

KIT 470134-782

AP[®] Biology **Investigation #12:** **Interactions: Behavior** **Teacher's Guide**

Meets Revised College Board AP Biology Standards

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Abstract

Organisms orient to stimuli that are important to their survival. Movement toward or away from important stimuli (taxis) depends upon both the sensory and motor abilities of the organism. This lab explores the chemotactic behaviors that fruit flies and/or pill bugs exhibit when exposed to the controlled environment of a choice chamber. Students identify patterns in the behaviors and make inferences based on the composition of the tested materials and the organisms' responses. Students then determine what materials and experimental paradigms will be tested further.

Required Prior Knowledge

Students should:

- be able to make and record good observations.
- recognize an insect life cycle with complete metamorphosis and the role which apoptosis (programmed cell death) plays in completing the life cycle.
- be able to explain the genetic basis of behavior and how taxis can ensure survival.
- be able to outline the general structure and relationship of sensory organs and neurons.
- recognize environmental factors that trigger behavior.

Activity Learning Objectives

In this investigation, students will perform activities to help them answer the following question:

What behaviors will help an organism survive?

Students will use model organisms (*Drosophila melanogaster* and pill bugs) to determine if the organisms' behavior is due to taxis (response driven) or kinesis (random movement). Students will also study the anatomy and determine the gender of the organisms.

Materials Checklist

For a list of replacement items, visit: www.wardsci.com, and click on the AP Biology tab for this kit/item #.

Materials Included in Kit:

- 1 vial/100 pH paper, 1-14 range
- 1 pkg. filter paper, medium grade
- 8 Ward's dual magnifiers
- 1 pkg./20 disposable Petri dishes
- 473 mL white vinegar
- 8 animal behavior trays with lids
- 1 pkg./300 cotton balls
- 1 pkg./100 pipets
- 10 nutrient agar plates
- 1 instructions (this booklet & Student Guide)
- 1 redemption coupon (*see below) for pill bugs (*Armadillidiidae*) and fruit flies (*Drosophila*)

Materials Needed but not Provided:

- Lab notebook
- Clear plastic bottles (e.g., soda bottles) with caps
- Household substances, condiments, foods with heavy odors
- Masking tape
- Clear plastic packing tape
- Water
- Funnel
- *Drosophila* morgue (beaker filled with salad oil or alcohol)
- Light
- Safety glasses
- Timers
- Spatula or stick

Optional Materials (not provided):

- Alka Seltzer® tablets
- Fine paintbrushes
- Cold packs or crushed ice
- Aluminum foil
- Dissecting microscopes
- Other materials as determined by students' experiment design

* It is recommended that you **redeem your coupon for live/perishable materials as soon as possible** and specify your preferred delivery date. Generally, for timely delivery, at least two weeks advance notice is preferred.

Standards Alignment

This lab activity is aligned with the 2012 AP Biology Curriculum (registered trademark of the College Board). Listed below are the aligned Content Areas (Big Ideas and Enduring Understandings), the Learning Objectives, and the Science Practices of the lab as described in AP Biology Investigative Labs: An Inquiry-Based Approach (2012). This is a publication of the College Board that can be found at: http://media.collegeboard.com/digitalServices/pdf/ap/APBioTeacherLabManual2012_2ndPrt_1kd.pdf

