# The Raw-Egg Mystery

Susan S. Plati

## Topic

Osmosis and diffusion

## Time

15 minutes for setting up, 3 to 5 days for observation

## Safety

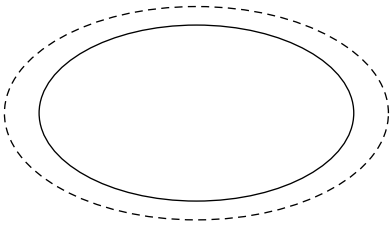
**Please click on the safety icon to view the safety precautions.**

## Materials

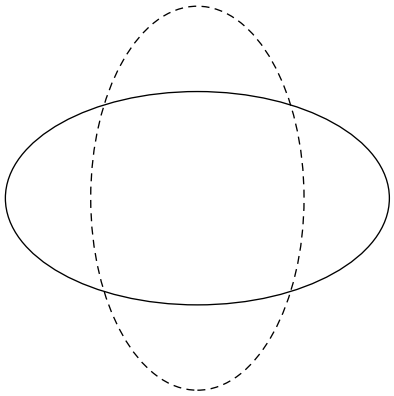
raw hen's egg
vinegar (any kind)
tape measure, or string and ruler
jar, with lid, large enough to hold egg
water

## Procedure

1. On day 1, obtain a raw egg in its shell.
2. Measure the long and short circumferences (see the illustration) with a tape measure or a string and ruler. Enter your results on the data table alongside day 1.
3. Place the egg in a jar, and cover with vinegar.
4. Screw on the jar lid to prevent evaporation.
5. On day 2, observe the egg without removing it from the jar. Record your observations.
6. On day 3, carefully remove the egg from the vinegar, and rinse it with tap water. Observe how the egg looks and feels. Record your observations. Measure the long and short circumferences, and record these measurements.
7. Remove the vinegar from the jar, thoroughly rinse out the jar, and place the egg inside.
8. Cover the egg with tap water, and screw on the jar lid to prevent evaporation.
9. On day 4, observe the egg and record your observations.
10. On day 5, remove the egg from the jar. Measure and record the long and short circumferences. Observe and record how the egg looks and feels.



long circumference



short circumference

| DATA TABLE | | | |
|---|---|---|---|
| Day | Short circumference | Long circumference | Observations |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |

11. How did the egg look and feel on day 3? Try to explain what had happened to the shell of the egg.
12. How did the measurements on day 3 compare with the measurements on day 1? Try to explain the change.
13. How did the measurements on day 5 compare with the measurements on day 3? Try to explain the change.

## What's Going On

Initially, the vinegar, which is a dilute solution of acetic acid, breaks down the eggshell, which is primarily composed of calcium carbonate. The bubbles you see surrounding the shell are carbon dioxide, given off during the reaction. The reaction exposes the egg membrane, which, because it is a protein, does not react with the vinegar. Once the membrane is exposed, the egg grows larger as the vinegar passes through the membrane by diffusion, moving from an area of high concentration of solvent to an area of low concentration. The egg usually continues to increase in size when it is sent into tap water. Sometimes there is a decrease in size at this point or a slowing of the rate of increase because some of the acetic acid leaves the membrane. In each case, the change in size is caused because the molecules move from greater to lesser concentration through a selectively permeable cell membrane

## Connections

The cell is the basic building unit of all living organisms. The human body contains trillions of cells, each working to keep the body alive. Food moves into the cell and waste moves out of the cell through a process called *diffusion.* Molecules pass through the cell's permeable membrane, flowing from where they are more concentrated to where they are less concentrated. It is difficult to see this process in humans because human cells are so small. But in this experiment, you will be able to see the process clearly using a large single cell: a hen's egg. Solutions separated by a membrane tend to become equal in concentration.

# Safety Precautions

READ AND COPY BEFORE STARTING ANY EXPERIMENT

Experimental science can be dangerous. Events can happen very quickly while you are performing an experiment. Things can spill, break, even catch fire. Basic safety procedures help prevent serious accidents. Be sure to follow additional safety precautions and adult supervision requirements for each experiment. If you are working in a lab or in the field, do not work alone.

