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Biology Lab Activities: Frog

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> Background Questions

Based on what you've learned in class, in your textbook, and from using Visible Body, answer the following questions about the frog.

- 1. What type of body symmetry is present in frogs?
- Frogs are terrestrial and aquatic vertebrates. They breathe through their
 when they are on land and through their when
 they are in the water. Their skin is ______, which means they can
 absorb oxygen and water from the environment. Frogs can also release
 _____ from their skin to protect against predators.
- 3. The frog's feet have adapted to help it escape predators and catch prey. The bones of the frog's digits are elongated to help the frog jump farther. Also, the frog's hind feet are _____, which helps it swim faster.
- 4. Frogs are part of the phylum Chordata. In 1–2 sentences, explain the characteristics the frog shares with other animals in this phylum.

For the text that's underlined in the following question, circle the correct answer.

5. Frogs reproduce <u>asexually</u>/sexually. Both male and female frogs release their gametes through the ______ into the environment, where they are externally fertilized.

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Lab 1: Frog Structure and Function

> Activity 1: Label the frog

- 1. Launch the view
 - Launch Visible Body.
 - \circ $\,$ Browse or use the Search tool to view the Frog model.
- 2. Label the image below
 - Explore the 3D model of the frog to find the structures you need to label. You can use the Systems Tray, located on the left side of the screen, to isolate specific body systems in the frog model.
 - Fill in the blanks to label the structures from the list below.

Part A: Label the structures of the frog's exterior and its head region.

Word List:	
Digits, webbed	
Epidermis and dermis	
Nictitating membrane	
Nostrils (external nares)	
Skull	
Tympanic membrane	



Part B: Label the structures of the frog's circulatory and respiratory systems.

<u>Word List</u> :	
Anterior vena cava	
Aortic arches	
Arteries	
Dorsal aorta	
Glottis	
Larynx	
Lungs	
Posterior vena cava	
Pulmonary vessels	
Right atrium	
Systemic arches	
Veins	
Ventricle	



Part C: Label the structures of the frog's support and nervous systems.



Part D: Label the structures of the frog's digestive system.

<u>Word List</u> :	
Esophagus	
Fat bodies	
Large intestine (colon)	
Liver	
Oral cavity	
Small intestine	
Stomach	



Part E: Label the structures of the frog's reproductive and excretory (urogenital) systems.

Word List:	
Adrenal glands	
Bladder	
Cloaca	
Kidneys	
Testes	
Ureters	



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Lab 1: Frog Structure and Function

> Activity 2: Explore the structures of the frog and their functions

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

Part A: Circulatory, Nervous, and Respiratory Systems

Structures:

- a. Anterior vena cava
- b. Aortic arches
- c. Brain
- d. Dorsal aorta
- e. Larynx
- f. Lungs
- g. Pulmonary vessels
- h. Right atrium
- i. Spinal cord
- j. Systemic arches
- k. Tympanic membranes
- I. Ventricle

Descriptions:

- _____ This structure pumps oxygenated blood from the lungs to the rest of the body.
- _____ This structure processes sensory information and generates motor commands.
- ____ This structure pumps oxygenated blood through the aorta to the body.
- ____ This structure processes the frog's reflexes.

____ The truncus arteriosus divides into these structures, named by their locations within the circulatory system.

_____ This structure branches from the sinus venosus attached to the right atrium.

- _____ The vocal cords are located within this structure.
- _____ These structures transmit sound vibrations to the inner ear.
- ____ This structure receives deoxygenated blood from the veins.
- _____ The dorsal aorta forms where these structures meet.
- _____These structures allow the frog to breathe while on land.

