

Teachers Guide: Make a Microbe.

Materials

- Arts-and-crafts supplies needed to make microbes
 - 1 weight, such as a nut or washer, per student (must be used)
 - 1 Styrofoam or Wiffle ball per student
 - Various supplies (e.g., pipe cleaners, rubber pencil grips, paper clips, straws, buttons, beads, toothpicks, and balloons) to vary buoyancy and protect against predation
- Safety scissors
- Transparent plastic tubs to test buoyancy (~30 cm [1 ft.] deep, filled three-quarters of the way with water)

Procedure

1. Discuss with students what phytoplankton are and why they need to stay relatively close to the ocean surface (plant-like microbes require energy from the Sun for photosynthesis).
2. Discuss with students the dangers of being right at the ocean surface (e.g., predators, ultraviolet rays).
3. Explain that each student will be given arts-and-crafts materials to design and construct a microbe. The goal is to make a microbe that sinks slowly through the water column. They must also protect their microbe from predators (e.g., encase it in the Wiffle ball, or make spines from straws, toothpicks, or pipe cleaners). Every student must use their weight (i.e., nut or washer) when constructing their microbe.
4. Before distributing materials to students, test the density of selected materials. Before placing the objects in the tub, ask students to predict what will happen:
 - a. The object will float (less dense than water).
 - b. The object will sink quickly (much denser than water).
 - c. The object will sink slowly (slightly denser than water: ideal.)
 - d. Have the class brainstorm how materials could be combined or shaped to vary their density.



Microbe models with varying flotation. *Photos by Ryan Kagami and Michelle Hsia*

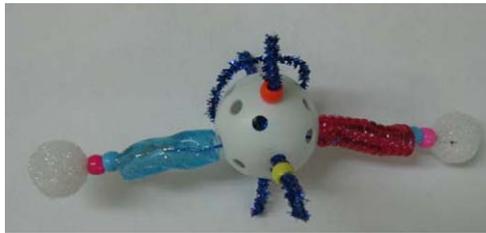
5. Allow students to work individually to construct microbes. We recommend not making the plastic tubs available to students at this time, so that students do not have the opportunity to test and modify their design multiple times before submitting them for the final buoyancy test.
6. In small groups or as a whole class, have students share their microbes, explaining

- which adaptations they used to protect against predation, and
- why they think their microbe will sink slowly through the water column.

Have students examine each other's microbes, predict which microbes will

- float,
- sink quickly, or
- sink slowly,

Have students explain their reasoning.



Microbe model. *Photos by Ryan Kagami and Michelle Hsia*

7. Once all hypotheses are made, have students drop their microbes into the water-filled plastic tubs. For microbes that do not sink slowly, allow students to make appropriate adjustments and try again.