

## **Guided Inquiry Lab: *The Effect of Fertilizer on Algae***

**Question:** How do excess nutrients affect the growth of algae?

### **Background**

As primary producers, algae form the base of the food web in the upper layers of the ocean and in freshwater lakes and ponds. The term *algae* is used to describe a range of organisms, from large brown kelp found attached to rocks at the seashore to the tiny green algae found in fish tanks. Like other plants, green algae need nitrogen, phosphorus, and potassium in order to grow. All three nutrients must be available for the algae to thrive and reproduce.

Have you ever seen a pond with a thick, green layer of algae on its surface? This layer is a sign that the homeostasis of the ecosystem may have been disturbed by the presence of too much nitrogen or phosphorus in the water. Fertilizers and animal waste contain these nutrients, which can be transferred to bodies of water when rainfall flows downhill from farms.

In this lab, you will work with *Chlorella*, a type of algae that is commonly found in ponds and aquariums. You will select nutrient amounts and compare the growth of *Chlorella* when nutrients are limited and when nutrients are abundant.

**Science Practices:** Plan and Carry Out an Investigation, Collect Data, Analyze and Interpret Data

### **Materials:**

- 3 test tubes
- glass-marking pencil
- test-tube rack
- 2 dropper pipettes
- algae culture
- 25-mL graduated cylinder
- spring water
- fertilizer
- 3 cotton balls
- grow light
- compound microscope
- glass slides
- glass coverslips

### **Safety**



Wear safety goggles when handling live cultures, such as algae. If you are using glass test tubes or cylinders, check for cracks or chips. Handle slides gently to avoid breaking them and cutting yourself. Review the rules for handling a microscope. To avoid electrical shocks, make sure that cords, plugs, and your hands are dry when using the light source. At the end of the lab, wash your hands thoroughly with soap and warm water.

# Procedure

## Part A Set-up

1. The test tube rack at your lab station should have 3 test tubes labeled Control, Fertilizer 1, and Fertilizer 2. Each test tube should have a sample of algae.
2. Decide how many drops of fertilizer to put in the two Fertilizer test tubes. Select between one and six drops. Record your plan in the Experimental Design Table on the lab sheet.
3. Use a dropper pipette to add drops of fertilizer solution to the test tube labeled Fertilizer 1 and 2 according to the Experimental Design Table on the lab sheet.
4. Loosely plug each test tube with a cotton ball to slow the evaporation of the water. Place each test tube in the properly labeled location in the test tube rack.
5. Clean work area and put away any unused materials. Wash hands.

## Part B Days 1-4

1. On the day after set up (Day 1), observe a small sample from the control test tube under a light microscope:
  - Gently swirl the test tube so that the algae are mixed evenly in the water. If algae are collected in a pellet at the bottom of the test tube, then dislodge the pellet by holding your finger over the test tube and shaking the test tube carefully and vigorously.
  - When the algae are thoroughly mixed into the water, use the Control dropper pipette to transfer one drop from the test tube onto a glass slide and cover with a coverslip.
2. Examine the slide under high power. Count the number of *Chlorella* cells in the field of view. Record this number in the Data Table. As time allows, move the slide and count the cells in one or two additional new fields of view. Calculate the average number of cells per field.
3. Use the Fertilizer dropper pipette and repeat for the test tubes labeled Fertilizer 1 and Fertilizer 2. Rinse both dropper pipettes, making sure to avoid cross-contamination.
4. Repeat each day for the next four days.

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**Name:** \_\_\_\_\_ **Period:** \_\_\_\_\_

**Pre-Lab:**

- 1. To which trophic level does algae belong?
- 2. How does algae obtain energy?
- 3. What are three important nutrients that algae need to grow?

**Data:**

Experimental Design	
	# Drops Fertilizer
Control	
Fertilizer 1	
Fertilizer 2	

Data Table						
Day	Control counts	Control average	Fertilizer 1 counts	Fertilizer 1 average	Fertilizer 2 counts	Fertilizer 2 average
1						
2						
3						
4						

