SAVING FROGS

ASSOCIATION OF ZOOS & AQUARIUMS

Soak It Up

Audience/ Group Setting

This activity works best for a classroom or camp setting, but can also be a simple demonstration that event visitors can view. For an event setting, it isn't necessarily a hands-on activity, but it does demonstrate how an amphibian's skin is very permeable. This activity's audience would generally be for visitors aged 7 and older.

Goal

To understand the concept of permeability and how different body coverings can effect how much and how fast a chemical moves into an animal's body.

Objectives

By the end of this activity, participants will be able to:

- View any differences in how far the dye permeates in an egg with and without its hard shell.
- Discuss and understand how this experiment relates to amphibians and pollution.

Big Idea/ Main Message

Amphibians are more readily affected by pollution because of their permeable skin.

Conservation Action/ Behavior Addressed

Don't pollute.

Do your part to keep garbage, chemicals, and non-native plants and animals out of the natural environment. Amphibians absorb chemicals through their skin easily. They also fall prey to non-native species.

Background Information

Definition of permeable: having openings that liquids (or gasses) can pass through.

Amphibians have unique skin compared to that of many other vertebrate animals. An amphibian's skin is thinner, which allows for higher levels of oxygen to exchange with the blood vessels that are close to the surface of the skin. This permeable skin distinguishes them from birds, mammals or reptiles – and it is one of the characteristics that has contributed to their declining populations and extinctions.

Permeability relates to how easily a gas or liquid molecule can pass back and forth from the environment into the animal or from the animal into the environment. Typically, the larger a molecule is, the more difficult it is to enter the animal through its skin. Amphibian skin is much more permeable than other vertebrates. Many amphibians use this characteristic to their advantage, especially those animals that live in drier habitats. For example, some species of toads can absorb water from the soil around them by pressing their bellies against the moist ground.

Many amphibians also use their permeable skin to help them breathe. Oxygen is a small molecule that can easily pass through the skin of an amphibian. The oxygen first dissolves into

the liquid on the surface of the animal's skin, then it is picked up by blood that is in vessels close to the surface of the skin. An example of this would be a frog that hibernates at the bottom of a pond. During this hibernation, the frog's skin acts as a giant gill, passing oxygen from the water to the frog's blood. Also, some salamanders are so efficient at breathing through their skin that they do not have lungs!

This same characteristic that help amphibians survive in a variety of habitats also makes it very easy for harmful chemicals to pass into the animal's body. Toxic chemicals found in rainwater, ponds, rivers, and creeks may kill frogs by contaminating their bodies. Reptiles are not as susceptible to these chemicals because their scaly skin is less permeable.

For this activity, you will be using hard-boiled eggs to show how amphibians are susceptible to pollution because of their permeable skin, much like an egg without a shell. The shell of an egg acts like a mammal or reptiles' skin. It is less permeable and therefore acts as a barrier to the water and food coloring. The water will not penetrate into the shelled egg as far as it will for the unshelled or peeled egg.

The peeled egg, with only a thin membrane surrounding it, absorbed more water. The food coloring will travel further into this egg. The absorbed water will also make the egg swell, increasing its circumference.

Materials needed

- Hard boiled eggs (prepared prior to the event/class)
- Food coloring (dark colors work best)
- Measuring tapes (or you can use string and rulers)
- Clear cups
- Water
- Knife

Staff

This activity needs a volunteer or staff person to supervise.

Length of Activity

Classroom setting: ~40 minutes over the course of 2 days
Event setting: ~5 minutes

Set up

- Ahead of time: Hard-boil the eggs.
- Day of: Prepare other activity materials and or table setting (event).

Procedures

Day #1:

- Begin the activity by discussing the function of skin with the group. Why is skin important to mammals? Then discuss how an amphibian's skin is very different because it is more permeable to substances, which can be helpful and harmful at the same time.
- Divide the class into small groups. Each group should receive for the experiment:
    - 2 hard boiled eggs
    - 2 clear cups filled with water
    - Food coloring.
- Instruct the groups to peel one of the hard-boiled eggs (carefully).
- Each egg's circumference should be measured and noted (using either the measuring

tape or rulers and string).

- Put each egg in a cup and label each cup w ith "peeled" or "un-peeled."
- Add at least 20 drops of dye to each cup (again, dark colors work best).
- Let the eggs rest in the water for **AT LEAST** 24 hours.

Day #2:

- Have the groups return to their eggs and cups. Remove both eggs from the cups.
- Gently peel the egg that still has a shell.
- Gently cut each egg in half (from top to bottom, through the yolk).
- Using rulers or measuring tape, measure how far into the egg the food coloring has moved.
- Discussion points:
    - What animal do you think would be more affected by water pollution, a frog or lizard? Why?
    - What does this experiment tell you about the susceptibility of amphibians to water pollution? What types of pollution might affect amphibians? What is the source of the pollution?
- Wondering what to do with the left-over eggs? Although you probably don't want to use these eggs in egg salad (since they have been touched by visitors all day long) – use them for compost! By composting these used eggs instead of placing them in the trash bin, you are ensuring that the eggs don't end up in a landfill.

Activity Extensions/Modifications

Event Use Modification:

For an event setting, this would mainly be used as a demonstration piece – the activity can be set-up at a staffed table. You can present both eggs that are still in the water, hard-boiled eggs that are still shelled and peeled for visitors to view/feel, and then the final product for visitors to view. Having a picture of amphibian's skin magnified for visitors to see would also be useful. By viewing these items, hopefully visitors will gain the idea of permeability and pollution.

National Science Education Standards

This activity is aligned to the K-8 Life Science Content Standards.

- Structure & Function in living systems
- Regulations & Behavior
- Populations & Ecosystems
- Form & Function
- Population, Resources & Environment
- Natural Hazards

Note: Activity materials adapted from and used with permission of Amphibian Alert!.