

Chapter 30 Nonvertebrate Chordates, Fishes, and Amphibians

Investigating Frog Anatomy

Introduction

Frogs are typical amphibians, adapted to live in water and on land. The organization of an adult frog's internal organs is similar to the internal organization of other vertebrates that live on land. Its small size makes it easy to study. In this investigation you will dissect an adult frog and observe structures that make the frog adapted to its environment.

Problem

What are some features of a frog's anatomy that help it adapt to its environment?

Pre-Lab Discussion

Read the entire investigation. Then, work with a partner to answer the following questions.

1. What will you examine in Part A of this investigation?

2. Why is it important to make shallow cuts when cutting the skin around the frog's hindlimb?

3. After you expose the internal organs in Part B, what two structures might you have to remove in order to examine the organs?

4. Which organs of the digestive system will you identify in Part C?

5. Without the presence of eggs, how will you know whether your frog is male or female?

Materials *(per pair)*

plastic gloves
preserved frog
paper towels
dissecting tray
dissecting scissors



dissecting probes
forceps
plastic food bag
dissecting pins
waterproof marker

Safety

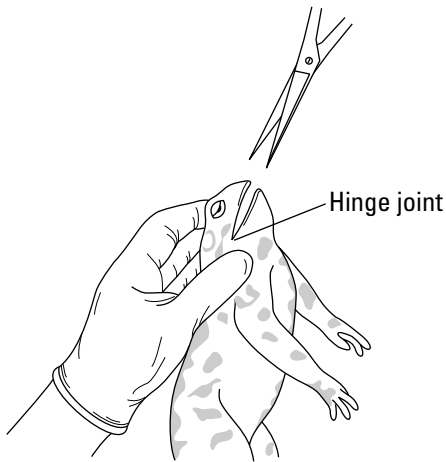
Put on safety goggles, a laboratory apron, and disposable plastic gloves. Treat the preserved animal, preservation solution, and all equipment that touches the organism as potential hazards. Do not touch your eyes or your mouth with your hands. Be careful when handling sharp instruments. Return or dispose of all materials according to the instructions of your teacher. Wash your hands thoroughly after carrying out this investigation. Note all safety symbols next to the steps in the Procedure and review the meanings of each symbol by referring to Safety Symbols on page 8.

Procedure

Part A. The Head and Limbs

-  1. Work in pairs throughout this investigation. Wear your safety goggles, laboratory apron, and disposable gloves. Obtain a preserved frog from your teacher. Rinse the frog with water to wash off as much preservative as possible and then blot it dry with a paper towel. Place the frog in the dissecting tray and briefly examine it. **CAUTION:** *When working with preserved organisms, do not touch your eyes or mouth with your hands.*
2. Examine the frog's head. Notice the size and position of the eyes. The round, flattened areas of skin behind the eyes are the tympanic membranes, or eardrums. The two holes near the mouth are the nostrils, called the external nares.
-  3. To examine the interior of the mouth, pry open the mouth and use the scissors to cut the edges of the mouth at each hinge joint, as shown in Figure 1. **CAUTION:** *Handle sharp tools carefully.* Insert the dissecting probe into both external nares. The openings inside the mouth through which the probe emerges are the internal nares. Along the rim of the mouth you will find a row of small maxillary teeth. Farther back, attached to the roof of the mouth, are two sharp vomerine teeth.
4. Find the wide opening in the center of the mouth. This is the top of the esophagus—the tube that leads to the frog's stomach. Below the esophagus is a vertical slit called the glottis—the tube that leads to the lungs.
5. Use a dissecting probe to move the frog's tongue. Note where the tongue is attached to the jaw.
6. On page 222, label each part of the frog's mouth on the lines provided.
7. Examine the frog's forelimbs and hindlimbs. Observe the webbed toes. Compare the sizes of the muscles on the front and back limbs.

8. With the point of your scissors, carefully make an incision through the skin where one of the hindlimbs joins the body. If necessary, use the forceps to pull up the skin. Cut the skin around the hindlimb, as shown in Figure 2. **Note:** *The frog's skin is very thin. When cutting the skin, make shallow cuts to avoid damaging the muscles under the skin.* With the forceps, peel the skin off the hindlimb to expose the muscles underneath. Gently remove the thin, connective tissue covering the muscles. The muscles are connected to the bones with tough white cords called tendons. When a muscle contracts, the tendon moves and pulls the bone.



