

# Biology Lab Activities: Animal Nervous Comparison

# How to use this manual

This lab manual is intended for use with the [Visible Biology](#) product.

## Where to find 3D models

The screenshot shows the Visible Biology interface. At the top, there are three main sections: 'Units', 'Study', and 'My Library'. Under 'Study', there are sub-sections for 'Flashcard Decks', 'Flashcards', 'Quizzes', and 'Lab Activities'. The 'Lab Activities' tab is circled in red. Below this, a red arrow points to a 'Get Labs' button, also circled in red. To the right, a red text box says: 'Under the Study section of Visible Biology, there is a Lab Activities tab.' Below the 'Get Labs' button, there is a section titled 'Prokaryotic and Eukaryotic Cells Lab'. It contains three 3D models of cells: 1. Bacterial Cell, 2. Animal Cell, and 3. Plant Cell. A red arrow points to these models with the text: 'Find the row of 3D views that corresponds to each lab manual and use the views to investigate and find answers.'

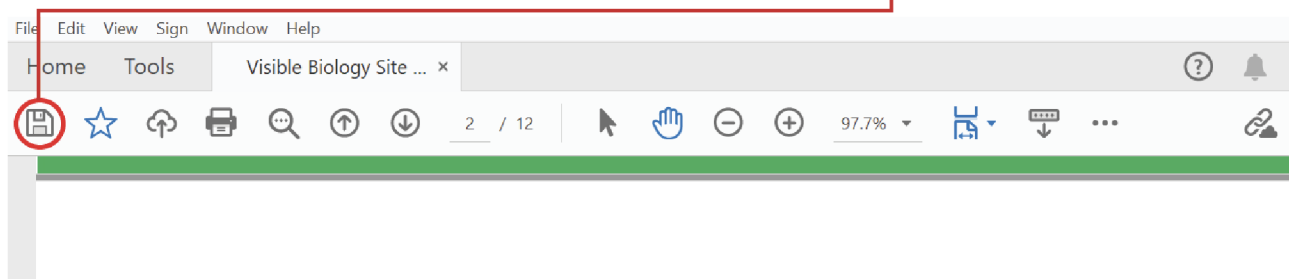
## How to save answers

1. Have Adobe Reader installed on your computer.  
Windows: <https://get.adobe.com/reader/>  
Mac: <https://helpx.adobe.com/acrobat/kb/install-reader-dc-mac-os.html>

2. Download each lab file to your computer.



3. Open the downloaded file in Adobe Reader.  
Right-click on the file. In the menu that appears, go to "Open with..." and select Adobe Reader from the submenu.
4. Type your answers into the boxes to complete the lab and select the "Save" icon to save the lab.



5. Submit your saved version of the lab to your instructor via email, dropbox, Google Drive, or however your instructor has requested.

Any questions? [visiblebiology.com](http://visiblebiology.com)

Name:

Date:

## **Biology Lab Activities: Animal Nervous Comparison**

*Last updated: 3/24/2023*

### **Background Questions**

Based on what you've learned in class, in your textbook, and from using Visible Biology, answer the following questions about the nervous structures and functions of the sea star, earthworm, frog, and pig.

1. Earthworms, frogs, and pigs all have central and peripheral nervous systems. The sea star has a much simpler nervous system.
  - a. Earthworms, frogs, and pigs all have a \_\_\_\_\_ that processes sensory signals and transmits motor commands throughout the body. Sea stars lack this structure.
  - b. Frogs and pigs have a \_\_\_\_\_ that processes their reflexes and carries nervous signals between the brain and the body. The earthworm has a similar structure, the \_\_\_\_\_, which carries nervous signals between the brain and peripheral nerves in each body segment.
  - c. Sea stars have \_\_\_\_\_ in the epidermis that receive touch and smell information from their environment. They also have \_\_\_\_\_ at the end of their arms that detect light intensity from their environment. Their nerves carry these sensory signals to the rest of the body.
  
