

Name: _____

AP Biology Lab 12: Introduction to the Scientific Method and Animal Behavior

Overview

In this lab you will:

- Observe an organism and design an experiment to investigate their responses to environmental variables.

Objectives

After doing this lab you should be able to:

- Design a controlled experiment.
- Understand the concept of distribution of organisms in a resource gradient
- Describe the difference between kinesis and taxis.
- Describe some aspects of animal behavior, such as orientation behavior, agonistic behavior, dominance display, or mating behavior
- Understand the adaptiveness of the behaviors you studied.

INTRODUCTION

Part 1: Animal Behavior

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 random movements in all directions, that is kinesis.

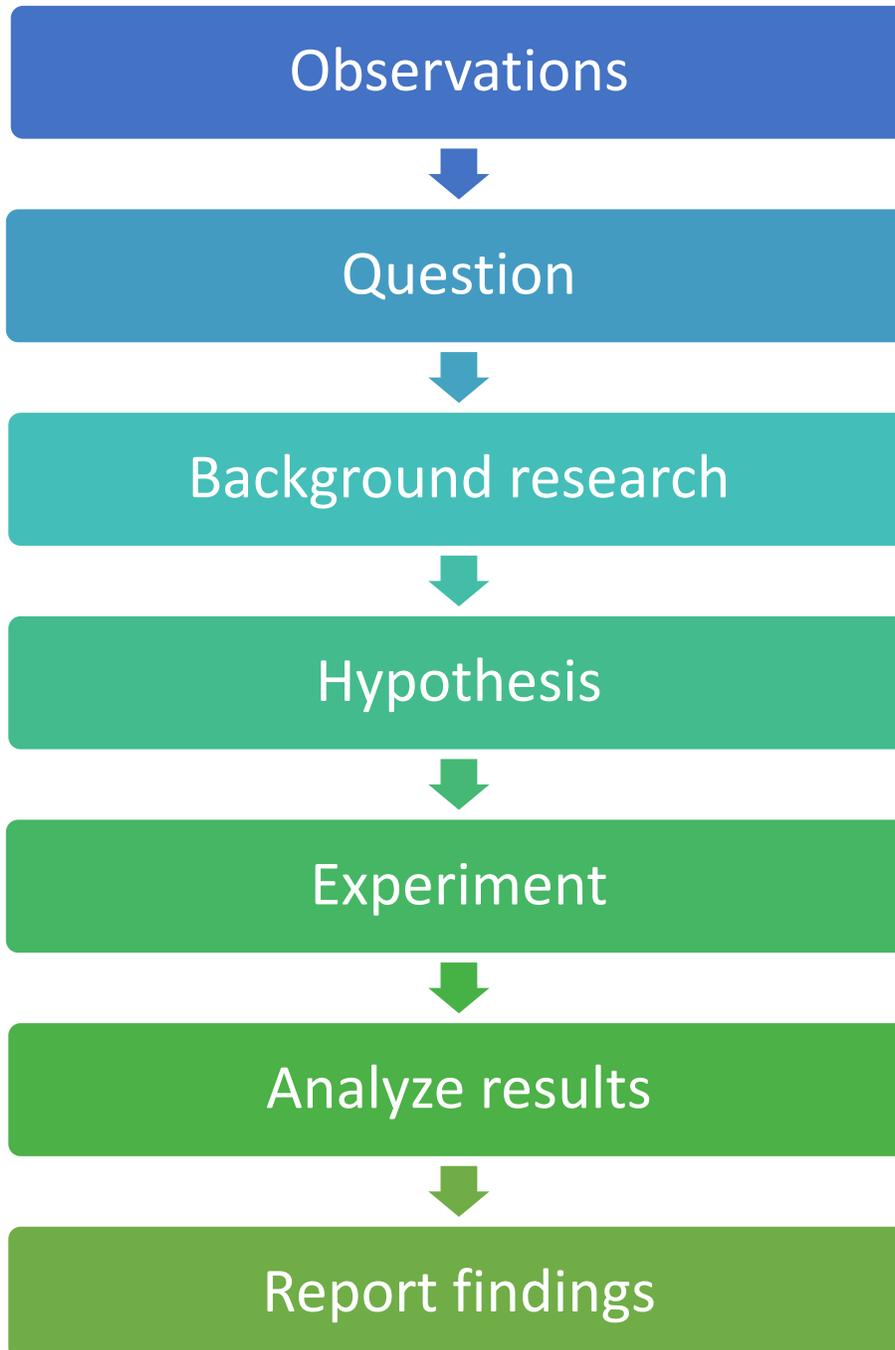
Agonistic behavior is exhibited when animals respond to each other by aggressive or submissive responses. Often the agonistic behavior is simply a display that makes the organism look big or threatening. It is sometimes studied in the laboratory with *Bettas* (Siamese Fighting Fish). **Mating behaviors** may involve a complex series of activities that facilitate finding, courting, and mating with a member of the same species.

Part 2: The Scientific Method

Experimental Design

a. All of the information in your science textbook is the result of critical thinking backed up by results from scientific experiments. Scientific thinking follows the following process:

Scientific Process



b. In order for experiments to be valuable to the scientific community, they must adhere to accepted guidelines for experimental design, including the following aspects.

Experimental Design

Variables

- Independent
 - What is manipulated
- Dependent
 - What is measured
- Controlled
 - What is kept constant

Control group

- A group that receives no treatment in the experiment so that the results can be compared to something.

Experimental groups

- Also called "treatments".
- The groups that undergo manipulated conditions.