Big Ideas	2	Biological systems utilize energy and molecular building blocks to grow, to reproduce, and to maintain homeostasis.
	4	Biological systems interact, and these interactions possess complex properties.
Enduring Understandings	2.D.1	All biological systems from cells and organisms to populations, communities, and ecosystems are affected by complex biotic and abiotic interactions involving exchange of matter and free energy.
	2.E.3	Timing and coordination of behavior are regulated by various mechanisms and are important in natural selection.
	4.A.6	Interactions among living systems and with their environment result in the movement of matter and energy.
	4.B.4	Distribution of local and global ecosystems changes over time.
Learning Objectives	2.22	The student is able to refine scientific models and questions about the effect of complex biotic and abiotic interactions on all biological systems, from cells and organisms to populations, communities, and ecosystems.
	2.23	The student is able to design a plan for collecting data to show that all biological systems (cells, organisms, populations, communities, and ecosystems) are affected by complex biotic and abiotic interactions.
	2.24	The student is able to analyze data to identify possible patterns and relationships between a biotic or an abiotic factor and a biological system (cells, organisms, populations, communities, or ecosystems).
	2.38	The student is able to analyze data to support the claim that responses to information and communication of information affect natural selection.
	2.39	The student is able to justify scientific claims, using evidence, to describe how timing and coordination of behavioral events in organisms are regulated by several mechanisms.
	2.40	The student is able to connect concepts in and across domain(s) to predict how environmental factors affect response to information and change behavior.
	4.14	The student is able to apply mathematical routines to quantities that describe interactions among living systems and their environment which result in the movement of matter and energy.
	4.15	The student is able to use visual representations to analyze situations or solve problems qualitatively to illustrate how interactions among living systems and with their environment result in the movement of matter and energy.
	4.16	The student is able to predict the effects of a change of matter or energy availability on communities.
	4.19	The student is able to use data analysis to refine observations and measurements regarding the effect of population interactions on patterns of species distribution and development.

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Standards *continued*

Science Practices	1.3	The student can refine representations and models of natural or man-made phenomena and systems in the domain.
	1.4	The student can use representations and models to analyze situations or solve problems qualitatively and quantitatively.
	2.2	The student can apply mathematical routines to quantities that describe natural phenomena.
	3.2	The student can refine scientific questions.
	4.3	The student can collect data to answer a particular scientific question.
	5.1	The student can analyze data to identify patterns or relationships.
	5.2	The student can refine observations and measurements based on data analysis.
	6.1	The student can justify claims with evidence.
	6.4	The student can make claims and predictions about natural phenomena based on scientific theories and models.
	7.2	The student can connect concepts in and across domain(s) to generalize or extrapolate in and/or across enduring understandings and/or big ideas.

Time Requirements

	TIME FRAME	TEACHER TASK(S)	STUDENT TASK(S)
Pre-lab Prep	At least 2 weeks prior to lab.	Redeem coupon for live materials. See page 11 for more pre-lab prep.	Read background and complete pre-lab questions. Read lab and bring test variables for Activity 2. (1 day before)
Activity 1	Total of 30 minutes: 10 minutes set up 10 minutes observation and recording 10 minutes analysis	Option: May conduct as two experiments – 30 minutes for control (no stimulus in tray) and 30 minutes for experiment with stimulus in tray	Test vinegar as stimulus.
Activity 2	Total of 20 minutes: 5 minutes set up 10 minutes observation and recording 5 minutes analysis		Test variables of student's choice.
Activity 3	1 week after arrival of flies (while flies are still in larval stage)		Test vinegar as stimulus.
Activity 4	Total depends on student/teacher scheduling and parameters of experiment		Design taxis experiment.

Safety Precautions



General Safety:

- The teacher should 1) be familiar with safety practices and regulations in his/her school (district and state) and 2) know what needs to be treated as hazardous waste and how to properly dispose of non-hazardous chemicals or biological material.
- Consider establishing a **safety contract** that students and their parents must read and sign. This is a good way to identify students with allergies (e.g., latex) so that you (and they) will be reminded of specific lab materials that may pose risks to individuals.
- Students should know where all **emergency equipment** (safety shower, eyewash station, fire extinguisher, fire blanket, first aid kit etc.) is located.
- Require students to remove all dangling jewelry and tie back long hair before they begin.
- Remind students to **read all instructions, SDSs and live care sheets** before starting the lab activities, and to ask questions about safety and safe laboratory procedures. The SDSs and the most updated versions of live care sheets can be found at www.wardsci.com. SDSs can also usually be found on each chemical manufacturer's website.
- In student directed investigations, make sure that collecting safety information (like SDSs) is part of the experiment procedure.
- As general laboratory practice, it is recommended that students **wear proper protective equipment**, such as gloves, safety goggles, and a lab apron.

At the End of the Lab:

- Before disposing of any chemicals in the trash or down the drain, review local regulations or consult with local authorities.
- All laboratory bench tops should be wiped down with a 10% bleach solution or disinfectant to ensure cleanliness.
- Remind students to wash their hands thoroughly with soap and water before leaving the laboratory.