ATLANTA BOTANICAL GARDEN

At Home Science!
Thirsty Frogs

Students will complete a science experiment using household items to create a simplified model of how frogs “drink” through their skin.

Background information

Frogs don’t drink water. At least not the way humans and many other animals drink water. You will likely never see a frog sitting at a water bowl lapping up the liquid in its tongue like a puppy. Instead you will see the frog sitting in the water bowl like it’s having a bath. Why is this?

Frogs are a type of amphibian along with salamanders and caecilians (an animal that looks like a cross between a snake and an earthworm). All amphibians produce some sort of mucus to cover their skin. This mucous covering sometimes causes the amphibian to feel slimy, and allows the animal to take in air and even water.

Amphibian skin is unique. Frogs in particular have areas of skin around their hind legs and bellies that are quite permeable to water. This means that the skin in these areas allows water to move easily inside or outside of the frog as needed. The movement of water across membranes from areas of high concentration (lots of water) to areas of low concentration (less water) is called osmosis. The reason frogs do not have to actively drink water and instead can sit in a bowl of water and absorb water passively is due, in large part, to osmosis.

In this experiment, you will be using a chicken egg as a model for osmosis in frogs. The egg will represent the frog and the egg’s rubbery membrane will represent the frog’s semi-permeable skin. You will put your frog model in different liquid habitats to see how it is able to survive.

What You’ll Need:

- Chicken egg (may need more than one)
- Vinegar
- Jar
- Water
- ¼ tsp Salt
- 1 TBSP Sugar
- Food coloring

Preparing your Frog Model

1. Record the length, width, and observations of your raw egg in the table below.
2. Carefully place the egg* in a jar.
3. Fill a jar with vinegar so that the entire egg is covered with the liquid.
4. Let the egg sit in the vinegar for at least 24 hours. This will become your frog model.**
5. Take your egg out of the vinegar and gently rub away any remaining shell.
6. Record the length, width, and observations of the egg now that the shell has been removed. Compare the texture of the egg to how you think amphibian skin might feel.

*Note: Try preparing more than one egg, if possible. Once the shells are removed from the eggs they burst more easily than hard-shelled eggs. It is good to have a backup and handle with care.

**What is happening here: Soaking the egg in vinegar removes the hard outer shell. The acetic acid from the vinegar reacts with the calcium carbonate shell, releasing carbon dioxide and leaving just the membrane of the egg.

Scenario I: Shell-less Egg in Water- Modeling How Frogs Drink

In this scenario, place your frog model (egg soaked in vinegar) in water to see what happens.

1. Empty the jar of vinegar used to prepare your frog model and rinse. Pat dry and refill the jar with water.
2. Place the model in the water and let sit overnight.
3. Remove the model from the water and look for changes. What happened? Record the new length and width as well as any observations you notice.

Scenario 2: Shell-less Egg in Salt/Sugar Solution- Modeling How Caretakers Sometimes Treat Sick Frogs with Edema

Usually frogs are able to regulate the amount of water in their bodies through their skin and organs like their kidneys. Sometimes though, frogs are unable to maintain this homeostasis and take in too much water. This water makes the frog swell and look like a giant balloon. This bloating makes the frog uncomfortable and can damage their internal organs.When this becomes an emergency, sometimes animal caretakers will put the frog in a pedialyte solution that contains sugars and salts. Let's make a similar solution for our "frog" and model how this approach may help the animal.

1. Empty and rinse the jar from the previous scenario.
2. In the clean jar, mix a solution of 2 cups water, 1TBSP sugar, and ¼ tsp salt until all particles are dissolved.
3. Place the bloated egg from scenario one in the jar of solution overnight.
4. Remove the egg from the solution and look for changes. Record the size and note any observations you make. What happened? Where did the water go?