Accuracy

- Are the experimental results close to the known values?
- Achieved by taking careful measurements and adhering to procedure

Reliability

- Are the results precise?
- Can the experiment be duplicated with the same results over and over again?
- Achieved by:
 - Duplicating the experiment several times and averaging the results
 - Using large sample sizes and averaging the results

Sources of Error

- Events that happened during the experiment that may have skewed the results.

Example: The effect of sunlight on gardenia flowers

Observation: Your father hangs gardenias from the front patio roof, which enjoys a few hours of morning sunshine. Despite the fact that he waters them every day, they are drooping within a week and the flowers have completely fallen off. You tell him that they need more sunlight, but he does not believe you.

Question: How much sunlight do gardenias require?

Background research: A trip to the local gardening center teaches you that gardenias are supposed to have “full light”, which means more than 6 hours of sunlight per day.

Hypothesis: Gardenias placed in full sunlight on the front porch will sprout more flowers than gardenias hung from the patio roof in partial sunlight.

Experiment: You hang 3 gardenias from patio roof, place 3 gardenias on the porch steps, and 3 gardenias inside the house. The patio roof receives 2 hours of sunlight each day while the porch steps receive 8 hours of sunlight each day and the inside plants receive no direct sunlight. They are planted in identical pots with identical fertilizer. You give them two cups of water per day. At the end of each day, you count how many flowers are present on each plant. You continue this for 4 weeks.

Independent variable: Amount of sunlight

Dependent variable: # of flowers

Controlled variables: pot, fertilizer, amount of water

Control group: gardenias placed inside the house

Experimental groups: gardenias hung from patio roof and placed on the porch steps

of treatments: 2 (patio roof and porch steps)

Sample size: 3 (3 gardenias per location)

Analyze results: You tabulate your results in a bar graph, which shows that the gardenias on the porch steps grew the most flowers. Since all other conditions except sunlight were the same for all flowers, you conclude that gardenias require a lot of sunlight to produce healthy flowers.

How accuracy was achieved: You were precise in all your measurements and procedures.

How reliability was achieved: You used a sample size greater than one and averaged the results

Sources of error: You forgot to water the plants on two occasions: day 18 and day 24. On day 13, there was a short rain shower that watered the gardenias on the porch steps but not the other locations.

Report findings: You explain the results to your father. He is so impressed that he buys you a new car.

Animal Behavior Introduction

Observations

In this activity you will be working with terrestrial isopods commonly known as "pillbugs", "sowbugs", or "roly-polys". These organisms are members of the Phylum Arthropoda, Class Crustacea, which also includes shrimp and crabs. Most members of this group respire through gills.

Working with your partners, make a list of observations about the organism that you will be working with.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

Animal Behavior Design an Experiment

Student-Designed Experiment to Investigate Pillbugs' Response to Temperature, pH, Background Color, Light, or Another Variable

Design the experiment in a Google Doc in one of your lab members AP Bio Shared folder. A template is attached

1. Select one of the variable factors listed above and develop a hypothesis concerning the pillbugs' response to the factor.

2. Use the material available in your classroom to design an experiment. Remember that heat is generated by lamps. Use the following questions to guide your experimental design.

- o How will the variables be controlled?
- o How will variables be measured?
- o How will variables be manipulated?
- o What equipment and supplies do I need?
- o Does my experimental design really do what it is supposed to do?
- o Will my experiment answer my question?
- o Have I identified all of the variables?
- o How many pill bugs will I use in the investigation?
- o How many times will I repeat the investigation?
- o Have I accounted for possible sources of error?
- o How might the pill bug behavior I am investigating affect the ability of pill bugs to survive in their natural environment?

a. State the objective of your experiment.

b. List the materials you will use.

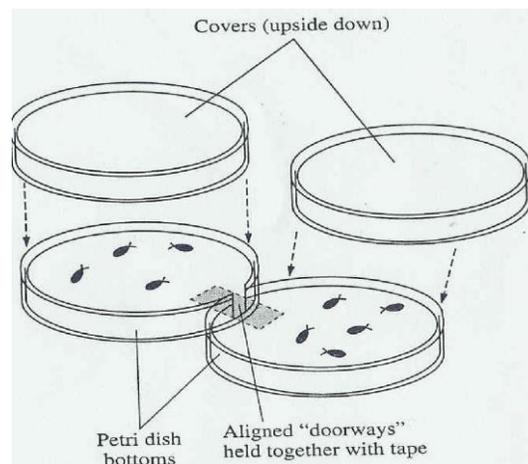
c. Outline your procedure in detail.

3. Decide what data you will collect.

4. Make any graphical representation of your data

- (Hint: Data Tables & Graphs) that visualize or interpret the data.

5. Run your experiment



6. Finish Post-Lab questions and write a conclusion based on your experimental results.

Post Lab Questions (Answer INDIVIDUALLY)

1. Explain what part(s) of a properly done scientific investigation were missing in your lab design. Why is this part(s) important and why is it left out of most lab experiences in high school?

2. What conclusions do you draw from your data? Explain the physiological reasons for the behavior observed in this activity.

3. How does your organism locate an appropriate environment (what structures/methods does it use)?

4. Is your organism's response to the variable tested kinesis or taxis? Explain.

5. What other investigations do your results from this lab lead you to do? What new questions are raised by the results of this lab? How could you test them?

Animal Behavior Experimental Design

Observation

Question

Hypothesis

Experiment

Summary of procedure:

Independent variable:

Dependent variable:

Controlled variables:

Control group:

Results

Summary of results:

How was accuracy achieved?

How was reliability achieved?

Sources of error (list at least 2):