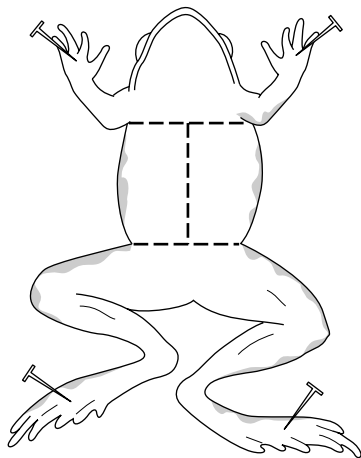
Carefully cut the edges of the mouth at each hinge joint.

Figure 1



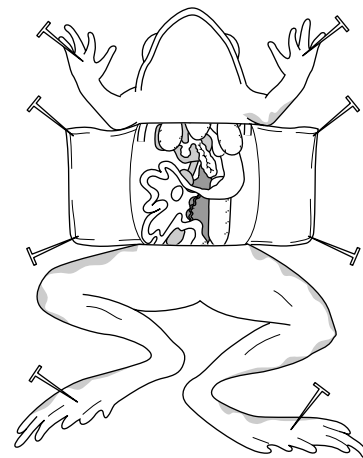
Carefully cut the skin around one hindlimb. Make shallow cuts to avoid damaging muscles.

Figure 2




Gently lift the loose skin where the hindlimbs meet. Carefully make an incision through the raised skin.

Figure 3




Lift the skin flaps and pin them to the wax.

Figure 4

-  9. At the end of the laboratory period, wrap the frog in a wet paper towel and put it in a plastic bag. Tie the bag closed and label it with your name and your partner's. **CAUTION:** *Wash your hands with soap and water after working with the preserved frog.*

Part B. The Frog's Internal Anatomy

1. Wear your safety goggles, laboratory apron, and disposable gloves. Lay the frog on its back in the tray. Use the dissecting pins to attach the limbs to the wax in the tray. With the forceps, gently lift the loose skin where the frog's hindlimbs meet. Use the scissors to make an incision through the raised skin. Cut the skin as shown by the dotted lines in Figure 3, along the center of the body to the base of the head. Then cut the skin laterally from the central incision to each of the limbs. Lift the skin flaps and pin them to the wax in the tray as shown in Figure 4.
2. Cut the muscle of the body wall in the same way that you cut the skin. Raise the muscle with your scissors as you cut to avoid damaging the structures underneath. When you reach the forelimbs, you will have to cut through the frog's breastbone, or sternum.
-  3. Pin back the muscle flaps to expose the internal organs. If the frog is a female, the organs may be covered with a mass of black and white eggs. If so, cut away the eggs and remove them. Yellow fingerlike structures, called fat bodies, may also be covering some organs. Remove those structures as well. Dispose of the eggs and fat bodies according to your teacher's instructions.

Part C. Digestive System

1. As you continue to examine the frog's internal anatomy, refer to the diagrams in Section 30–3 of your textbook to help locate and identify internal organs. Find the large, lobed, reddish brown organ in the middle of the body cavity. This organ is the liver, which stores food, aids fat digestion by producing a substance called bile, and removes poisonous wastes from the blood.
2. Use the dissecting probe to gently raise the liver. Under the liver you will find a greenish sac called the gall bladder. This organ stores the bile produced by the liver before it passes into the small intestine.
3. The oval, whitish sac is the frog's stomach. The esophagus carries food from the mouth to the stomach, where it is partially digested. From the stomach, food passes into the small intestine, where digestion is completed. Find the thin, ribbonlike pancreas lying above the curved end of the stomach. This organ secretes digestive enzymes into the small intestine.

4. Notice that the small intestine is looped. With the dissecting probe, lift the small intestine. Using the forceps, carefully remove some of the connecting tissue that holds the small intestine in place. The small intestine leads to a wider tube called the large intestine. Food wastes pass from the large intestine to the cloaca, a large sac that passes wastes out of the frog's body.
5. Draw and label parts of the frog's digestive system in Figure 6 on page 222.

Part D. Circulatory and Respiratory Systems

1. Find the heart, a reddish triangular organ in the middle of the upper body. The heart has three chambers. The two upper atria collect blood from the veins and pass the blood to the lower chamber, the ventricle. The ventricle pumps the blood throughout the body through arteries.
2. The red, pea-shaped organ near the small intestine is the spleen. It produces white blood cells and removes dead red blood cells from the blood.
3. Locate the pair of spongy-textured lungs on either side of the heart. A frog takes in air through its external nares and enlarges its mouth by lowering the floor of the mouth. Then it closes its external nares and raises the floor of the mouth, forcing air through the glottis into the lungs.
4. Draw and label the heart, spleen, and lungs in Figure 6 on page 222.

