** Not part of the NSF-funded SS&C project.

Student Materials

Learning Sequence Item:

911

Neurons and the Nervous System

September 1996

Adapted by: Tom Hinojosa

Contents

Matrix

Suggested Sequence of Events

Lab Activities

1. You're Making Me Nervous
2. You're Making Me Nervous, Again
3. Common Carriers
4. Cell Phones

Science as Inquiry

You're Making Me Nervous**How do organisms move and respond to external stimuli?****Overview:**

Environmental conditions on Earth change often. Seasons bring changes in weather. Day turns to night. Organisms must cope with situational changes, as when they encounter other organisms. Responses to these and other external stimuli can be either innate or learned and in multicellular animals are generated by a nervous system. Where do we find nerves and the other components of the nervous system? In this activity, you will investigate the nervous system of a simple animal.

Procedure:

Work with a partner for this activity. One person should perform the main procedure while the other records observations. Earthworms have well-developed nervous systems. A main nerve cord extends along the bottom (ventral) side of the body. Many clusters of nerve cell bodies occur along the nerve cord. A large cluster of cell bodies is located at the front end of the body. Your task is to find and expose as many aspects of the nervous system as you can through careful dissection. You should create a labeled drawing of your findings and note the location of nervous system tissue in relation to other tissues.

Caution: Always be careful with all sharp objects.

Pin both ends of the worm to the dissecting pan. With scissors, cut through the body wall just to the left of the midline. Use care to cut through only the body wall and not the underlying internal structures. Work slowly and separate the edges of the cut as you proceed. Pin down the sides of the body wall to expose the interior structures.

Use a hand lens to study the internal anatomy and a blunt probe to help separate and locate various structures. Find the central nerve cord (a white line on the ventral body wall) and observe how far it extends through the body. Find as many aspects of the nervous system as you can and record their location and appearance in your lab notebook.

Draw an outline of the animal's body. Then draw in and label the components of the nervous system based on your observations. Record any other interesting observations as well.

Caution: Give all dissected materials to your teacher for disposal. Always wash your hands after a dissection procedure.

Questions:

1. What components of the nervous system were you able to find? What components (if any) were you unable to find?
2. Describe precisely where nerves are found in this animal.
3. Describe the appearance of the nerves you located.
4. What seems to be the function of the nerves you found?
5. What is the relationship between the nervous system and the muscles?

6. How does the location of nerves relate to their function?

7. In order to respond, the organism must first perceive (or be aware) of an external stimulus. We use the term “motor function” to refer to a movement response and the term “sensory function” to refer to the sensing of a stimulus. Do the nervous system parts you found provide for a sensory function as well as a motor function? Explain.

Science as Inquiry

You're Making Me Nervous, Again**How do organisms sense and respond to external stimuli?****Overview:**

A grasshopper is well adapted to its way of life. Like other multicellular organisms, it must respond to environmental changes and to other organisms that it encounters. Behavioral responses are generated by its nervous system. Where would you expect to find the nerves and other components of the nervous system in a grasshopper? Is the nervous system of this simple organism anything like our own?

Procedure:

Work with a partner for this activity. One person should perform the main procedure while the other records observations. Grasshoppers have a main nerve cord that extends along the bottom (ventral) side of the body. Along the nerve cord are many clusters of nerve cell bodies or ganglia. Connected to the nerve cord at the top (dorsal) part of the head is a large ganglion or brain. Your task is to find and expose as many aspects of the nervous system as you can through careful dissection. You should create a labeled drawing of your finding, noting the location of nervous system tissue in relation to other tissues.

Caution: *Always be careful with all sharp objects.*

Remove the three left legs. Carefully insert the point of your scissors under the top surface of the last segment of the abdomen. Slowly cut just to the left of the midline along the top surface, taking care not to cut the organs underneath. In front of the thorax, cut the left side down to the bottom of the body. Cut through the exoskeleton covering the top of the head from between the left antenna and the left eye down to the mouth. Remove the exoskeleton on the left side of the head.

Use a hand lens to study the internal anatomy and a blunt probe to help separate and locate various structures. Find the central nerve cord and observe how far it extends through the body. Find as many aspects of the nervous system as you can and record their location and appearance in your lab notebook. Draw an outline of the animal's body. Then draw in and label the components of the nervous system based on your observations. Record any other interesting observations as well.

