

**STEAM Subject:** Cell Biology

**Lab:** Gelatin Diffusion

**Grades:** 6-8

**Learning objective:**

Students will be able to

- Model the process of diffusion
- Identify the function of a semipermeable membrane in a cell

**ENGAGE:**

Have you ever helped your parents make spaghetti? After you boil the noodles you pour them into a strainer, and let the excess water run down the drain. The holes in the strainer allow the hot water to pass through but are small enough to keep the spaghetti from passing through. The strainer works in a similar way to the plasma membrane of a cell. The **plasma membrane** is a barrier around the cell that, put simply, keeps good things in and bad things out.

For a cell to survive, it needs water and oxygen to come in, and for anything that could harm the cell to stay out. The cell's membrane is **selectively permeable**, meaning it only allows certain molecules to come in, and it can even regulate how they enter the cell.

**EXPLORE**

*Gelatin Diffusion Activity:*

Lab procedure sourced from:

<https://www.generationgenius.com/wp-content/uploads/2020/02/GG-Plant-and-Animal-Cells-DIY.pdf>

Explain to your student that they will be using gelatin to model the diffusion that happens in cells. We are using cabbage infused gelatin because when the cabbage juice reacts with vinegar, it becomes clear. As the vinegar molecules move into the gelatin squares through diffusion, we will be able to observe the color change. We will test to see how long it takes for different sized blocks of gelatin to become completely clear.

**Materials needed:**

- ¼ head of red cabbage
- 4 cups water
- Blender
- Strainer
- Saucepan
- 4 packets gelatin
- 1 Tsp Ammonia
- Baking dish
- Knife
- Ruler
- Large Tupperware
- Cup of vinegar

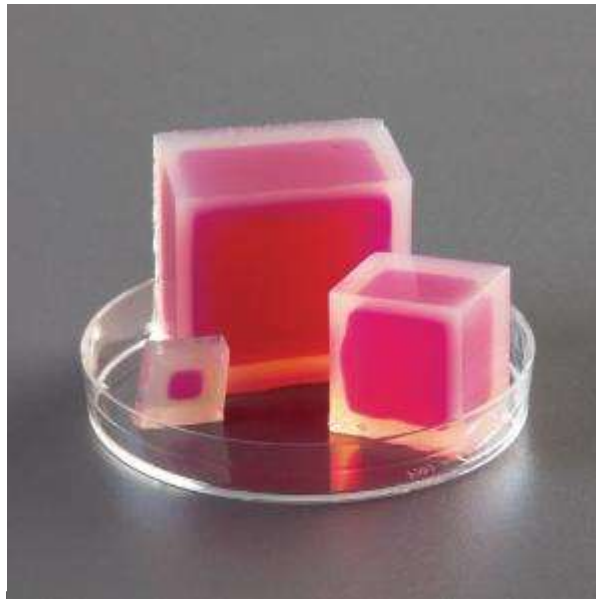


Image credit:

<https://www.wardsci.com/store/product/13288592/ward-s-prepared-agar-cubes>

**Procedure:**

**Activity Prep (Parental Supervision Required)**

1. Blend ¼ of a red cabbage with 4 cups of water for 1 min.
2. Strain the mixture into a pot and heat until almost boiling
3. Stir 4 packets of gelatin into the heated mixture.
4. Transfer the mixture into a plastic container and stir in 1 tsp of ammonia.  
Warning: Ammonia has strong odors. Once mixed in, there is no odor.
5. Place the mixture in the fridge overnight.

**Student's Procedure**

6. Gather gelatin, a small bowl/container to fill with vinegar, and a knife
7. Cut out 3 gelatin cubes:
  - 2 cm<sup>3</sup>
  - 1 cm<sup>3</sup>
  - 0.5 cm<sup>3</sup>
8. Create a prediction as to which square will become fully clear quickest
9. Add the cubes into a bowl of vinegar and observe.

**EXPLAIN:**

Substances pass through the membrane of the cell by diffusion. **Diffusion** is the movement of anything from a region of high concentration to low concentration.

