



Elementary Institute of Science

Hands-on Marine Biology Activity 4

Topic and Learning Objective:

Homeostasis and Body Composition of Marine Organisms

The lesson will comprise of multiple activities that will explore the ways marine organisms utilize body composition to survive in their respective environments.

Alignment with NGSS Grades 3-5

Science and Engineering Practices

Planning and Carrying Out Investigations

Builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.

Connections to Nature of Science

Scientific Investigations Use a Variety of Methods

- Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings.

Disciplinary Core Ideas

LS1.A: Structure and Function

- Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.

Crosscutting Concepts

Stability and Change

- Feedback (negative or positive) can stabilize or destabilize a system.



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Materials:

- Crisco/shortening, 2 small thick rubber gloves, plastic freezer bags, duct tape, plastic bin, cold water, ice cubes, various pasta (spaghetti, rotini, shells, penne, rotelle), potato, clear beakers/cups, salt, water

Detailed Description:

- Potato Activity – Osmoregulation In 2 groups, each group will be given 3 potato slices, salt, and three beakers. In each beaker, the group will form salt solutions of different concentrations, with one being very dilute and one being very concentrated. One student will trace the size and shape of each potato slice on a piece of whiteboard/waterproof paper. The students will place on potato slice in each of the solutions and will be asked to make observations using any existing knowledge about osmosis. After 20 minutes (we will go through the following activities) and some discussion, the students will observe the change in shape or size to the potato slices by retracing the potato slice and will be asked to explain why they had observed such a change. We will then discuss how osmosis works on the cellular level and how marine animals in high salinity environments use osmoregulation to maintain body function and energy.
- Pasta activity – Shells, skeletons, and exoskeletons Students will be given multiple pasta forms and will be asked to brainstorm different kinds of marine organisms that utilize a skeletal/structure similar to that pasta shape (example would be shells = snails, or spaghetti = urchin spines). They will also be asked to try to break each pasta type by bending, snapping, or crushing, and should then note which pasta shape is most resilient. Using these observations and by making inferences they would then be asked to form pros and cons to having a certain shell/skeletal form for a marine organism.
- Shortening activity – Blubber insulation Volunteers (health permitting) will be asked to dunk their hand in ice water to test a hypothesis about blubber. First, the volunteer will rub their hands together to use friction to warm their hands. On one hand, the student will put on a lather glove, a layer of shortening, and a freezer bag over, taping the layers together at the end (instructor will assist with this). On the other hand, the volunteer student will wear one rubber glove, a freezer bag, and a tape seal. These represent blubber and muscle systems respectively. The volunteer will then dip their hands in ice water at the same time for 10 seconds (another student may time). The volunteer will call out observations



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and the other students will be asked to infer how fat/blubber works to help insulate marine mammals, especially in cold environments. The experiment may be repeated with another volunteer as an extra trial if time permits.

How will you conclude the lesson to enforce the learning objective?

At the end of all of the activities, we will go over how osmoregulation, biomechanics, and insulation of marine organisms help them live in different marine environments. They will also be asked how they think humans can use marine organisms as inspiration for human inventions (for example: how can humans better survive cold environments, create stronger structures, and use osmosis to deal with high salinity water?)

What science process skills will this lesson exercise?

- Forming hypotheses
- Making observations
- Using controls and experimental variables
- Collaborative discussion

Safety precautions:

Students should handle broken pasta shells carefully. Children who volunteer for ice activity should be healthy and not prone to sensitivity to coldness.