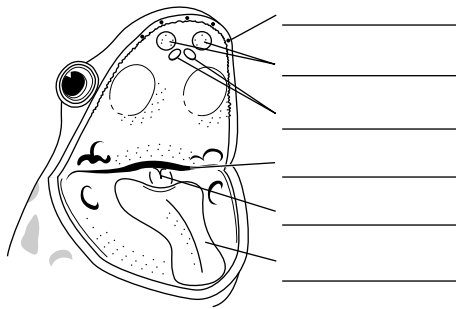
Part E. Excretory and Reproductive Systems

1. Gently move the small intestines to the side with a dissecting probe. The two long, dark organs embedded in the back wall are the kidneys. The yellow, fingerlike projections above each kidney are fat bodies, which store fat. The kidneys filter chemical wastes from the blood. Find the tube, called the urinary duct, that leads from each kidney to the urinary bladder. The urinary bladder empties into the cloaca through which the urine, eggs, and sperm are eliminated from the body.
2. If your frog is filled with eggs, it is a female ready for breeding. If your frog is a female not ready for breeding, the egg-producing ovaries appear as thin-walled, gray, folded tissues attached to the kidneys. A coiled white tube, called an oviduct, leads from each ovary and carries eggs to an ovisac where the eggs are stored until a male squeezes the eggs from the female's body.
3. The yellow, bean-shaped testes of a male frog are attached to the kidneys. Sperm from the testes pass through the urinary duct into the cloaca.

4. Draw and label the excretory and reproductive structures of the male or female frog in Figure 7 below.

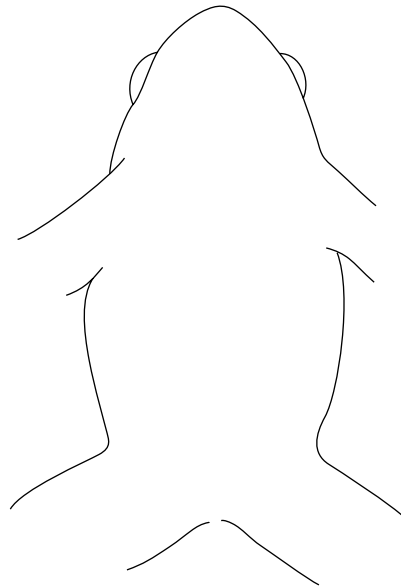


5. When you have finished your dissections, dispose of the frog as instructed by your teacher. Wash your hands with soap and water.



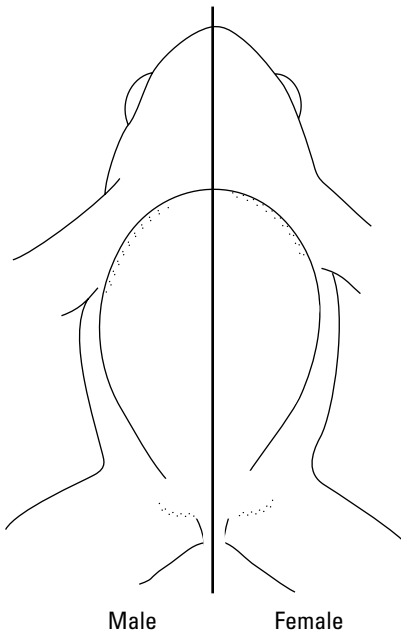
Frog's Mouth

Figure 5



Circulatory, Digestive, and Respiratory Systems

Figure 6



Reproductive and Excretory Systems

Figure 7

Analysis and Conclusions

1. **Applying Concepts** Identify three functions of a frog's cloaca.

2. **Inferring** Explain how the length of the small intestine relates to its function in absorbing nutrients.

3. **Drawing Conclusions** Explain how the frog's hindlimbs are adapted for life on land and in water.

4. **Inferring** Describe a situation in which the location of the frog's external nares would be an advantage in breathing.

5. **Inferring** Infer how the attachment of the frog's tongue helps it to catch prey.

Going Further

Based on the results of this investigation, develop a hypothesis about whether or not the internal organs of frogs are similar to the internal organs of other amphibians. Propose an experiment to test your hypothesis. If the necessary resources are available and you have your teacher's permission, perform the experiment.