

Let's Break a Sweat



You've probably noticed how athletes, such as gymnasts and weight-lifters, chalk their hands before engaging in their sport. The chalk improves an athlete's grip by absorbing sweat. In this activity, you'll use a moisture-absorbing cellophane fish to detect sweating in the palms of the hands. You'll compare the fish's behavior in various settings to confirm that moisture is the key factor for the toy fish's movement. You'll also design an experiment to determine whether an increase in physical activity increases sweat production in the palms of the hands.

Stuff You'll Use: ▶ Fortune Teller Fish ▶ paper towel ▶ water

What to Do:

- 1 Remove the Fortune Teller Fish from its plastic wrapper and save the wrapper for step 2. Lay the fish in the palm of your hand. *What do you observe? What factors might cause the observed behavior?*
 - 2 Lay the plastic wrapper on your hand and put the fish on the wrapper. *What happens?* Based on your observations in steps 1 and 2, develop a hypothesis on what caused the fish to behave as it did.
 - 3 Slightly dampen a folded paper towel with water and squeeze out as much excess water as possible. Place the cellophane fish on the moist paper towel and observe the behavior of the fish. Compare and contrast the fish's behavior in steps 1, 2, and 3. *Which variable had the greatest effect on the fish's motion?*
- !** *Avoid overly wetting the fish when you put it on the damp paper towel and do not put the fish directly into water, as these actions could render the fish useless.*
- 4 Design an experiment that uses the cellophane fish to determine if physical activity affects the amount of sweat in the palms of your hands or the rate of its evaporation from the palms. Make sure to specify the type of physical activity and its duration. *Did your physical activity affect the amount of sweat on the palm of your hand?*

How It Works:

The Fortune Teller Fish curls and twists primarily because it absorbs water from the sweat glands in your hand and subsequently loses this water through evaporation. The fish is made of cellophane that is hygroscopic. ("Hygro" means "wetness" and "scopic" means "to view or find.") As water is absorbed, it moves through small pores in the cellophane and evaporates due to the heat from your hand. The lightness of the cellophane makes the fish very susceptible to air currents, which adds to the "dancing" effect. This type of movement is not observed when the fish is on the plastic wrapper, because the bag forms a barrier that prevents the cellophane from absorbing water from your palm. When placed on a moist paper towel, the fish behaves like it does when placed on the palm, indicating that moisture is an important factor in the fish's behavior.

Most people experience an increase in palm sweating with an increase in physical activity, although results will vary depending on the individual, the intensity of the physical activity, and the humidity of the air. If body temperature increases during physical activity, the rate of sweat evaporation will also increase.



The chalk that athletes put on their hands is magnesium carbonate (MgCO_3). It is water-insoluble and hygroscopic, just like the cellophane fish. This hygroscopic property allows the chalk to absorb moisture (particularly perspiration) from the athlete's hands.

More Fun?

Terrific Science Press offers a more in-depth, fully inquiry-based version of this activity as a TS Short download. The activity includes a section on the use of spectroscopy to help students understand how the atomic structure of the materials used to make the fish and the wrapper contribute to the observations of the fish's behavior. See link below for details:

▶▶ [*A Cellophane Toy and Its Wrapper: A Study in Materials Science*](#)

Terrific Science Press (www.terrificscience.org/sciencestore) offers the following books that include activities about this hygroscopic toy:

▶▶ [*Teaching Chemistry with TOYS*](#)

▶▶ [*What's That Smell? The Science Behind Adolescent Odors*](#)

Want to buy Fortune Teller Fish? Visit the Terrific Science Toys, Etc. Store at www.terrificscience.org/sciencestore.

