SINKING SLOWLY

QUESTION
How do planktonic organisms, which are not strong enough to swim against the current in the water, keep from sinking to the bottom of the ocean?

UNDERLYING CONCEPT
Plankton have a variety of strategies (adaptations) for staying above the bottom of the ocean in the water column.

SKILLS
- Observation
- Prediction
- Inference
- Measurement
- Experimentation

OBJECTIVE
- Students will be able to describe strategies used by plankton to keep from sinking and test their predictions about certain strategies in a model building exercise.

TIME NEEDED
- 2 hrs. Allow time to experiment with the materials they will be using to design plankton.

MATERIALS NEEDED
- Pictures of different types of plankton
- Movie or video on plankton if available
    - *Plankton and the Open Sea*, 18 minutes, Encyclopedia Britannica
    - *Plankton of the Sea*, 12 minutes, Fleetwood Films
    - *Plankton: Pastures of the Ocean*, 10 minutes. Encyclopedia Britannica
    - *Plankton: the Endless Harvest*, 18 minutes, Universal Education
- Various art supplies (sticks, string, beads, plastic, clay, styrofoam, wire, aluminum foil, nuts, glue, pipe cleaners, etc.)
- Buckets of water
- Large glass aquarium or trash can full of water
- Stopwatches
- Small prizes

VOCABULARY
Plankton- Organisms that drift; they cannot swim against a current stronger than 1 knot (1 nautical mile/hour)
Phytoplankton- plant plankton
Zooplankton- animal plankton
Photosynthesis- process through which plants obtain their energy from the sun
Adaptation- a feature that allows an animal to survive in its environment.

Adapted from Living in Water
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BACKGROUND

Plankton are organisms that drift; they cannot swim against a current any stronger than 1 knot (1 nautical mile/hour). Usually, plankton are very small, microscopic organisms but some larger animals, like certain jellyfish, are also considered plankton. Plankton are divided into two groups, plants (**phytoplankton**) or they can be animals (called **zooplankton**). Phytoplankton make their own food through **photosynthesis** (using sunlight to combine carbon dioxide and water into sugar), but zooplankton must ingest or eat food from the ocean.

Plankton are usually heavier than water. This is important because if a planktonic organism just floated on the surface of the water, it might not be able to get to food sources below it or it might get too warm or too much light from the sun (even phytoplankton can be "bleached" by the sun!). So plankton will tend to sink in the water column. But phytoplankton do need to stay where sunlight penetrates. Zooplankton feed on phytoplakton so the zooplankton want to stay where the phytoplankton are in the water column. One important note is that zooplankton are usually able to swim upward in the water column very slowly to maintain their position. But if they sink too quickly or are too heavy, they will go straight to the bottom of the ocean and not be able to get back up! Therefore, planktonic organisms will have **adaptations** that prevent them from sinking too quickly. These adaptations include the following:

1) small size (small things sink slower than large things)
2) long spines or projections that increase drag
3) long, thin or flattened shape - also increases drag
4) contain small amounts of oil (which is lighter than water)

ACTIVITY:

"SINKING SLOWLY"

Before Class:

This is a great, messy activity. It is particularly good for a warm day when the class may be naturally restless and ready for some excitement. The best way to finish this class is with a contest so you may want to think about some possible prizes (coupons for lost homework, small toys).

During Class:

1) Start with observations of zooplankton and phytoplankton. Observe their shapes, projections and behaviors. Most plankton are heavier than water and tend to sink. Ask how they might stay up in the water. Make a list of the students' observations.

2) Some of the students should notice that many plankton have long projections or antennae or hairs. Have them speculate on how these would affect movement through water. Could the students run through water faster with their own arms spread out or folded up?

3) Now the students are going to see if they can make a model phytoplankton or zooplankton which will sink slowly. Since "thrashing" or swimming is not possible in a non-mechanical model, they must concentrate on designing a plant or animal that is just barely heavier than water and that slows its rate of sinking by increasing its resistance to movement through

water with long projections or hairs or that sinks slowly because it swings back and forth as it goes down. Have selections of materials and buckets of water available around he room for design and testing. Use stopwatches to time the speed of sinking. Set a time limit for experimentation and announce a contest for the slowest sinking animal or plant at the end of that time.

4) The best way to have the contest is to gather around a large glass aquarium where everyone can see. A big trash can of water or a large bucket will work, but you cannot give everyone a good view. In that case have several students help you as judges. You can time each separately, but it will be more exciting if pairs of phytoplankton or zooplankton are released to "reverse race" their way down. Put both on a sheet of cardboard so they can be tipped in at the same time for a fair start. The SLOWEST from each pair goes into a second heat and so on until you get down to two.

5) Have the students analyze what they think made each of the last two models winners. Then have them vote on which they think will win the grand prize for slowest overall based on their analysis. Do the final test and distribute prizes. *Note: The plankton must SINK not float. They may not sink because they get wet slowly, but rather, because they are heavier than water from the start.*

Results:

Something just barely heavier than water with lots of projections should win unless a student can produce a flat, pie pan shaped object that makes big swings from side to side as it descends.

Discussion:

1) Have students discuss why certain models floated and others sank.

Extension:

Have the students write a poem or paragraph about what it might feel like to be a phytoplankter or zooplanker, tending to sink. Remember that zooplankton can "swim" their way up.