2. Although each of these animals has some unique nervous structures, the process for moving nervous signals throughout the body is similar in all of them. In 2–3 sentences, describe how nervous signals are sent throughout the body.

Name:

Date:

### Lab 1: Nervous Structures

#### Activity 1: Label the sea star's nervous structures

1. Launch the view
  - Launch Visible Biology.
  - Navigate to Study/Lab Activities, and find the Evolution: Animal Diversity Lab section.
  - Select view 9. Sea Star, Nervous.
2. Label the image below
  - Explore the 3D model of the sea star to find the structures you need to label.
  - Fill in the blanks to label the structures from the list below.

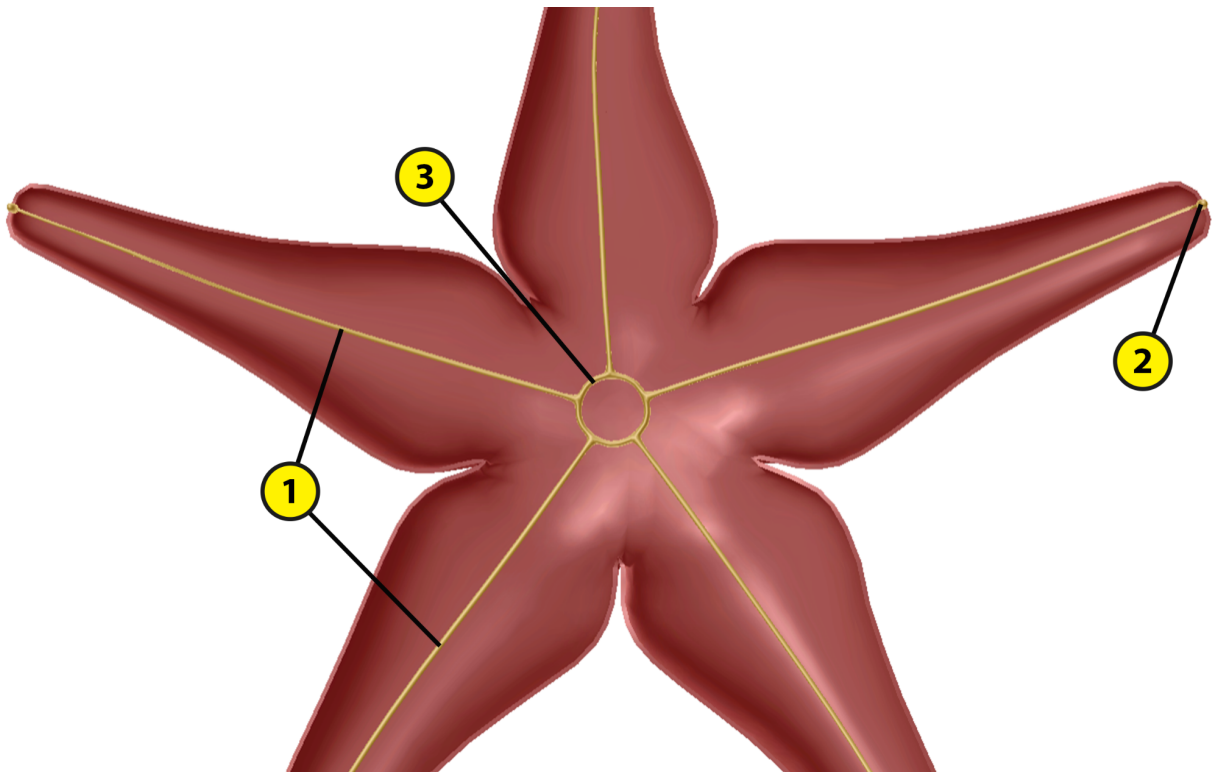
Word List:

Eyespot

Nerve ring

Radial nerves

—  
—  
—



Name:

Date:

### Lab 1: Nervous Structures

#### Activity 2: Label the earthworm's nervous structures

1. Launch the view
  - Launch Visible Biology.
  - Navigate to Study/Lab Activities, and find the Evolution: Animal Diversity Lab section.
  - Select view 10. Earthworm, Nervous.
2. Label the image below
  - Explore the 3D model of the earthworm to find the structures you need to label.
  - Fill in the blanks to label the structures from the list below.

