

ShoeBox Investigation: Effect of Changes to the Mealworm Environment

AP Biology

Introduction

Ethology is the study of animal behavior. Behavior is an animal's response to sensory input and falls into two basic categories: **learned** and **innate** (inherited).

Orientation behaviors place the animal in its most favorable environment. In **taxis** the animal moves toward or away from a stimulus. Taxis is often exhibited when the stimulus is light, heat, moisture, sound or chemicals. **Kinesis** is a movement that is random and does not result in orientation with respect to a stimulus. If an organism responds to bright light by moving away, that is taxis. If an animal responds to bright light by moving in all directions, this is considered to be kinesis.



In the first part of this activity, you will learn to construct an ethogram, which is a data collecting tool used to gather information about typical behaviors an organism might exhibit. Next, you will make some general observations about the organism we will be working with—wingless fruit flies. You will then make notes about the mealworm's usual behaviors when it is placed into a choice chamber and record your observations using the ethogram you construct. A choice chamber is a chamber divided into two sections, with two different environments on either side.

For the second part of the experiment, you and your partner will design an experiment in which you choose one environmental variable to change in order to observe how the behavior of the pillbug changes once you have changed the environment.

Investigating the Effect of Changes to the Mealworm Environment

Part A: you will make general observations about the mealworm's behavior and use an ethogram to help you record qualitative data about their behavior.

Part B: You will predict which side of a choice chamber mealworm will move toward: light or dark. Then you will manipulate the mealworm's environment by exposing them to a light or dark environment in a choice chamber.

Part C: You will conduct an investigation about mealworm behavior based on your own experimental design which has been approved by your instructor.

SAFETY CONSIDERATION:

You will be working with **live** invertebrate organisms in this activity. It is important that you take precautions not to intentionally hurt or kill the organisms you are working with. Be sure to wash your hands after you complete the activity.

MATERIALS NEEDED:

- Mealworms
- Spoons
- Aluminum Foil
- Light Source
- Choice Chambers
- Small Paint Brush
- Timer
- Breakfast Flake Cereal
 - Corn
 - Brand
 - Sugar
 - Chocolate

Part A Procedure: General Observations

1. **Before beginning**, read through the directions to determine what sort of data chart you should create to gather data with.
2. Place **20 mealworms** in the choice chamber provided for you.
3. Observe the organisms for **15 full minutes**. A bit of patience is required here. It is also important that you focus and pay close attention to the behavior of your mealworms—you don't want to miss anything!
4. Make careful and thorough notes on their general appearance, movements about the tray, and interactions with each other. **Make sure your observation of their behavior occurs each minute during this 15 minute period.** Notice if they appear to prefer one area to another, if they keep moving, settle down or move sporadically. Note any behaviors that involve 2 or more organisms. Try to make your observations *without* disturbing the organisms in any way. **Do not prod or poke or shake the tray, make loud sounds, or subject them to bright lights. You want to observe their behavior, not influence it or interfere with it.**
5. When you are done making your general observations, then move on to the second part of the experiment.

Part B Procedure: Changing the Environment—Light and Dark

1. **Before beginning**, read through the directions to determine what sort of data chart you should create to gather data with.
2. **Before** beginning the experiment, make a prediction about which side of a choice chamber you think the mealworms will move toward: the light or the dark side. Be sure you **predict how many** will move toward each side in **15 minutes**.
3. Wrap one end of the choice chamber with aluminum foil. Make sure the light side of the choice chamber is exposed to maximum of light. Use a lamp or other light source to ensure enough light is being used.
4. Place **20 mealworms** into one of the light sections and begin timing your **15 minute** observation period. **Be sure you observe the organisms for 15 full minutes.** Record the number of mealworms on either side of the choice chamber each minute for **15 minutes**.
5. After you have completed your observations, carefully return the organisms to the stock culture, taking care not to harm or damage any of them. Clean out your choice chambers and return them to the supply area.

Part C Procedure: Flake Connoisseurs—Student Designed Inquiry

1. Choose a type or types of breakfast flakes to test and design your experiment.
2. **Design** your experiment procedure and get it approved from your teacher.
3. Place **20 mealworms** into one of the sections that contains no breakfast flakes and begin timing your **15 minute** observation period. **Be sure you observe the organisms for 15 full minutes.** Record the number of mealworms on either side of the choice chamber each minute for **15 minutes**.
4. After you have completed your observations, carefully return the organisms to the stock culture, taking care not to harm or damage any of them. Clean out your choice chambers and return them to the supply area.

DELIVERABLE:

All parts of the Deliverable will be turned in **via google classroom** by **you and your partner**. Make sure to be thorough.

Part A: You will turn in your data chart, and an ethogram. Make sure you construct appropriate graphs for the data you collected.

Part B: You will turn in your data charts and observations. You will also conduct a chi-square test to determine if your predicted numbers of mealworm's "fits" your observed number of mealworms on each side of the choice chamber.

Part C: You will construct an Electronic Mini-Poster for this section. Refer to the Mini-Poster Guidelines and Grading Rubric for guidelines that should be followed when writing this up.