Caution: *Give all dissected materials to your teacher for disposal. Always wash your hands after a dissection procedure.*

Questions:

1. What components of the nervous system were you able to find? What components (if any) were you unable to find?
2. Describe precisely where nerves are found in this animal.
3. Describe the appearance of the nerves you located.
4. What seems to be the function of the nerves you found?
5. What is the relationship between the nervous system and the moving parts of the body?
6. How does the location of the nerves relate to their function?

7. In order to respond, the organism must first perceive (or be aware) of an external stimulus. We use the term “motor function” to refer to a movement response and the term “sensory function” to refer to the sensing of a stimulus. Do the nervous system parts you found provide for a sensory function as well as a motor function? Explain.

Science as Inquiry

Common Carriers

**How extensive is the nervous system in various organisms?
How is this related to how the body functions?**

Overview:

All organisms have to deal with various changing conditions. Seasons bring changes in weather. Day turns to night. Organisms encounter other organisms. How do organisms sense these changes and what determines how they respond? In multicellular organisms behavioral responses are generated by the nervous system. Where do we find nerves and the other components of the nervous system? In this activity, you will investigate the nervous systems of a several animals in order to become familiar with their basic parts and where they can be found.

Procedure:

Study Lab Sheet A. Three different kinds of organisms are illustrated. All of the organisms have certain common components in their nervous systems with slight but important variations.

For each illustration, locate the following structures: nerve cord, brain, ganglia, nerves.

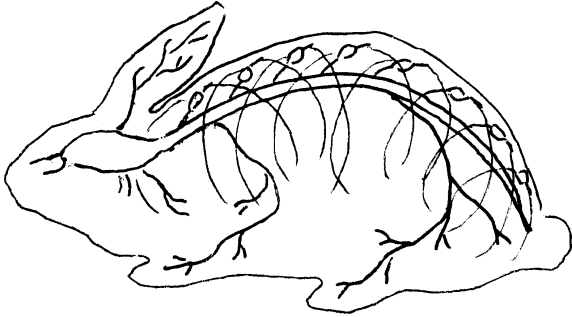
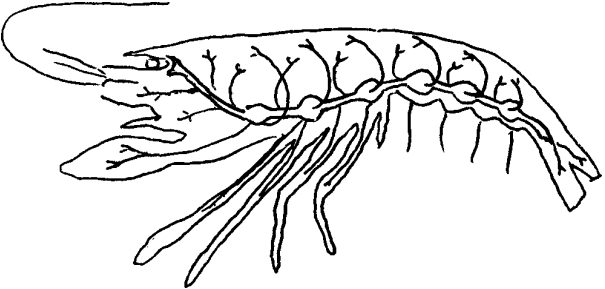
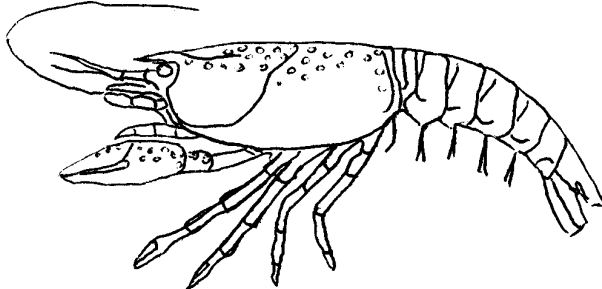
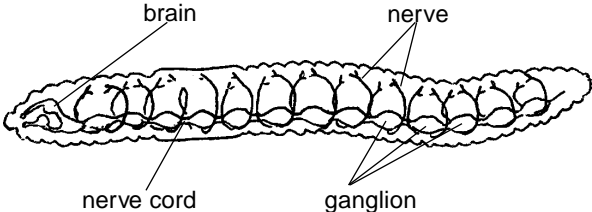
Copy the outline drawing of each organism into your lab notebook and label and color code each of the nervous system structures (listed above) that you identified. Record exactly where each of these structures is located in each of the organisms, noting both similarities and differences.

Now look at Lab Sheet B. Copy or trace the illustrations of the person and the grasshopper into your notebook in outline form only. Based on the illustrations in Lab Sheet A, consider any differences you would expect to find between the nervous systems of these two species. Now draw in the same structures as before (nerve cord, brain, ganglia, nerves) in the locations you would expect to find them in the actual organisms. Color code the structures as before.