Scenario 3: Shell-less Egg in Water with Food Coloring- Modeling How Frogs Can Absorb Pollutants

Since frogs absorb air and water through their skin they are susceptible to pollution. This makes them good indicator species because scientists can monitor numbers and types of frogs in an area to help determine the health of the environment. If frogs start disappearing or dying, it could mean that the air or water is contaminated and not safe for humans. Some pollutants are

soluble, meaning that they dissolve in water. Let's add some of "pollution" to the water and see what happens

1. Empty and rinse the jar from the previous scenario.
2. To the clean jar add water and a couple of drops of food coloring.
3. Place the egg from scenario 2 in the jar overnight.
4. Remove the egg from the water with the food coloring. What happened? Record any size changes and observations.

	Raw Egg with Shell	**Egg without shell after vinegar soak**	**Egg after Scenario 1**	**Egg after Scenario 2**	**Egg after Scenario 3**
Length					
Width					
Appearance					
Feel					
Observations/ Notes					

Digging Deeper

Frog Survey

You can count the number of different types of frogs in your area without even having to use your eyes! Scientists usually use their ears to help identify what species of frog are present in a habitat. That's because each species of frog "speaks" its own language. Generally male frogs call to defend their territory from other males or let females know where they are during mating season.

Here are some examples of frogs that are common in our area and their calls. Can you hear any of these in the evenings near your home?

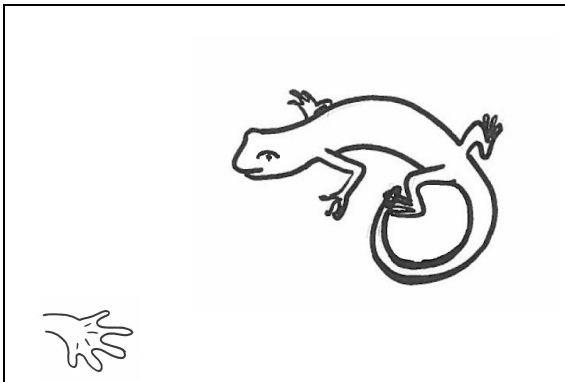
Cope's Grey Tree Frog *Hyla chrysoscelis*
Green Treefrog *Hyla cinerea* (Georgia's state amphibian)
Bullfrog *Lithobates catesbeianus*
Spring Peeper *Pseudacris crucifer*

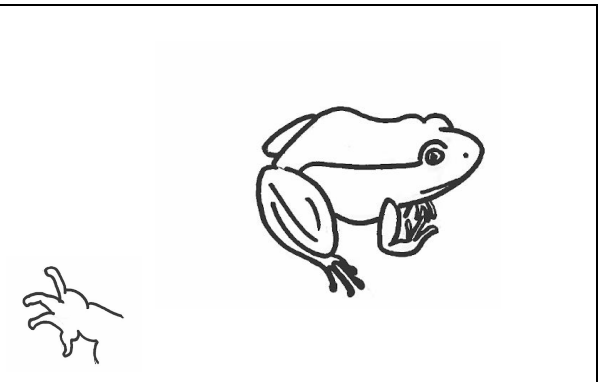
Frog Life Cycle

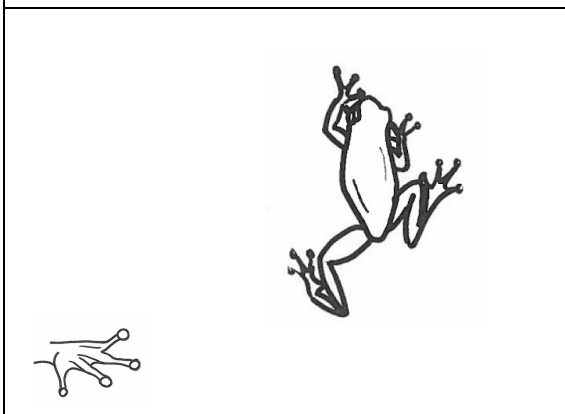
Most frogs and amphibians have a unique life cycle that includes metamorphosis from jelly like eggs to tadpoles with gills that live in water, to froglets with a tail and finally to adult frogs with lungs that can live on land. Use different materials to create a diagram of the frog life cycle for yourself. Perhaps use snack items like apples and raisins to make frogs and eggs, or recycled materials like bubble wrap and newspaper. Compare the frog's life cycle to a human's life cycle or even butterfly's.