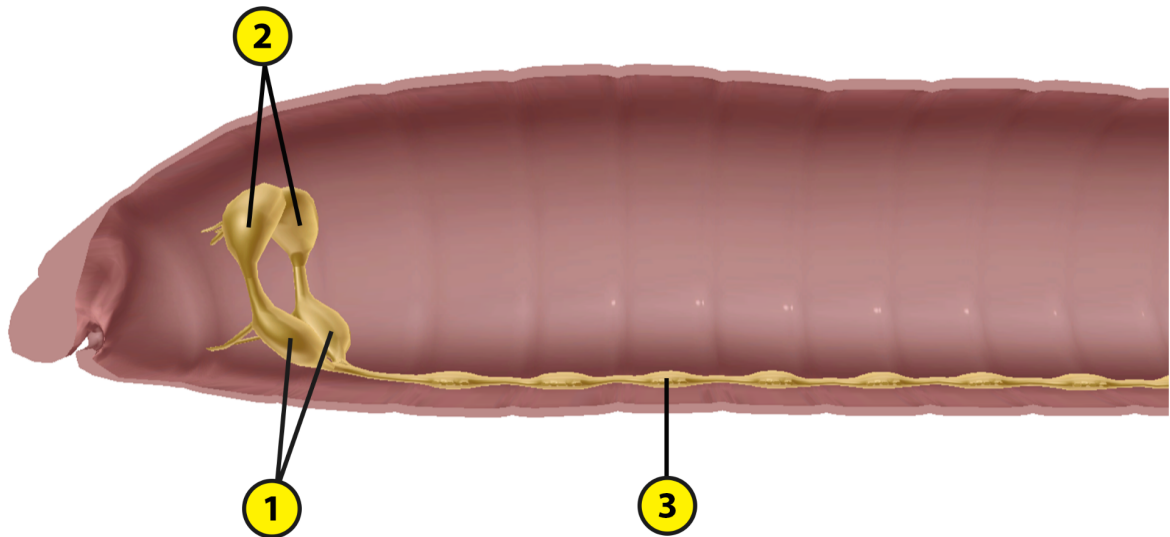
Word List:

Brain (cerebral ganglia)

Subpharyngeal ganglia

Ventral nerve cord

\_\_\_\_  
\_\_\_\_  
\_\_\_\_



Name:

Date:

