Name: Period:

1 The Science of Biology

Simple Behaviors in Fruit Flies

OVERVIEW:

In this lab you will be using a common laboratory animal, *Drosophila melanogaster*, to learn about simple behaviors in regards to different environmental stimuli. You will use simple statistics to determine whether the data is meaningful or not.

PURPOSE:

- To examine fruit flies for evidence of phototactic or geotactic behavior
- To determine if phototactic behaviors dominate when fruit flies are exposed to light

INTRODUCTION:

The simplest behaviors are *kineses* and *taxes*. Kineses occur when animals achieve a body orientation toward or away from a stimulus by changing their rate of random movement. Pill bugs, usually found in moist places, get there because of kineses. When in dry conditions, they move quickly in random directions, but in moist conditions, they move slowly or not at all. Thus they tend to congregate. In contrast to kineses, taxes are directed movements toward or away from a stimulus. A planarian will move away from light, a taxes that benefits the flatworm as darkness more closely resembles the water bottom habitat that it favors. Both taxes and kineses are innate (unlearned) behaviors and involve complex neuronal interactions. The stimulus must be sensed and specific movements initiated.

PROCEDURES:

This lab will examine phototaxes in fruit flies, specifically, their ability to orient to light.

1. Your teacher may perform this step for you. Obtain a small plastic vial, some cellophane tape, and 9 fruit flies in a second plastic vial from the supply table. Tap the vial containing the flies on the table, so that all the flies fall to the bottom. Quickly remove the stopper and tape the open end of the empty vial to the other vial, so that you have a double vial experimental chamber. The tape should pass completely around the seam between vials (figure 14.1). Use a marker to place lines on the double vial, dividing it into thirds. Take a 5-inch piece of tape and turn it back on itself with a 2-inch overlap. Attach this as a pull tab on one end of the double vial. Do the same for the other end. This chamber and the flies it contains will now be used to study orientation behavior.

2. To determine if fruit flies will orient to light, slide the chamber into a black tube and put stoppers in the ends of the tube so no light enters. Place the tube horizontally on a table. Let the tube sit for one minute to allow the flies to settle down and become accustomed to their new environment.

3. Now remove the stopper from one end to let light in from the room for 5 minutes.

4. After five minutes, slip the tube off while holding the experimental chamber by its tab to prevent movement. *Immediately* count the number of flies in each third of the chamber and record your results in table 14.1. Repeat the experiment twice more, but each time turn the experimental chamber end-for-end before slipping it back into its tube and let the flies sit for one minute before exposing them to light.

   Why is it important to repeat the experiment three times?

5. While the experiment is running, form a hypothesis for this experiment. Your hypothesis should predict the effect of light on the flies and include an explanation why you think light will have this effect.
Hypothesis:

6. Record your totals from table 14.1 on the blackboard. Copy the class data from the blackboard to table 14.2. Why do we use class data and not individual data?

FIGURE 14.1: EXPERIMENTAL SETUP FOR STUDYING PHOTOTAXIS

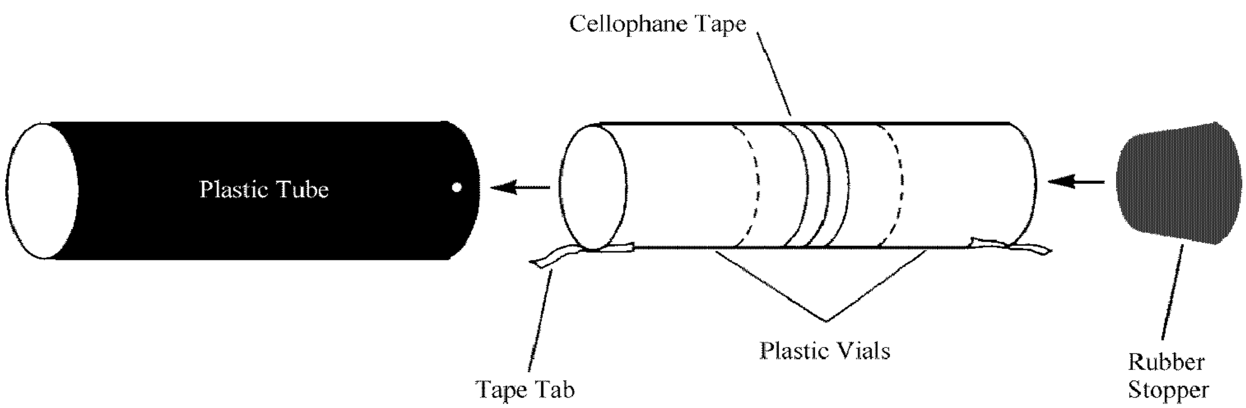

TABLE 14.1: RESULTS FROM THE PHOTOTAXIS LAB

	Fruit Fly Distribution		
Sampling	***Nearest 1/3***	***Middle 1/3***	***Farthest 1/3***
Trial 1			
Trial 2			
Trial 3			
Totals:			

TABLE 14.2: CLASS DATA FOR PHOTOTAXIS AND ANALYSIS OF DATA

	Fruit Fly Distribution			
Group	Nearest 1/3	Middle 1/3	Farthest 1/3	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				Grand Total
Totals (Observed)				
Expected (Exp)				

ANALYSIS OF RESULTS:

1. The method for analyzing this data is called Chi-Square Goodness of Fit and is used when the expected values are known. To determine the known values, we must think about where the flies would be distributed in the vial if no stimulus was acting on them.

   If light has no affect on the behavior of fruit flies, how do you think they would be distributed in the vial? This is your expected result.

   How were they distributed at the end of your experiment? This is your observed result.

2. Were the flies phototactic? __________________ . Positively or negatively?____________________ ___ .

3. Refer back to your original hypothesis. Support or reject your hypothesis using data.

4. To calculate the percent error for this experiment, use the following formula:

$$\frac{\text{Expected - Observed}}{\text{Observed}} \quad \text{X} \quad 100 = \text{percent error, in absolute value}$$

Calculate the percent error using the class data. Show your work below.

Biologists generally accept a percent error of 5% or less. If the value is less than 5%, it is considered to be meaningful. If it is greater than 5%, some other factor besides the independent variable may be affecting the experiment. Would your results be accepted? Explain.

5. Name two sources of error that could have occurred in this experiment using cause and effect relationship.

6. How could you do this lab differently to eliminate the errors you discussed?

7. What was the independent variable in this experiment? The dependent variable?

   What was the control group in this experiment?

   Name three constants that must be addressed when performing this experiment.