# Chapter Project Egg-speriment With a Cell

The following steps will walk you through the Chapter Project. Use the hints and detailed directions as you guide your students through the gathering of information, presentation, and reflection.

## Chapter Project Overview

When you introduce the project, you may want to do the following demonstration so students can see the cell membrane they will be studying as they carry out the project. Gently crack open a chicken egg, and carefully pour the contents into a dish. Show the class the membrane that remains attached to the inside of the shell.

Be aware that students may not understand the changes they observe in their egg until they read Section 4. Therefore, you may want to provide the class with some background information at the start of the project. First tell the class that the chalky shell of the egg, which surrounds the membrane, is made up mostly of the mineral calcium carbonate. Explain that calcium carbonate dissolves in acids such as vinegar, which is why they will first soak their egg in vinegar for two days. After the shell has dissolved, only the membrane will remain around the egg. Then introduce students to the idea of the cell membrane as selectively permeable, although you do not need to use that term at this point. Tell students that water, oxygen, and some other substances can pass easily through the membrane, while many other substances, such as salt, cannot. Ask: **What do you think would happen to the egg if water passed into the egg through the membrane?** *(The egg would get bigger.)* **What do you think would happen to the egg if water passed out of the egg through the membrane?** *(The egg would get smaller.)*

Hand out the Chapter Project Overview. Review the project rules with the class, and give students time to read the project hints.

Stress the importance of starting to soak their eggs in vinegar as soon as possible in order to dissolve the shells. Suggest appropriate containers for students to use, and advise them to find a place to put their eggs where they will not be disturbed. Also remind students to measure the circumferences of their eggs before they start to soak them.

Remind students to carefully wash their hands after handling raw eggs because the eggs may contain harmful bacteria. Advise students to clean up any broken eggs with soap and hot water.

Set dates for the Keep Students on Track steps at the ends of Sections 1, 2, and 4, and a deadline for the project presentation.

Distribute the Chapter Project Scoring Rubric, which you will use for assessing students' work. Also distribute Chapter Project Worksheet 1 and urge students to use it to record and graph the data they collect during the project.

## Keep Students on Track Section 1

Check that students have started to soak their eggs in vinegar. Students should not remove their eggs from the vinegar until the shells have completely dissolved.

Allow time for students to observe and measure their eggs each day. Make sure students understand how to measure their eggs and that they measure the eggs the same way each time. Students should record their data on Worksheet 1.

Students should handle the eggs carefully and work slowly to avoid breaking the eggs. Remind students to wash their hands after handling the eggs.

## Keep Students on Track Section 2

Call on volunteers to share their observations to date. Most students will have noticed an increase in the size of their eggs and a change in the eggs' appearance and texture. Students also may have noticed bubbles in the vinegar and pieces of shell floating on its surface. Explain that the bubbles are carbon dioxide, which is released when the shell dissolves in vinegar.

Remind students to start soaking their eggs in different liquids after soaking them in vinegar for two days. After using the vinegar, students should soak their eggs first in plain water for two days and then in water with food coloring, salty water, and other liquids they choose for one day each. Challenge students to

predict how their eggs will change as they soak in each liquid.

## Keep Students on Track Section 4

Have students use the graph on Worksheet 1 to make bar graphs of the daily measurements of their eggs' circumferences. Remind students to indicate on their graphs in what liquids the eggs soaked each day. Suggest that they use either labels or symbols with a key to show this information.

Information presented in Chapter Project Worksheet 2 will help students understand the process of osmosis so they can interpret the results of the project. Hand out the worksheets at this point, and instruct students to complete them before they give their presentations.

## Chapter Project Wrap Up

As students give their presentations, urge them to compare their results with the results obtained by their classmates.

After all the students have given their presentations, make two lists on the board: (a) liquids that students found increased the size of the eggs; (b) liquids that students found decreased the size of the eggs. The first list should include vinegar and plain water. The second list should include salt water and thick liquids such as syrup.

Challenge students to explain why some liquids caused the eggs to increase in size, whereas others caused the eggs to decrease in size. *(Liquids causing the eggs to increase in size have a higher concentration of water than the eggs, resulting in water passing into the eggs by osmosis. Liquids causing the eggs to decrease in size have a lower concentration of water than the eggs, resulting in water passing out of the eggs by osmosis.)*

## Extension

Give students a chance to apply what they learned in the Chapter Project by having them explain why the body is harmed when a person drinks salt water. *(The person's body cells would lose water through osmosis.)*

Name _____ Date _____ Class _____



# Chapter Project Egg-speriment With a Cell

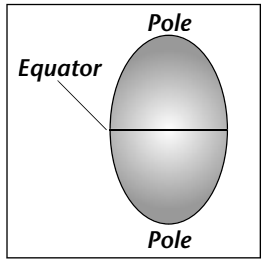
One of the cell structures you will be learning about is the cell membrane. In the Chapter Project, you will model how a cell membrane works to let water enter and leave the cell. You will use a chicken egg as a model of a cell. After dissolving the shell in vinegar to expose the membrane, you will soak the egg in various liquids and observe how the size of the egg changes as it takes on or loses water through the membrane. You also will keep a daily record of observations and measurements of the egg.

## Project Rules

- As soon as you get your egg, observe its features and measure its circumference. Record your observations and measurements.
- Soak the egg in vinegar for at least two days. Then observe and record how the egg has changed, including any changes in appearance or texture. Also measure the circumference of the egg, using the procedure described on the next page. Record your observations and measurements.
- Soak the egg in plain water for one or two days. Each day, observe and record how the egg has changed and measure and record its circumference.
- Soak the egg in water with food coloring, salt water, and another liquid of your choice for at least one day each. Continue to keep a daily record of observations and measurements of the egg's circumference.
- Graph the data you have collected and prepare a report of your results. Be prepared to explain your results and show your egg to the class.