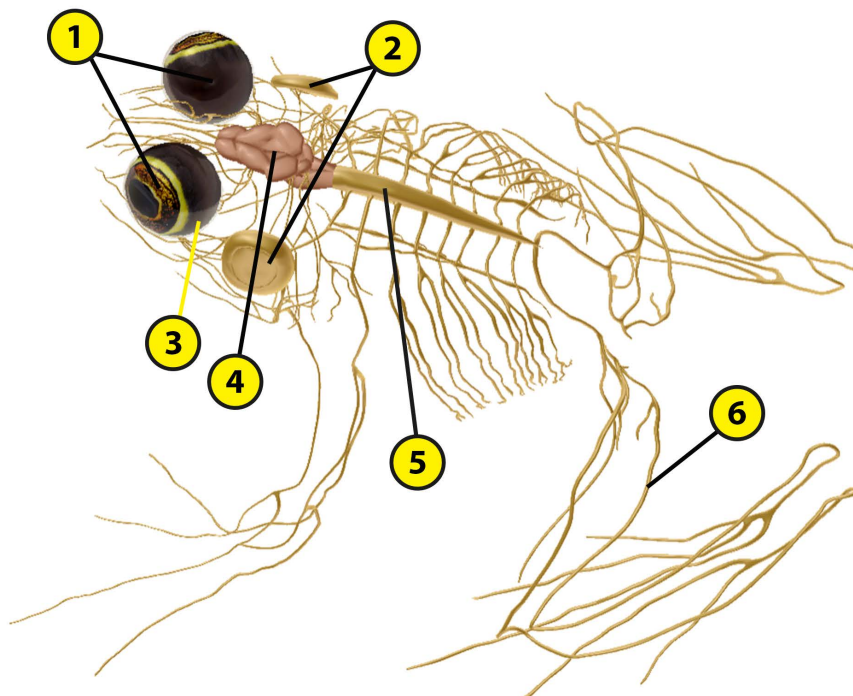
### Lab 1: Nervous Structures

#### Activity 3: Label the frog's nervous structures

1. Launch the view
  - Launch Visible Biology.
  - Navigate to Study/Lab Activities, and find the Evolution: Animal Diversity Lab section.
  - Select view 11. Frog, Nervous.
2. Label the image below
  - Explore the 3D model of the frog to find the structures you need to label.
  - Fill in the blanks to label the structures from the list below.

Word List:

- Brain \_\_\_\_\_
- Eyes \_\_\_\_\_
- Nerves \_\_\_\_\_
- Nictitating membrane \_\_\_\_\_
- Spinal cord \_\_\_\_\_
- Tympanic membranes \_\_\_\_\_



Name:

Date:

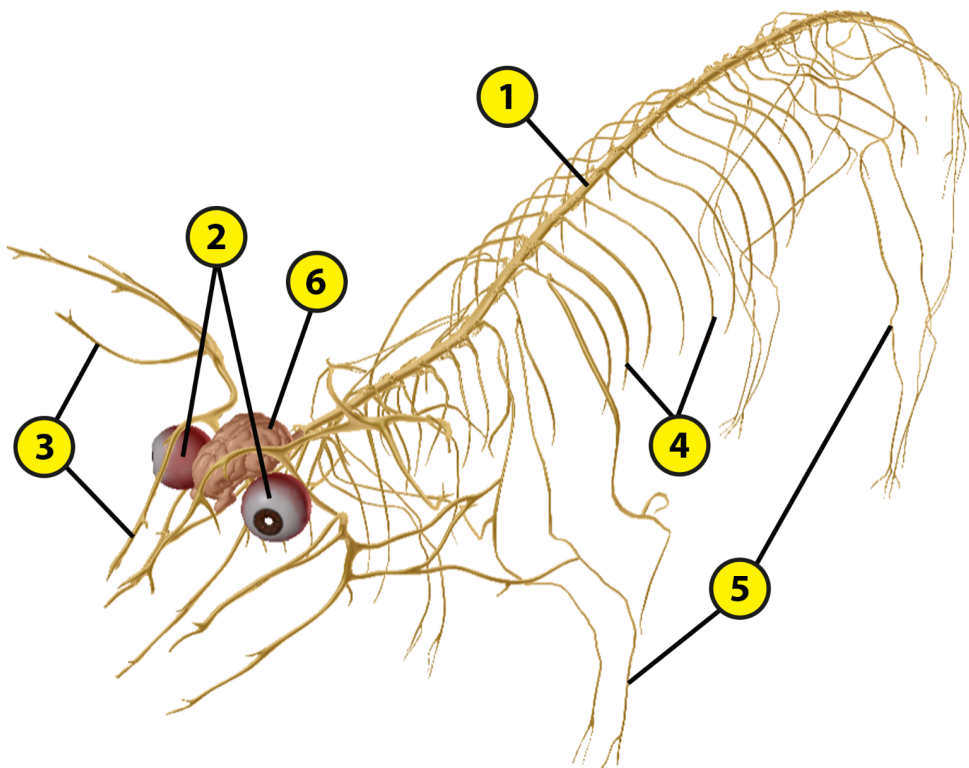
### Lab 1: Nervous Structures

#### Activity 4: Label the pig's nervous structures

1. Launch the view
  - Launch Visible Biology.
  - Navigate to Study/Lab Activities, and find the Evolution: Animal Diversity Lab section.
  - Select view 12. Pig, Nervous.
2. Label the image below
  - Explore the 3D model of the pig to find the structures you need to label.
  - Fill in the blanks to label the structures from the list below.

