The Osmosis Scenario: Middle School Science

Overview

This is a middle school science assignment that is intended to take one class period, approximately 45 minutes. Prior to this lesson, students have been engaging with the structures of the cell membrane. Today, they are focusing on how water moves across a cell membrane. After this lesson, students will model this activity and set up their own independent experiment of an egg cell in a solution of their choice.

This scenario aligns with parts of NGSS. MS-LS1-2 Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.

Lesson

Students will develop and use a model to describe the movement of water across the cell membrane, as a way to understand how different parts of the cell contribute to the function. This is important because it supports two important science habits of mind: to develop a model to explain what you observe and to be able to transfer that understanding to new situations. This helps us understand real world applications. For example, you could use this model to understand more about the human body, such as why one gets chapped lips or how constipation works.

Goals

- Students will develop a model to explain how water will move across a cell membrane (osmosis).
- The “I can” statement: I can develop a model to explain how water will move across a cell membrane.

Materials

- Projection and paper version of three cells picture
- Osmosis handout (paper or digital)
- Markers and other coloring supplies
- Computer with an auto-captioned video

Methods

1. When students enter the classroom, the goal and “I can” statement is posted on the board.
2. Students will also be given a picture of these eggs with a description and the image will be displayed on the whiteboard.
3. Students will be told: “Here are three egg cells. An egg is one single cell, so it is a good model for understanding cellular processes such as osmosis.”
4. Students will be shown the goal and the teacher will restate it:
   Osmosis is the movement of water through the cell membrane from high to low concentration. Your challenge is to figure out which direction water moved through the cell membrane of each cell (egg) in this picture.”

5. The students will pair up to discuss what the goal means and to make a note of what they know or do not know yet. They spend a few minutes re-crafting the goal in their own words on the Osmosis Handout.
6. Also on the Osmosis Handout, students will be prompted to answer:
   “What do you see, notice, or wonder about the amount of water in these cells? Take a minute to jot down your ideas or discuss them with a partner.”
   “Make a guess of whether you think water moved in or out of each cell.”
7. There will be three ways students can learn about osmosis. They can work with partners or independently.
   - Choice 1: Begin by crafting a model for understanding the process of osmosis using the 3 egg cells.
   - Choice 2: Watch an auto-captioned video and then craft a model for understanding the process of osmosis using the 3 egg cells (note: students have been shown how to turn on captions if needed).
   - Choice 3: Use step by step directions to craft a model for understanding the process of osmosis using the 3 egg cells.

8. Students will review the goal before making their choice. On their handout, they will indicate why this choice is the best for them.
9. As students work to develop their model to explain how water moves across a cell membrane, they will track their progress for understanding using the prompts:
    - “What is the reason that you think water moves in or out of each cell?”
    - “What is the cause and effect relationships between the eggs and their solutions?”
    - “What patterns emerge that will help you predict how water will move across any cell membrane?”
10. When students are finished, they can read (or have the text read aloud) from an article that tells more about the process of osmosis. The article has two bonus questions as options: Chapped Lips: Do you Need Chapstick?

Assessments

1. As students work, the teacher will check in on the responses in their Handout. If a group or an individual student is struggling, the teacher will give a hint (for example, they might be prompted to remember that water moves from a high concentration to low concentration).
2. The teacher will have a checklist of students’ names to be marked as they walk around the room and observes them use the drawing to know how water moves in or out of the cell membrane.
3. At the end of class, students record their reflections on the Osmosis Handout. They can use pictures, words, and/or numbers to describe how they know their answer. If students use the digital version of the Handout, they could record their answers verbally.
    - How well did they meet the goal for today?
    - What is model to explain how water will move across a cell membrane (osmosis)?
4. The teacher will offer feedback on the students’ reflection and solutions for the next class period.