

Chapter 7 Cell Structure and Function

Observing Osmosis

Introduction

Osmosis is the diffusion of water across a semipermeable membrane, from an area of high water concentration to an area of low water concentration. Osmosis also occurs in response to changing concentrations of water-soluble solutes. Osmosis can be observed in individual cells or in collections of cells, as in multicellular organisms or their structures. In this investigation you will use a shelled egg's external membrane to demonstrate how osmosis can occur in solutions where there are changes in the concentrations of solutes.

Problem

How does solute concentration affect the movement of water across a biological membrane?

Pre-Lab Discussion

Read the entire investigation. Then, work with a partner to answer the following questions.

1. Explain the meaning of the term *water-soluble*.

2. Why does the investigation ask you to blot the egg each time it is removed from a beaker?

3. What are some differences between the liquids used in the investigation?

4. What data will you record in Data Table 2?

5. Why do you need to record the times the egg was immersed?

Materials (per pair)

2 decalcified eggs	syrup
paper towels	marker
weighing container	2 plastic spoons
2 250-mL beakers	balance
distilled water	

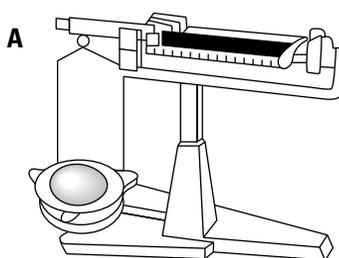
Safety



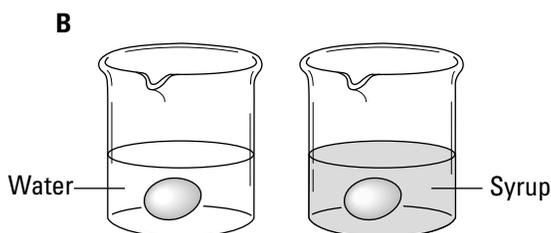
Put on safety goggles. Put on a laboratory apron. Be careful to avoid breakage when working with glassware. Always use caution when working with laboratory chemicals, as they may irritate the skin or stain skin or clothing. Wear plastic gloves when handling eggs or egg whites or tools that have been in contact with them. Wash hands thoroughly after carrying out this lab. Note all safety symbols next to the steps in the Procedure and review the meaning of each symbol by referring to Safety Symbols on page 8.

Procedure

-  1. Wear your safety goggles, plastic gloves, and laboratory apron. Work in pairs. You will eventually share your data with other members of the class.
-   2. Obtain two decalcified eggs, provided by your teacher. Gently blot them on a paper towel and determine the mass of each, using correct procedure (use weighing paper or a container on the balance). Record the initial mass of each egg in the spaces provided in Data Tables 1 and 2.
-  3. Place one egg in a beaker. Fill this beaker with distilled water to just cover the egg. See Figure 1. In Data Table 1 record the time the egg is placed in the water. Note the appearance of the water at this time and record your observation in Data Table 3. **CAUTION:** *Be careful to avoid breaking glassware.*



Determine the initial mass of each egg.



Place one egg in beaker, cover with water, and note the time. Place the other egg in second beaker, cover with syrup, and note the time.



After egg has been immersed for 10 minutes, remove it from beaker with a spoon and set it on a paper towel.

Figure 1

4. Place the other egg in a beaker. Pour syrup into the beaker to just cover the egg. In Data Table 2 record the time the egg is placed in the syrup. Note the appearance of the syrup at this time and record your observation in Data Table 3.

5. Using the marker, label one plastic spoon *water* and the other spoon *syrup*. After 10 minutes have elapsed, use the correctly labeled plastic spoon to remove each egg from its beaker. Carefully blot the egg with a paper towel and determine the mass of the egg. See Figure 2. Record in Data Table 1 the mass of the egg that was immersed in water. Record in Data Table 2 the mass of the egg that was immersed in syrup. Gently return each egg to its appropriate beaker. Note the times again.