#### Word List

- Brain \_\_\_\_\_
- Cranial nerves \_\_\_\_\_
- Eyes \_\_\_\_\_
- Peripheral nerves \_\_\_\_\_
- Spinal cord \_\_\_\_\_
- Spinal nerves \_\_\_\_\_





Name:

Date:

## Lab 2: Nervous Functions

### **Activity 1: Explore the nervous structures of the sea star and their functions**

Refer to your labeled sea star image from Lab 1, Activity 1 and the content in Visible Biology. Based on what you've learned, match each of the following structures with the brief description of its function.

#### Structures:

- a. Eyespots
- b. Nerve ring
- c. Radial nerves

#### Descriptions:

- \_\_\_ These structures carry nervous signals along each of the sea star's arms.
- \_\_\_ These structures detect light intensity within the sea star's environment.
- \_\_\_ This structure carries nervous signals around the central disk and into the nerves in the arms.



Name:

Date:

## Lab 2: Nervous Functions

### **Activity 2: Explore the nervous structures of the earthworm and their functions**

Refer to your labeled earthworm image from Lab 1, Activity 2 and the content in Visible Biology. Based on what you've learned, match each of the following structures with the brief description of its function.

#### Structures:

- a. Brain (cerebral ganglia)
- b. Subpharyngeal ganglia
- c. Ventral nerve cord

#### Descriptions:

- \_\_\_ These structures connect the brain to the ventral nerve cord.
- \_\_\_ This structure carries nervous signals between the brain and the peripheral nerves in each body segment.
- \_\_\_ This structure processes sensory signals from the body segments and sends motor commands to move the earthworm.

Name:

Date:

## Lab 2: Nervous Functions

### **Activity 3: Explore the nervous structures of the frog and their functions**

Refer to your labeled frog image from Lab 1, Activity 3 and the content in Visible Biology. Based on what you've learned, match each of the following structures with the brief description of its function.

#### Structures:

- a. Brain
- b. Eyes
- c. Nerves
- d. Nictitating membranes
- e. Spinal cord
- f. Tympanic membranes

#### Descriptions:

- \_\_\_ These structures prevent the eyes from drying out and protect them from debris.
- \_\_\_ These structures connect to the optic lobes of the forebrain via the optic nerves, allowing the frog to process visual information rapidly.
- \_\_\_ These structures transmit sound vibrations to the inner ear.
- \_\_\_ These structures carry sensory and motor signals between the brain, spinal cord, and body.
- \_\_\_ This structure processes sensory information and generates motor commands.
- \_\_\_ This structure processes the frog's reflexes and relays information between the brain and the nerves.

Name:

Date:

## Lab 2: Nervous Functions

### **Activity 4: Explore the nervous structures of the pig and their functions**

Refer to your labeled pig image from Lab 1, Activity 4 and the content in Visible Biology. Based on what you've learned, match each of the following structures with the brief description of its function.

#### Structures:

- a. Brain
- b. Cranial nerves
- c. Eyes
- d. Peripheral nerves
- e. Spinal cord
- f. Spinal nerves

#### Descriptions:

\_\_\_ This structure processes the pig's reflexes and relays information between the brain and the spinal nerves.

\_\_\_ These structures connect to the optic nerves to relay visual stimuli.

\_\_\_ This structure processes sensory information and generates motor commands.

\_\_\_ These structures branch out from the spinal cord and carry nervous signals throughout the body.

\_\_\_ These structures relay information between the brain and the sensory organs and other structures within the head and upper body.

\_\_\_ These structures carry sensory and motor signals between the brain, spinal cord, and body.