This book assumes that you will read the safety precautions that follow, as well as those at the start of each experiment you perform, and that you will *remember* them. These precautions will not always be repeated in the instructions for the procedures. It is up to you to use good judgment and pay attention when performing potentially dangerous procedures. Just because the book does not always say "be careful with hot liquids" or "don't cut yourself with the knife" does not mean that you should be careless when simmering water or stripping an electrical wire. It *does* mean that when you see a special note to be careful, it is extremely important that you pay attention to it. If you ever have a question about whether a procedure or material is dangerous, stop to find out for sure that it is safe before continuing the experiment. To avoid accidents, always pay close attention to your work, take your time, and practice the general safety procedures listed below.

### PREPARE

- Clear all surfaces before beginning work.
- Read through the whole experiment before you start.
- Identify hazardous procedures and anticipate dangers.

### PROTECT YOURSELF

- Follow all directions step by step; do only one procedure at a time.
- Locate exits, fire blanket and extinguisher, master gas and electricity shut-offs, eyewash, and first-aid kit.
- Make sure that there is adequate ventilation.
- Do not horseplay.
- Wear an apron and goggles.
- Do not wear contact lenses, open shoes, and loose clothing; do not wear your hair loose.
- Keep floor and work space neat, clean, and dry.
- Clean up spills immediately.
- Never eat, drink, or smoke in the laboratory or near the work space.
- Do not taste any substances tested unless expressly permitted to do so by a science teacher in charge.

### USE EQUIPMENT WITH CARE

- Set up apparatus far from the edge of the desk.
- Use knives and other sharp or pointed instruments with caution; always cut away from yourself and others.
- Pull plugs, not cords, when inserting and removing electrical plugs.
- Don't use your mouth to pipette; use a suction bulb.
- Clean glassware before and after use.
- Check glassware for scratches, cracks, and sharp edges.
- Clean up broken glassware immediately.

- Do not use reflected sunlight to illuminate your microscope.
- Do not touch metal conductors.
- Use only low-voltage and low-current materials.
- Be careful when using stepstools, chairs, and ladders.

### USING CHEMICALS

- Never taste or inhale chemicals.
- Label all bottles and apparatus containing chemicals.
- Read all labels carefully.
- Avoid chemical contact with skin and eyes (wear goggles, apron, and gloves).
- Do not touch chemical solutions.
- Wash hands before and after using solutions.
- Wipe up spills thoroughly.

### HEATING INSTRUCTIONS

- Use goggles, apron, and gloves when boiling liquids.
- Keep your face away from test tubes and beakers.
- Never leave heating apparatus unattended.
- Use safety tongs and heat-resistant mittens.
- Turn off hot plates, bunsen burners, and gas when you are done.
- Keep flammable substances away from heat.
- Have a fire extinguisher on hand.

### WORKING WITH MICROORGANISMS

- Assume that all microorganisms are infectious; handle them with care.
- Sterilize all equipment being used to handle microorganisms.

### GOING ON FIELD TRIPS

- Do not go on a field trip by yourself.
- Tell a responsible adult where you are going, and maintain that route.
- Know the area and its potential hazards, such as poisonous plants, deep water, and rapids.
- Dress for terrain and weather conditions (prepare for exposure to sun as well as to cold).
- Bring along a first-aid kit.
- Do not drink water or eat plants found in the wild.
- Use the buddy system; do not experiment outdoors alone.

### FINISHING UP

- Thoroughly clean your work area and glassware.
- Be careful not to return chemicals or contaminated reagents to the wrong containers.
- Don't dispose of materials in the sink unless instructed to do so.
- Wash your hands thoroughly.
- Clean up all residue, and containerize it for proper disposal.
- Dispose of all chemicals according to local, state, and federal laws.

BE SAFETY-CONSCIOUS AT ALL TIMES