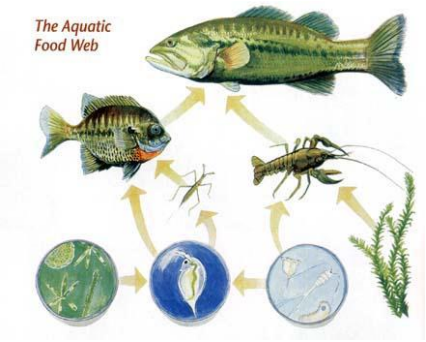
LAB: Biomagnification in a Freshwater Food Web

Purpose

The purpose of this lab is to demonstrate the concept of **bioaccumulation**, and to show how **persistent pollutants** increase in concentration as they travel up the food chain (**biomagnification**). *In this lab, you will be using volumes of water to model how biomagnification of toxins and pollutants can occur in an ecosystem.*



We will use our conclusions from the lab to begin our study of biomagnification, so please follow the directions carefully. To complete the lab, it will also be important to remember the following:

- Measuring the volume of liquids:
  When measuring the volume of liquids in graduated cylinders, we use the bottom of the meniscus as the point from which we measure.

- Calculating concentrations:
  The percent concentration of one substance in a mixture of two or more substances is equal to the volume of that substance divided by the total volume of the mixture, times one hundred.

  Example: 1 mL of chocolate syrup mixed with 9 mL of milk makes 10 mL of chocolate milk.
  *Therefore, the concentration of chocolate syrup in the chocolate milk is 1/10*100 or* ***10%.***

Materials

Your lab team will need the following materials:

- 1000 mL graduated cylinder (or beaker or flask)
- 100 mL graduated cylinder (or beaker or flask)
- 10 mL graduated cylinder
- 50 mL beaker (or beaker)
- vegetable oil

WRITE ALL ANSWERS/DATA IN YOUR LAB NOTEBOOK

Procedure

1. Fill the 1000 mL graduated cylinder with 990 mL of tap water (*if using a 1000 mL beaker use the 100 mL graduated cylinder to measure the last 90 mL*). The 1000 mL graduated cylinder represents the first trophic level, the **producers,** in our food web.

   → What would be an example producer in a lake food web? _____

2. Then use the 50 mL beaker to get 10 mL of vegetable oil. *Slowly and carefully* add the oil to the 990 mL of water by pouring it gently down the side, so it forms a film on the surface.

3. Let the oil sit until all of the droplets have coalesced into a film on the surface. The oil represents a **persistent pollutant** that the producers have absorbed from the soil or water. Its insolubility with water represents its resistance to biological degradation and metabolism by the producer.
4. Record the volume of water and the volume of oil in the 1000 mL graduated cylinder in the data table below. Then calculate the % concentration of oil in the first trophic level of our food web.

5. Then, *slowly and carefully* pour 100 mL of the oil/water mixture from the 1000 mL graduated cylinder into the 100 mL graduated cylinder. *NOTE: Accurately pouring this mixture of oil and water can be difficult, so pour slowly!*

6. Let the mixture settle so that all of the oil droplets have coalesced into one layer at the surface. The 100 mL graduated cylinder represents the second trophic level, the **1st order consumers**, in our food web.

   → What would be a 1st order consumer in a lake food web? _____

7. Record the volume of water and the volume of oil in the 100 mL graduated cylinder in the data table below. Then calculate the % concentration of oil in the second trophic level of our food web.

8. Lastly, *slowly and carefully* pour 10 mL of the oil/water mixture from the 100 mL graduated cylinder into the 10 mL graduated cylinder, using the same care as before. The 10 mL graduated cylinder represents the third trophic level, the **2nd order consumers**, in our food web.

   → What would be a 2nd order consumer in a lake food web? _____

9. Record the volume of water and the volume of oil in the 10 mL graduated cylinder in the data table below. Then calculate the % concentration oil in the third trophic level of our food web.

10. When you have finished, check in with your instructor before cleaning up. To clean the oily glassware you will need to use hot water, SOAP and cleaning brushes! Everyone on the team should help clean the glassware and table top of oil before leaving the lab.

Data / Calculations (Record this data table in your lab notebook)

trophic level	device	volume of water	volume of oil	total volume of mixture	% oil
producers	1000 mL			= 1000 mL	
1st order consumers	100 mL			= 100 mL	
2nd order consumers	10 mL			= 10 mL	

Lab Analysis

1. How did the % concentration of oil change as we went from the bottom of the food chain to the higher trophic levels?
2. If the oil represents a pollutant first absorbed by the producers, what does this mean for our consumers at the top of the food chain?

NOTE: To complete the following questions, you may need to look-up the terms that have been bolded.

3. What would be true of a pollutant that is…
   - **hydrophobic**? Why?
   - **hydrophilic**? Why?
   - **lipophobic**? Why?
   - **lipophilic**? Why?
4. Distinguish between a **persistent pollutant** and a **non-persistent pollutant**.
5. What types of pollutants are organisms able to excrete from their bodies through urine, sweat and feces – hydrophilic or hydrophobic? Explain why.
6. Where do hydrophobic pollutants accumulate in the body?
7. Based on what you've just learned, try to explain how **biomagnification** of **persistent pollutants** occurs in the freshwater food web.