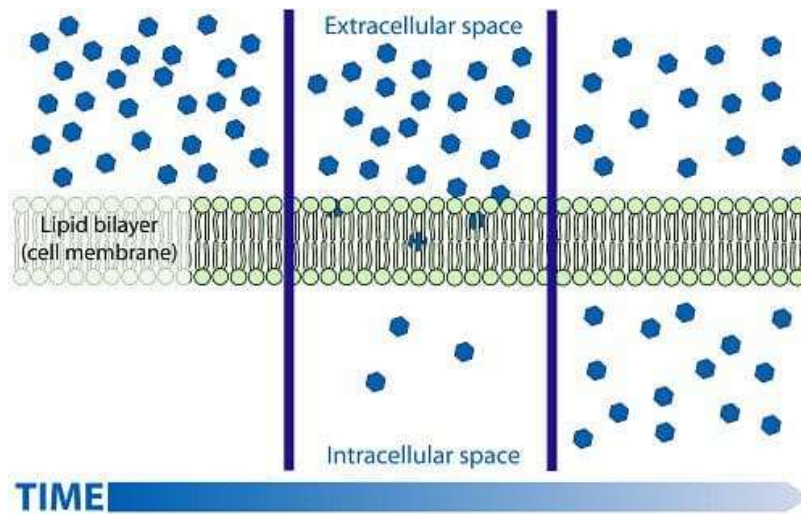


Image credit: [https://upload.wikimedia.org/wikipedia/commons/thumb/c/cc/Scheme\\_simple\\_diffusion\\_in\\_cell\\_membrane-en.svg/1200px-Scheme\\_simple\\_diffusion\\_in\\_cell\\_membrane-en.svg.png](https://upload.wikimedia.org/wikipedia/commons/thumb/c/cc/Scheme_simple_diffusion_in_cell_membrane-en.svg/1200px-Scheme_simple_diffusion_in_cell_membrane-en.svg.png)

You can observe diffusion in action by putting a tea bag in a cup of hot water. What happens? The color spreads throughout the water until the liquid becomes one even color. This happens because the molecules move from the tea bag into the water and disperse through the water evenly.

We mentioned earlier that cell membranes are **selectively permeable**. Selective permeability allows things like nutrients to diffuse into the cell, while preventing anything harmful from getting in.

In the experiment, you should find that the smallest cube is the first to turn completely clear. Why is this? The vinegar diffuses through the surface of each of the three cubes at the same rate, but it fills the smallest first because of its *surface area to volume ratio*. A smaller cube has a higher surface area compared to its volume, meaning there is a greater area for the vinegar to diffuse through than space to fill up.

All of the substances that cells need, like oxygen, water, and food, must pass through the **plasma membrane**. Larger cells rely on the same resources as small cells, but they have to transport these materials through the membrane at a faster rate, because they have a larger space (volume) to fill relative to their surface area. Larger cells like those of animal and plant cells require additional structures to conduct the amount of transfer of molecules across the membrane that is necessary to maintain a healthy cell.

Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell.

## Review STEM Vocabulary

**Surface Area:** a measure of the total area of the exterior of an object. The surface area of a cube is 6 times one of the sides squared or  
 Surface area of a cube =  $6(X)^2$ .

X = is the length of the side of each edge of the cube.

**Volume:** The amount of space something occupies; the volume of a cube can be determined with the formula *length x width x height = volume*

**Watch** this BrainPop video and learn more about diffusion

<https://www.brainpop.com/science/cellularlifeandgenetics/diffusion/>

## EVALUATE:

What is the function of the cell membrane?

Why is diffusion important in living organisms?

Make a drawing or a model to explain what happened in the experiment.

## Sources

<https://www.generationgenius.com/wp-content/uploads/2020/02/GG-Plant-and-Animal-Cells-DIY.pdf>

<https://www.khanacademy.org/science/biology/membranes-and-transport/passive-transport/a/diffusion-and-passive-transport>

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