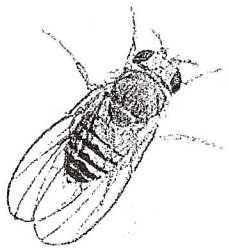
AP Biology Name LB 12/17/15

Animal Behavior Lab

Living organisms respond in various ways to their environment. Animals that move can exhibit external behavior in response to stimuli. Responses can be innate (genetic) or learned. **Innate responses** include **kinesis** and **taxis**. **Kinesis** is a *random* movement that is elicited by a stimulus. For example, if you lift up a log in the forest, small animals like ants and pill bugs will respond by moving in a quick, random manner. A **taxis** is a response that is *directional* and involves movement. It can be toward a stimulus (positive taxis) or away from a stimulus (negative taxis). A taxis differs from a **tropism** (ex. plant growing toward light) because the organism actively moves toward or away from the stimulus. **Chemotaxis** is a response to a ***chemical stimuli***, **phototaxis** is a response to ***light***, and **geotaxis** is a response to ***gravity***.



Examples of taxis in fruit flies:

- Adult fruit flies exhibit negative geotaxis and climb up their chambers against gravity.
- Adult fruit flies exhibit positive phototaxis and fly toward light.
- Larvae of fruit flies exhibit negative phototaxis and move away from light.
- Adult fruit flies exhibit positive chemotaxis and move toward rotting food (attracted to favorable egg laying environments).
- Adult fruit flies exhibit positive chemotaxis to ripe fruit and negative taxis to non-ripe fruit (ripe fruit contains higher concentrations of sugars).
- Adult fruit flies exhibit positive chemotaxis rotting fruit. This is because they are attracted to substances that offer food or an environment in which to lay their eggs and develop larvae. Typically those environments are rotting or fermenting fruit. They also show a positive chemotaxis to alcohol because it is a by product of yeast fermentation on rotting fruit. Fly larvae produce an enzyme called alcohol dehydrogenase so the alcohol levels do not affect them during feeding.

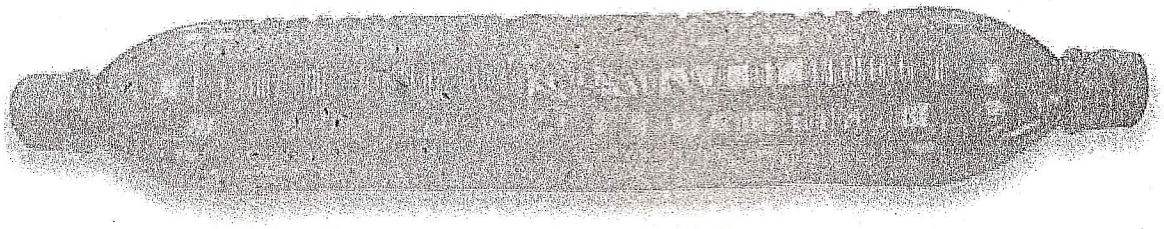
The Lab:

Your teacher will set up a choice chamber with live fruit flies (*Drosophila)* to demonstrate how you could go about carrying out an actual behavior experiment. You will **not** be setting up your own experiment using live flies, but will instead simply design an experiment on paper using the same techniques to investigate a similar question about taxis in fruit flies.

Your job is to design an experiment to test the responses of adult fruit flies to different substances. Your **simulated** experiment will have you placing twenty (20) flies into a choice chamber (see image on next page) with cotton plugs in the caps at each end. The cotton is used to absorb some substance that you will use in your experiment. You will be testing whether the flies exhibit a type of chemotaxis in response to that substance. You can use samples of the following substances:

- water
- glucose solution
- a solution extracted from rotting fruit
- a solution extracted from non-ripe fruit
- alcohol
- vinegar
- substance of your choice

State your hypothesis
Design Expt
Conduct Expt / collect data
Analyze Data
Conclusions
Modify Hypothesis if needed



Since the flies will be put in at one end of the chamber, it will take several minutes for the flies to move away from that end of the chamber. At the beginning of the experiment, you must allow the flies to distribute themselves randomly throughout the chamber. You will then count and record the number of flies found in each half of the choice chamber after 10 minutes.

On a separate sheet of paper, you and a partner need to explain **how** you would go about setting up your controlled experiment. It will include setting up 2 chambers, a control chamber and an experimental chamber. You will decide what you will put in each of the 2 chambers.

In your write up you must:
1. Include the following terms: control group, experimental group, experimental variable, controlled variable/s.
2. Explain the reasoning behind the way you set up your 2 chambers.
3. Predict the location of the flies in both chambers at the end of 10 minutes and justify your prediction.
4. Create a data table that would clearly show the results of the substances you tested.
   (you can make up some data)
5. Determine what type of graph you would use to show your results and then graph your results.
   (the data that you made up).

You would normally run some sort of statistical analysis on your results to help you conclude whether your experiment supported your initial hypothesis. The data from this type of experiment, with total counts that compare two or more different 'treatments' or 'classes,' is often analyzed using a Chi-square analysis. Since the data in your simulated experiment has been made up, do **not** complete a Chi-square on your simulated experiment.

The following page has a sample experiment where you can practice completing a Chi-square analysis on similar data.

Variable - a factor that could affect the outcome of an expt.

Experimental variable is chosen.

Controlled variables - ~~to~~ factors that may influence data but we are not interested in them so we hold them "constant" or the same over all expts.

1) Lighting the same
2) Temperature the same
3) Same # of flies in each container
4) Size of container same
5) Males vs. ♀?? may have different response.
6) Age of flies
7) amt of food flies have had

a variation on the same type of experiment, 2 different substances were tested in one choice chamber. The data were collected every two minutes for ten minutes for 10 minutes. Calculate the average number of flies at each end of the chamber during the 10 minute interval.

Chemical	2 min	4 min	6 min	8 min	10 min	Average
Vinegar	12	14	14	8	12	60/5 = 12
Sugar water	8	6	6	12	8	40/5 = 8

H_0 Expected 10 10

WATCH MR. ANDERSON'S VIDEO ON CHI^2 TEST AND COMPLETE THE TEST BELOW! /20

The data above seems to be in favor of the vinegar but, to be sure, a Chi-square test should be conducted. Use. **Calculate your Chi-square using the data collected at 10 minutes (12 and 8) NOT the average.**

✓ What is your null hypothesis? _____

✓ Fill in the following chart to calculate your Chi-square value: ✓ **# degrees of freedom** = _____

Class	Observed	Expected	$(o-e)^2/e$
Vinegar			
Sugar Water			
		$\sum X^2$	

CHI-SQUARE TABLE								
Degrees of Freedom								
p	1	2	3	4	5	6	7	8
0.05	3.84	5.99	7.82	9.49	11.07	12.59	14.07	15.51
0.01	6.64	9.32	11.34	13.28	15.09	16.81	18.48	20.09

Does your Chi square analysis support your null hypothesis? Explain your answer fully. Be sure to include information on the p value and critical value shown on the chi square table above.

We will do this in class—