Name:

Date:

### Lab 3: Evolutionary Similarities and Differences

Based on what you've learned about the nervous structures of the sea star, earthworm, frog, and pig, answer the following questions about their evolutionary similarities and differences and the adaptations that help them survive in their environments.

1. All animals have structures that move nervous signals throughout the body. The sea star, earthworm, frog, and pig have some similarities in their nervous structures and functions.
  - a. All four animals have nerves that run throughout their bodies.
    - i. Sea stars have a \_\_\_\_\_ that runs around the central disk and \_\_\_\_\_ nerves that run along the arms.
    - ii. Earthworms have a \_\_\_\_\_ that runs the length of its body, connecting the brain to \_\_\_\_\_ nerves that carry nervous signals to the body segments.
    - iii. Frogs and pigs both have \_\_\_\_\_ nerves that relay information between the brain and the sensory organs and other structures in the head and upper body. They also have \_\_\_\_\_ nerves that branch from the spinal cord and carry nervous signals between the brain and the body.
  - b. Earthworms, frogs, and pigs all have \_\_\_\_\_ and \_\_\_\_\_ nervous systems. All three of these animals have a \_\_\_\_\_ that processes and generates nervous signals.
2. These animals also have some unique nervous structures that distinguish them from each other. They developed these unique structures to help them receive sensory signals from their environments and generate motor commands to help them move through their environments.
  - a. What makes the sea star's nervous system unique from the other animals?
  - b. What two unique nervous structures does the earthworm have that the other animals don't?
  - c. The frog has some unique nervous system adaptations that help it survive on land and in water.
    - i. The frog's eyes extend from its brain, connecting to the optic lobes of the forebrain via \_\_\_\_\_. This allows the frog to process visual information quickly and from any angle with its \_\_\_\_\_ degree vision.
    - ii. The frog has \_\_\_\_\_ that protect its eyes from drying out when the frog is on land. They also protect the eyes from debris when the frog is swimming, sleeping, or hibernating.

- iii. The frog relies on its hearing to find mates and protect its territory. It has \_\_\_\_\_ that transmit sound to the inner ear. The \_\_\_\_\_ connect the inner ear to the throat and equalize pressure in the frog's inner ear when it is underwater.
- d. Like humans, frogs and pigs have a central nervous system, with a brain and spinal cord.
  - i. The brain and spinal cord are composed of \_\_\_\_\_ and white matter tissue. They are protected by layers of membranes, called \_\_\_\_\_.
  - ii. The spinal cord extends posteriorly from the \_\_\_\_\_ of the brain, down the vertebral column.
  - iii. As vertebrates, the frog and pig have a \_\_\_\_\_ that protects the brain and \_\_\_\_\_ that protect the spinal cord.
  - iv. The largest part of the brain, the \_\_\_\_\_, is divided into two hemispheres. Located behind this structure are the \_\_\_\_\_, which ensures smooth body movements, and a brainstem that connects the brain to the spinal cord.

3. Match each of the following animals with the description of how it receives sensory information from its environment.

Animals:

- a. Sea star
- b. Earthworm
- c. Frog
- d. Pig

Digestive Adaptations:

- \_\_\_ This animal receives sensory information mostly through its ears and eyes.
- \_\_\_ This animal detects light intensity through its eyespots and touch and smell information through receptors in its epidermis.
- \_\_\_ This animal receives sensory information through its eyes, ears, nostrils, and skin.
- \_\_\_ This animal receives light and dark, tactile, taste, smell, and chemical signals through receptors in its epidermis.

4. Based on what you've learned by labeling the nervous structures of these animals in Lab 1 and matching the structures with their functions in Lab 2, put these animals in order, from simplest to most complex (*where 1 has the simplest nervous system and 4 has the most complex nervous system*).

- \_\_\_ Earthworm
- \_\_\_ Pig
- \_\_\_ Sea star
- \_\_\_ Frog