Amazing Osmosis!

Age: Elementary School

Objective

Ever wonder what would happen to a freshwater fish in salty ocean water? What about a saltwater fish living in a freshwater stream? Through this experiment students will observe the damaging effect of osmosis on fish species that are forced to live in a habitat for which they are not equipped.

Background Lesson

What would you think if you were told a fish could die of dehydration while surrounded by water? As farfetched as it sounds, this is entirely possible. The cause of this phenomenon is osmosis, defined as the movement of water from an area of low solute concentration to an area of high solute concentration.

Saltwater fish spend their lives submerged in a solution containing a much higher concentration of solutes than is found in their body tissues. Due to their environment, marine fish are constantly losing water from their bodies through osmosis. These fish have therefore adapted many strategies to deal with this water loss. Saltwater fish drink water very frequently to bring it back into their bodies. Since drinking ocean water brings solutes into the body, fish have also developed a way to expel these solutes through their gills as well as through very concentrated urine.

If a fish with these adaptive strategies was to be placed in a freshwater environment, they would not be losing water by osmosis but rather gaining it. If the fish continued to participate in its water-conserving practices, so much water would enter the fish that it would explode! This is described as a hypotonic situation.

Alternatively, if a freshwater fish, adapted to water gains, was placed in a marine environment it would very quickly lose all the water in its body needed for daily processes. This is known as a hypertonic situation and would result in the fish becoming dehydrated while surrounded by a sea of water!

The Activity

Materials

- **A Potato**

- **Water**
- **Salt**
- **Sugar**
- **A Knife**
- **Paper**
- **Pencil or Pen**
- **3 Small Bowls or Cups**

Preparation

Fill the three bowls with water and allow them to sit for several hours without being disturbed. Label one bowl "Just Water" and leave it as it is. Label a second bowl "Salty Water" and add salt to the water until it can no longer dissolve. Lastly, the third bowl should be labeled "Sugary Water" and sugar should be dissolved until the solution is saturated.

Procedure

1. **Take your potato and carefully cut three wedges out of it. The wedges should be about ¼ inch thick. The thinner your wedges are cut, the better results you will see.**
2. **Place one of your potato wedges in each of the labeled bowls.**
3. **Leave the slices in the bowls for about 30 minutes before coming back and observing results. If there are not obvious changes in the properties of each potato wedge leave it submerged for a little bit longer before returning.**

Post Activity Discussion

- **What has happened to the wedge placed in salt water? Is it more rigid than before submergence or has the wedge become wilted and soft? Does the sugar water wedge appear similar?**
- **For the salt and sugar solution, has the water travelled into or out of the potato wedge?**
- **What has happened to the potato placed in pure water? Which way was the water travelling through osmosis?**
- **Which wedge most resembles a saltwater fish placed in freshwater? Which most resembles a freshwater fish placed in salt water?**

Possible Assignments

Students may research the biological adaptations that make each fish suitable for the water conditions that they live in.

Have students find a definition for the term "anadromous". Then have each student (or group) select a different anadromous fish species and research its life cycle.