TEACHER PREPARATION GUIDE.

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The Celery Droop Test: An Osmosis Lab

Biology | TEACHER GUIDE

Planning notes for teachers: materials, setup, expected results, and what to watch for.

Not yet classroom-tested. This is a new lab design that has not been tested in a classroom yet. Expected results, times and costs are estimates, not measured values. Run the full lab yourself before you use it with students or grade it, and adjust amounts to match your materials.

Item	Details
Unit and lessons	Unit 6: Cells and Homeostasis. Lessons: Passive Transport, The Cell Membrane
Class time	One 50-minute period (25-minute soak)
Groups	3 to 4 students
Cost	About $1 to $2 per group
Standards	HS-LS1-2, HS-LS1-3. SEP: Planning and Carrying Out Investigations; Analyzing and Interpreting Data. CCC: Structure and Function; Stability and Change.

Big Idea

Osmosis is linked to a function students can feel: stiffness. The measurement is mechanical (droop), not mass, so it ties water movement to plant structure. Odom and Barrow (2007) found high school students held misconceptions about tonicity even after instruction, so this lab leads with water movement and dissolved particles, and adds the terms hypotonic and hypertonic in the debrief.

Materials for 8 Groups

Item	Amount	Notes
Celery	2 bunches	Fresh and crisp. Use the outer stalks.
Table salt	About 160 g	Non-iodized is fine but not required.
Cups (9 oz)	40	Label with concentration.
Heavy books or binder clips, rulers	8 each	

Advance Preparation

1. Make 1 L of each solution: 0, 10, 20, 40, and 80 g of salt per liter of water (0%, 1%, 2%, 4%, 8%, mass per volume).
2. Cut strips 10 cm long and 5 mm wide from the outer part of the stalk. A cardboard template keeps them the same size. Keep the strips in a covered container with a damp paper towel (not in water) until class.
3. Pilot one 0% and one 8% strip to check that the change is at least 5 mm. If not, use thinner strips or a 30-minute soak.

Expected Results

Sample values are in the answer key. Expect the 0% strip to stiffen a little and the 4% and 8% strips to droop clearly. The zero-change point usually falls near 1%, but it depends on the celery.

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What Can Go Wrong

- Strips of different thickness droop differently. Use the template, and compare each strip with itself (before and after).
- Measuring from different angles. Read the ruler at eye level, held straight down from the table edge.
- Wilted celery to start. Buy it fresh or crisp it overnight in cold water, then let it rest on a towel for an hour.

Misconceptions to Listen For

- "Salt moves into the cell." Water moves; the membrane controls salt.
- "Osmosis stops at equilibrium." Water moves both ways at equal rates.
- "Cells want water." Water moves because of the concentration difference, not because cells want it.

Differentiation and Extensions

- Support: a diagram of a cell with arrows in and out. Sentence frame: "In ___% salt, water moved ___ the cells, so the strip got ___."
- Extension: pair with the ZornScience virtual Osmosis Lab (potato cores in sucrose) to compare mass data with stiffness data.
- Extension: test sugar solutions with the same number of dissolved particles.

Safety and Disposal

- Teacher cuts the strips, or students use plastic knives.
- Salt water down the drain; celery in compost or trash.

Standards

This lab builds toward these NGSS performance expectations:

- **HS-LS1-2:** Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
- **HS-LS1-3:** Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Disciplinary core ideas: LS1.A Structure and Function

Science and engineering practices: Planning and Carrying Out Investigations; Analyzing and Interpreting Data

Crosscutting concepts: Structure and Function; Stability and Change

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