Membrane Mystery

Use a model to investigate selective passage.

7.1.c "Plan and carry out an investigation to identify and explain features of a cell's semi-permeable membrane which enable it to control what enters and exits the cell."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline what the students kept the same, circle the results, and number two features of a living cell membrane that help control what passes through it.

What Can Cross?

1. At a pond, a frog's skin cells face water that may contain dissolved salts. Each cell has a membrane made mainly of two layers of lipids. The middle of this lipid bilayer resists many charged particles, including salt ions. Tiny water molecules can cross the bilayer slowly, and some cross faster through water-channel proteins. Other proteins help specific substances cross. This structure lets a cell take in needed materials and release wastes without letting everything in the pond enter at once.

2. To investigate selective passage, a class uses dialysis tubing as a model membrane. The tubing has tiny openings, but it is not made of lipids or transport proteins. Students seal starch solution inside one tube and plain water inside another. They place both tubes in separate cups of the same yellow-brown iodine solution for ten minutes. Iodine turns blue-black when it meets starch. Before the test, students predict that iodine can pass through the tubing but the larger starch molecules cannot. They use equal lengths of tubing and equal amounts of iodine solution.

3. After ten minutes, the starch-filled tube is blue-black inside, while the water-filled tube is yellow-brown inside. Both cups stay yellow-brown. The color inside the starch tube shows that iodine entered; no blue-black color outside suggests starch did not leave in a detectable amount. The plain-water tube shows that iodine alone does not cause a blue-black color. These observations support selective passage through the model's small openings. They do not show how a living cell's lipid bilayer or transport proteins move substances. Those features would need a different investigation.

2 ANSWER WITH EVIDENCE

Use the passage

1. Which result shows that iodine crossed the model membrane? Explain how the result shows this.

2. What result suggests that starch did not cross the tubing? Why can the class not claim that no starch crossed at all?

3. How does the water-filled tube help the class explain the blue-black color in the starch-filled tube?

4. Name one feature of a real cell membrane that this tubing cannot test. How does that feature help control passage?

3 YOUR TURN

Your own words

Plan a new test with dialysis tubing, glucose solution, plain water, and glucose test strips to find out whether glucose can leave the tubing. Describe your control, what stays the same, when and where you test, and what a positive result would and would not tell you about a real cell membrane.

ANSWER KEY

Membrane Mystery

GRADE 7 · 7.1.c

PART 1 · READ AND MARK

Underline what the students kept the same, circle the results, and number two features of a living cell membrane that help control what passes through it. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Which result shows that iodine crossed the model membrane? Explain how the result shows this.	**The starch-filled tube turned blue-black inside. Iodine must have entered because it turns blue-black when it meets starch.**
2	What result suggests that starch did not cross the tubing? Why can the class not claim that no starch crossed at all?	**Both cups stayed yellow-brown, so no starch was detected outside the tubing. A small amount might have crossed without causing a visible color change.**
3	How does the water-filled tube help the class explain the blue-black color in the starch-filled tube?	**The water-filled tube stayed yellow-brown inside. This shows that iodine alone does not turn blue-black inside the tubing; it must meet starch.**
4	Name one feature of a real cell membrane that this tubing cannot test. How does that feature help control passage?	**The lipid bilayer cannot be tested with this tubing. Its middle resists charged particles such as salt ions.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would seal glucose solution in one tube and plain water in a second tube, then place each in a separate cup of plain water. I would use equal lengths of tubing, equal liquid amounts, and the same waiting time. I would test the water outside each tube with glucose strips before placing the tubes in the cups and again after 20 minutes. Glucose detected only outside the glucose tube would show that glucose passed through the model tubing. It would not show whether glucose crosses a living cell membrane or needs a transport protein.

Accept either the lipid bilayer or transport proteins for question 4 if the student correctly explains its role. In Part 3, the plain-water tube is the control, and a positive result supports passage through tubing only, not through a living cell membrane.