____ The ventricle pumps deoxygenated blood through these structures to be carried to the lungs.

Part B: Digestive, Reproductive, and Excretory Systems Structures:

- a. Adrenal glands
- b. Bladder
- c. Cloaca
- d. Fat bodies
- e. Kidneys
- f. Liver
- g. Stomach
- h. Testes

Descriptions:

____ These structures provide extra nourishment for the frog during periods of hibernating or the breeding season.

____ These structures secrete hormones that help regulate water balance and overall homeostasis.

_____ This structure contains digestive enzymes that break down food into nutrients.

_____ This structure stores urine before it is excreted.

____ This structure produces bile to help fully break down food into absorbable nutrients.

____ These structures produce sperm cells.

_____ This structure excretes urine and feces and receives sperm from the testes.

____ This structure produces urine by filtering urea and other waste products out of the blood.

Part C: Exterior of the Frog and Support System

Structures:

- a. Cervical vertebra
- b. Epidermis and dermis
- c. Nictitating membranes
- d. Phalanges
- e. Radio-ulna
- f. Sacral vertebra
- g. Tibio-fibula

Descriptions:

____ This fused structure makes the frog's forelimb strong.

____ This structure connects to the back of the frog's skull and is also known as the atlas.

____ These structures cover the eyes to protect them from debris and prevent them from drying out when the frog is on land.

____ This fused structure helps power the frog's jumps.

____ These structures connect to the metacarpals in the hands and the metatarsals in the feet.

____ These structures cover the frog's surface, allowing it to absorb oxygen and water from its environment.

____ This structure is the frog's last vertebra.

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Lab 2: Frog Dissection

Introduction

Frogs are terrestrial and aquatic vertebrates with bilateral symmetry. These amphibians are part of the phylum Chordata, which is characterized by a notochord, a dorsal nerve cord, an endostyle or thyroid gland, pharyngeal slits, and a post-anal tail. Several adaptations help frogs catch prey and escape predators, including webbed hind feet, strong hind legs, camouflage, and the ability to produce toxins. A key adaptation that helps frogs survive on land and in the water is their ability to breathe through both their lungs and skin. They can move through their environment by jumping, swimming, climbing, crawling, and digging. Frogs eat live prey, which passes into the stomach, where it drowns in stomach acid. Nutrients and water are absorbed in the intestines, and waste is excreted through the cloaca (vent). Frogs reproduce sexually, with the female releasing her eggs and the male releasing his sperm for external fertilization. Frogs are deuterostomes, meaning their embryos develop the anus before the mouth. They hatch from eggs as tadpoles before developing into mature frogs. Frogs are small and accessible, so they often serve as a representative sample for studying complex vertebrate body systems.

In this activity, you will examine a frog and learn about its external and internal structures.

Materials

- Frog (virtual or preserved)
- Dissecting scissors or scalpels
- Dissecting pins and probes
- Dissecting tray
- Hand lens
- Lab gloves

Dissection Observe the external structures of the frog

Observe the frog's external surface. Many of its adaptive features help it move throughout its environment and protect itself against predators.

- 1. Observe the following external structures:
 - a. Anus

- b. Epidermis and dermis (skin)
- c. External nares (nostrils)
- d. Eyes
- e. Nictitating membranes
- f. Webbed hind digits and non-webbed front digits

If using the Visible Body virtual frog, follow these steps

Note: Use the Hide button to hide individual structures. You can use the Systems Tray to toggle individual body systems on or off in the view. Within the view, you can zoom in/out or rotate the model as needed to observe the frog's structures.

- 1. First, select the epidermis and dermis and use the book icon to learn more about the frog's skin. Then, use the Systems Tray to remove the entire integumentary system from the view.
- 2. Next, observe some of the frog's muscles, including its forelimb and hind limb muscles that help the frog with its powerful leaps and swimming. Then, rotate the frog as necessary to observe the following muscles, using the book icon to read about them as you go. Once you have examined each muscle, use the Systems Tray to remove the entire muscular system from the view.
 - a. Dorsalis scapulae (r, l)
 - b. Latissimus dorsi (r, l)
 - c. Longissimus dorsi (r, l)
 - d. Masseter (r, l)
 - e. Pectoralis (r, l)
 - f. Submaxillary (or mylohyoid)
- 3. Then, observe the following support/skeletal system structures. Select each of the following structures below and use the book icon to learn more about it. Once you have examined each support structure, use the Systems Tray to remove the entire support system from the view.
 - a. Cervical vertebra
 - b. Clavicle (r, l)
 - c. Episternum
 - d. Femur (r, l)
 - e. Humerus (r, l)
 - f. Maxillary teeth
 - g. Pelvic bones
 - h. Radio-ulna (r, l)
 - i. Sacral vertebra
 - j. Skull
 - k. Sternum
 - I. Tibio-fibula (r, l)
 - m. Vertebrae