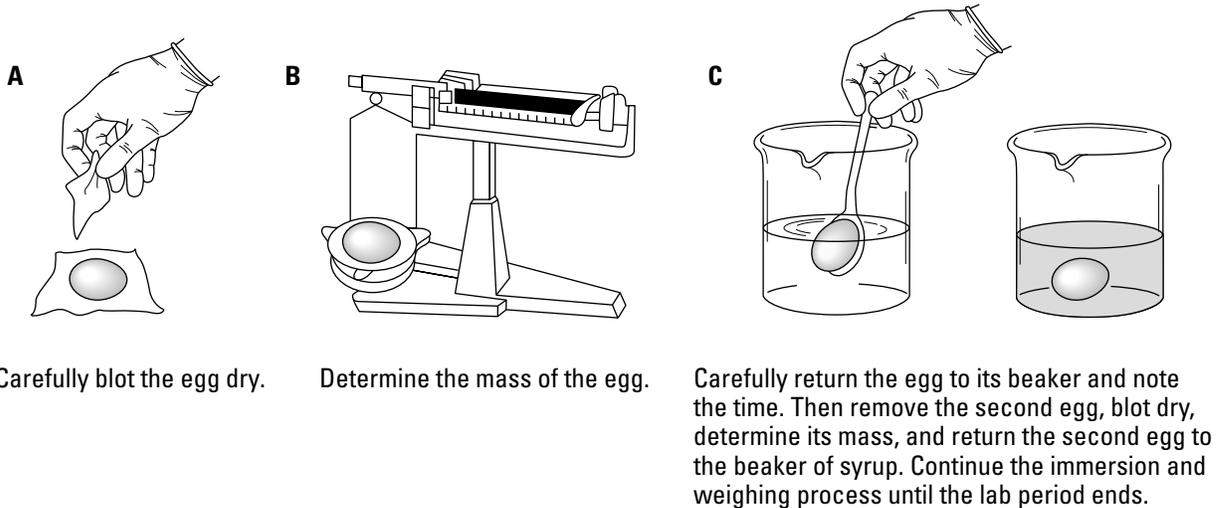


Figure 2

6. Repeat step 5 every 10 minutes, as long as time permits. Record the masses of the eggs for each 10-minute interval in Data Table 1 or Data Table 2.
-  7. After you have completed the last mass determination of the eggs in water and syrup, record the appearance of the water and syrup in Data Table 3. **CAUTION:** *Wash your hands thoroughly after carrying out this lab.*
8. Determine the percent change in mass of each egg for each 10-minute interval by using the following formula:

$$\frac{(\text{mass after immersion} - \text{initial mass}) \times 100}{\text{initial mass}}$$

Record this percent mass change in Data Tables 1 and 2.

Data Table 1: Egg in Distilled Water

Time (minutes)	Mass (grams)	% Mass change
In ____ Out ____	Initial mass ____	
In ____ Out ____	After 10 min. ____	
In ____ Out ____	After 20 min. ____	
In ____ Out ____	After 30 min. ____	
In ____ Out ____	After 40 min. ____	
In ____ Out ____	After 50 min. ____	

Data Table 2: Egg in Syrup

Time (minutes)	Mass (grams)	% Mass change
In ____ Out ____	Initial mass ____	
In ____ Out ____	After 10 min. ____	
In ____ Out ____	After 20 min. ____	
In ____ Out ____	After 30 min. ____	
In ____ Out ____	After 40 min. ____	
In ____ Out ____	After 50 min. ____	

Data Table 3: Appearances of Liquids

	Initial	Final
Water		
Syrup		

9. Graph the percent change in mass of each egg versus time using Figure 3. Use a different symbol or color for each egg.

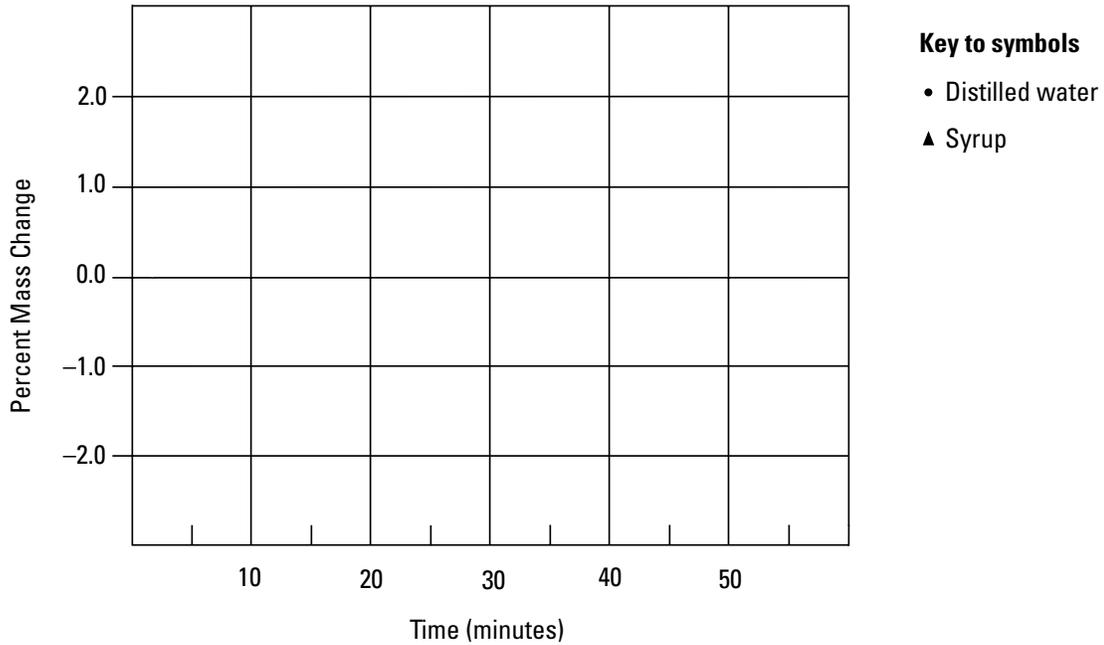


Figure 3

Analysis and Conclusions

1. **Observing** Did any egg gain mass over time? If so, which one(s)?

2. **Observing** Did any egg lose mass over time? If so, which one(s)?

3. **Observing** Describe any changes in the appearance of the water or the syrup.

4. **Inferring** Explain why there were changes in the mass of the eggs, either a loss or gain.

5. Formulating Hypotheses Explain any changes you observed in the appearance of the water or the syrup.

6. Forming Operational Definitions Using the terms isotonic, hypotonic, and hypertonic as defined in your textbook, explain the changes in mass of the two eggs.

7. Comparing and Contrasting Were the results consistent throughout the class? If not, explain the sources of error that may have affected the results.

8. Predicting Would you expect the same results if you used eggs that were still in their shells?

9. Inferring What might you infer if the syrup's color became darker as time progressed?

10. Formulating Hypotheses In the past, meat was preserved by packing it in salt. Explain how this technique might prevent the growth of microorganisms.

Going Further

Propose an experiment to determine the concentration of syrup or another solution that would be isotonic for an egg. If resources are available and you have the permission of your teacher, perform the experiment.