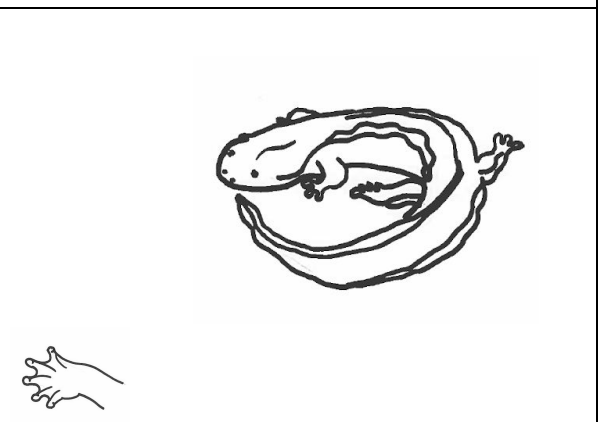
Amphibian Adaptations and their Habitats

Scientists can tell a lot about an animal's habitat just by looking at the animal's features or adaptations that help it survive in that habitat. Take a look at the four amphibians below and their feet adaptations. Two are frogs and two are salamanders. Which of these animals has foot structures that would allow it to burrow and live in sand? Which would be best adapted for climbing? Swimming? Squeezing between tight rocks? Draw a habitat for each amphibian that it could survive in with it's foot and body shape adaptations.









Additional Resources

How Frogs Work | HowStuffWorks
All About Frogs
Animal Summer Games: Tadpole Relay | National Geographic
Escape Hatch: The Tough Choices of Treefrog Embryos
The Glass Frog: The Ultimate Ninja Dad
I DON'T WANT TO BE A FROG Read Aloud
Finklehopper Frog. Childrens Story Read Aloud. Scholastic
Meet The Frog That Barfs Up Its Babies
Amphibians | Educational Video for Kids

Standards Covered

SKL2. Obtain, evaluate, and communicate information to compare the similarities and differences in groups of organisms.

c. Ask questions and make observations to identify the similarities and differences of offspring to their parents and to other members of the same species.

S1L1. Obtain, evaluate, and communicate information about the basic needs of plants and animals.

b. Ask questions to compare and contrast the basic needs of plants (air, water, light, and nutrients) and animals (air, water, food, and shelter).

S2L1. Obtain, evaluate, and communicate information about the life cycles of different living organisms.

a. Ask questions to determine the sequence of the life cycle of common animals in your area: a mammal such as a cat, dog or classroom pet, a bird such as a chicken, an amphibian such as a frog, and an insect such as a butterfly.

d. Develop models to illustrate the unique and diverse life cycles of organisms other than humans.

S3L1. Obtain, evaluate, and communicate information about the similarities and differences between plants, animals, and habitats found within geographic regions (Blue Ridge Mountains, Piedmont, Coastal Plains, Valley and Ridge, and Appalachian Plateau) of Georgia.

b. Construct an explanation of how external features and adaptations (camouflage, hibernation, migration, mimicry) of animals allow them to survive in their habitat.

c. Use evidence to construct an explanation of why some organisms can thrive in one habitat and not in another.

S3L2. Obtain, evaluate, and communicate information about the effects of pollution (air, land, and water) and humans on the environment.

a. Ask questions to collect information and create records of sources and effects of pollution on the plants and animals.

S7L4. Obtain, evaluate, and communicate information to examine the interdependence of organisms with one another and their environments.

a. Construct an explanation for the patterns of interactions observed in different ecosystems in terms of the relationships among and between organisms and abiotic components of the Ecosystem.

c. Analyze and interpret data to provide evidence for how resource availability, disease, climate, and human activity affect individual organisms, populations, communities, and Ecosystems.

SB1. Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells

d. Plan and carry out investigations to determine the role of cellular transport (e.g., active, passive, and osmosis) in maintaining homeostasis.