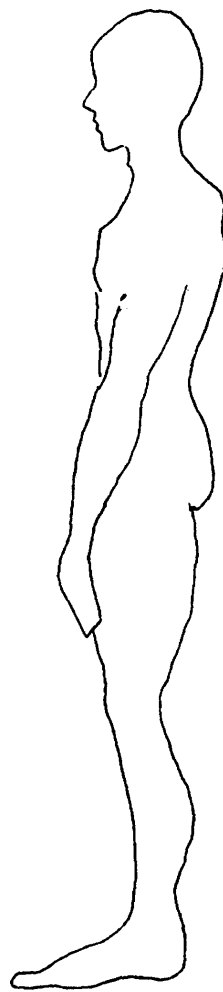
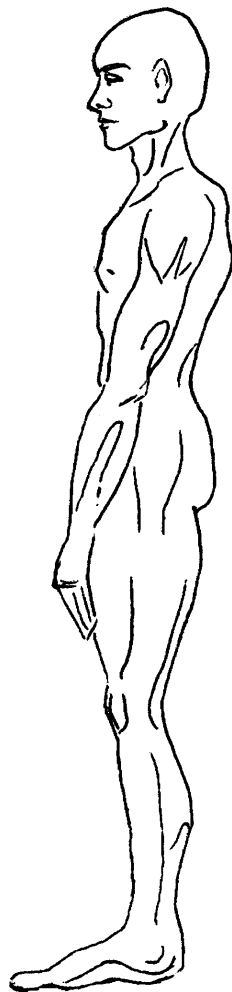
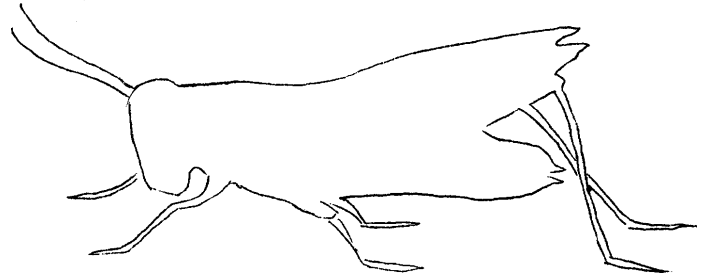
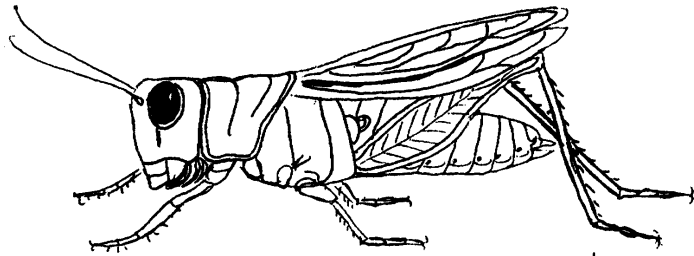
Questions:

1. What are the basic components of the nervous system common to all of the organisms in this activity?
2. What differences did you observe between the nervous systems of the various organisms?
3. Based on your observations, how would you describe to another person the location and extent of the nervous system in all animals?
4. In order to respond, an organism must first be aware of an external stimulus. We use the term “motor function” to refer to a movement response and the term “sensory function” to refer to the sensing of a stimulus. Do the nervous system parts you observed provide for a sensory function as well as a motor function? Explain.

LAB SHEET A



LAB SHEET B



Science as Inquiry

Cell Phones**How does the nervous system provide a communication system for the body?****Overview:**

The nervous systems you have studied thus far extend throughout the body of each organism. They include sensory components that transmit information about the outside environment (and environment inside the body) to the brain and motor, or effector, components that deliver the brain's messages to various muscles and tissues to cause appropriate responses to each stimulus. The basic unit of the nervous system is the neuron, or nerve cell. Based on its function, what would you expect a neuron to look like?

Procedure:

Work in groups as directed by your teacher. Your task is to determine which one of several prepared microscope slides is an actual nerve cell. Observe each of the slides that have been provided for you. Ask your teacher for help if you have trouble using or focusing the microscope.

Study the shape and other structural features of each cell while considering the function of a nerve cell. Record your observations (draw what you see on each slide) in your lab notebook along with notes on whether you believe each slide could be a nerve cell. State your reasons based on the cell's structural characteristics and/or shape. After viewing all the slides, come to an agreement within your group as to which slide you believe is a nerve cell. Be prepared to explain your choice.

Questions:

1. Describe the cell you chose as a nerve cell and thoroughly explain which features of the cell led to your decision.
2. Would you expect nerve cells in all multicelled organisms to be similar? Explain your reasoning.
3. How would you describe a nervous system? Complete this sentence: "A nervous system is like . . ."