## Project Hints

- For best results in this project, it is important to measure your egg carefully each day. This is because changes in the circumference of the egg may be slight, and measurements that are not precise may mask changes that have occurred.
- The drawing shows how to measure your egg's circumference.
- Follow these steps when measuring the egg each day:




1. Carefully take the egg out of the liquid and pour the liquid down the drain.
2. Rinse off the egg in cold water over the sink and blot it dry with a paper towel.

3. Using a flexible tape measure or piece of string, measure the circumference of the egg. If you are measuring your egg with a piece of string, follow these steps:
    a. Wrap the string snugly around the egg at the equator (but be careful not to cut into the egg's membrane with the string).
    b. Grasp the string between your thumb and finger exactly at the point where the end of the string meets the rest of the string after circling the egg.
    c. Keeping your thumb and finger in place, lay the string straight on a flat surface.
    d. Use a metric ruler to measure the distance from the end of the string to the point at which you are holding it.
4. Record your measurements and any other observations about the egg in the data table on Worksheet 1.
5. Return your egg to the container and cover it with the same or another liquid, according to the project rules above.

## Project Timeline

| Task | Date Due |
|---|---|
| 1. Finish soaking egg in vinegar and record results. | _____ |
| 2. Finish soaking egg in plain water and record results. | _____ |
| 3. Finish soaking egg in water with food coloring and record results. | _____ |
| 4. Finish soaking egg in salt water and record results. | _____ |
| 5. Finish soaking egg in a liquid of your choice and record results. | _____ |
| 6. Complete report and graph. | _____ |
| 7. Present results. | _____ |

Name _____ Date _____ Class _____



# Managing the Data

In the Chapter Project, you will collect two types of data: data on the circumference of the egg and data on changes you observe in the egg, such as changes in the egg's appearance and texture. Both types of data should be collected and recorded each day throughout the project. Use the table below, or one like it, to record your data.

## Data Table

| *Date* | *Liquid* | *Circumference (in millimeters)* | *Other Observations* |
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After you have collected the data and completed the table, use the data to create a bar graph showing changes in the circumference of the egg. Label the horizontal axis of your graph "Date" and the vertical axis "Circumference (mm)." Also indicate on the graph what liquid the egg was soaking in each day.

Name _____ Date _____ Class _____





# Understanding Osmosis

You learned that water can pass through a cell membrane by a process called osmosis. Osmosis occurs when water moves from an area where it is more concentrated to an area where it is less concentrated. For example, if a cell is placed in plain water, there will be a higher concentration of water outside the cell than inside the cell, because the inside of the cell contains other materials in addition to water. As a result, water will pass through the cell membrane into the cell by osmosis.

The concentration of water in a substance is the proportion of that substance that is made up of water. For example, if 10 milliliters of salt water contain 9 milliliters of water, the concentration of water in the liquid is 9 milliliters ÷ 10 milliliters, or 9/10, which is 90 percent.

*Calculate the percentage of water in each of the liquids in the table, and write your answers in column 4.*

**Calculating Concentration**

| *Liquid* | *Total Amount of Liquid (milliliters)* | *Amount of Water (milliliters)* | *Concentration of Water in Liquid (percent)* |
|---|---|---|---|
| *A* | *10* | *7* | |
| *B* | *100* | *92* | |
| *C* | *15* | *13* | |
| *D* | *28* | *22* | |

*Answer the following questions in the spaces provided.*

**1.** Many cells contain about 80 percent water. If you place them in a liquid that contains less than 80 percent water, they will lose water through the cell membrane by osmosis. If you place them in a liquid that contains more than 80 percent water, they will gain water through the cell membrane by osmosis. Which of the liquids in the table would cause many cells to gain water? To lose water?

_____

**2.** Name some specific liquids that you think might contain less than 80 percent water.

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Lab zone Chapter Project

# Egg-speriment With a Cell

In evaluating how well you complete the Chapter Project, your teacher will judge your work in four categories. In each, a score of 4 is the best rating.

| | *4* | *3* | *2* | *1* |
|---|---|---|---|---|
| ***Collecting and Recording the Data*** | Collects and keeps an accurate and complete record of observations and measurements each day for at least five different liquids. | Collects and keeps a satisfactory record of observations and measurements each day for at least four different liquids. | Collects and keeps a partial record of observations and measurements for at least three different liquids. | Collects but fails to record, or keeps an inadequate record of, observations and measurements for no more than two different liquids. |
| ***Graphing the Data*** | Constructs a high-quality graph of the measurements that includes a clear representation of the liquids used each day. | Constructs a satisfactory graph of the measurements that shows the liquids used each day. | Constructs a graph of the measurements that has errors or fails to show the liquids used each day. | Graph is unclear, incomplete, or constructed incorrectly. |
| ***Reporting the Results*** | Prepares an informative, well-organized report with diagrams and gives a thorough and accurate explanation of the results of the project. | Prepares a satisfactory report and gives an adequate explanation of the results of the project. | Report is not well organized and gives an explanation of the results of the project that contains some errors. | Report is incomplete and/or the explanation of the results of the project are incorrect. |
| ***Working Cooperatively (optional)*** | Takes a lead in all aspects of the project, including planning, collecting the data, and presenting the results. | Actively participates in all aspects of the project, including planning, collecting the data, and presenting the results. | Participates in most aspects of the project, including planning, collecting the data, or presenting the results. | Participates minimally in the project, including planning, collecting the data, and presenting the results. |