- 4. Next, observe the nervous system structures. Select each of the following structures and use the book icon to learn more about it. Once you have examined each nervous structure, use the Systems Tray to remove the entire nervous system from the view.
 - a. Brain
 - b. Eyes
 - c. Nerves
 - d. Spinal cord
 - e. Tympanic membranes
- 5. Then, observe the circulatory and respiratory system structures. The first structures you will notice are the veins and arteries. Click on these, read their definitions, and use the Hide button to remove as many as necessary to create a clear view of the other internal structures. Select each of the following structures below and use the book icon to learn more about it. Once you have examined each circulatory and respiratory structure, use the Systems Tray to remove the entire circulatory and respiratory systems.
 - a. Aortic arches
 - b. Dorsal aorta
 - c. Larynx
 - d. Left atrium
 - e. Lungs
 - f. Pulmonary vessels
 - g. Right atrium
 - h. Systemic arches
 - i. Ventricle
- 6. Finally, observe the following digestive, excretory, and reproductive system structures. One of the first structures you will see are the fat bodies. Select them and use the book icon to read their definition. Then, use the Hide button to hide them and get a clearer view of the other internal organs. Select each of the following structures below and use the book icon to learn more about it.

Note: If you want to view these internal organs in context, you can use the Systems Tray to add back any of the systems you removed in previous steps. You can also hide individual structures on the list below after you have examined them to get a clearer view of specific structures.

- a. Adrenal glands
- b. Anus
- c. Bladder
- d. Cloaca (vent)
- e. Esophagus
- f. Gallbladder
- g. Kidneys

- h. Large intestine (colon)
- i. Liver
- j. Oral cavity
- k. Small intestine
- I. Stomach
- m. Testes
- n. Tongue

If using a preserved specimen, cut into your frog to observe its internal structures

- 1. Place the frog on the dissecting tray with its dorsal side facing up. Observe the frog's external structures, such as its four limbs, its large eyes, the nictitating membranes that cover them, the external nares, and the anus.
- 2. To view inside the frog's oral cavity, use your dissecting scissors to cut near the frog's jaw on both sides to open the frog's mouth wider.
- 3. Observe the following structures:
 - a. Support System: Mandible and maxillary teeth
 - b. Digestive System: Tongue and esophagus
 - c. Respiratory System: Glottis
 - d. Muscular System: Masseter and submaxillary (or mylohyoid)
- 4. Place the frog with its ventral side (belly or abdomen) facing up. Use dissecting pins to secure each of the frog's limbs on the tray.
- 5. Make a vertical cut through the skin only, from the mouth to where the lower limbs begin.
- 6. Make two more horizontal incisions. Start from the center of the sternum and cut to where the forelimbs attach to the body. These incisions should allow you to open the skin and peel it back from the underlying muscle layer.
- 7. Carefully make the same cuts from steps 5 and 6 to cut through the muscle layers underneath the dermis. This incision also cuts through the sternum.
- 8. Pin back the resulting flaps of skin and muscle to reveal the internal organs. This opens up the frog's ribcage.
- 9. Observe the following internal structures:
 - a. Excretory System: Liver and gallbladder
 - b. Digestive System: Fat bodies, stomach, small intestine, and large intestine (colon)
 - c. Circulatory System: Heart (ventricle, right atria, and left atria)
 - d. Respiratory System: Lungs
- 10.Once you have observed the structures above, cut around the stomach to remove it from the body cavity. This will reveal organs of the excretory and reproductive systems.
- 11.Observe the following internal structures:
 - a. Excretory System: Kidneys, bladder, and cloaca (vent)

b. Reproductive System: Testes and cloaca (vent)

Note: If observing a female frog, you will look for the ovary and the oviduct instead of the testes.

Questions

Based on your observations during this lab activity and what you've learned about the frog's structures and their functions, answer the following questions.

- 1. Which structures help power the frog's jumps?
- 2. Why do you think animals like the frog have nictitating membranes? Explain your answer in 3–5 sentences.
- 3. The human heart has four chambers. What main difference did you notice about the frog's heart, in comparison to a human's?
- 4. Describe how frogs are able to process stimuli from the environment.