**Which Way Did It Go?** An Investigation of Animal Behavior

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Part 1: Nature versus Nurture**

Whether you are watching an animal documentary on tv, playing with your dog outside or idly watching fish in an aquarium, you are observing animal behavior. Some behaviors may be puzzling, like the toads in the spring that start to chirp or the aggressive actions of a sea lion on a dock. The reasons for the behaviors may not always be clear and scientists studying behavior often wrestle with a fundamental question about the origins of the behavior. Behaviors fall into two broad categories:

**Learned Behavior**: Behavior that an animal is not born with, but one that develops through experience. Animals can be trained using positive and negative reinforcement to avoid or reinforce behaviors. For example, a dog that receives a treat for sitting will learn the sit command.

**Innate Behavior:** This behavior is something an animal is born with, they are sometimes referred to as instincts or intrinsic behavior. Questions arise about these behaviors because it may not always be clear what purpose they serve. Biologists also explore the genetics of behavior, making an assumption that the code for innate behaviors must be found within the DNA of the organism and passed from one generation to the next.

1. Suggest 2 types of learned behaviors and two innate behaviors that you have observed in animals (cats, dogs, whales, humans)



2. Why would it be assumed that innate behaviors were coded somewhere in DNA?

 3. Fruit flies display **geotaxis**, or a response to the earth's gravity. If the flies are within a vial and the vial is flipped upside down, the flies will move/crawl to the top of the vial. A researcher notices that a group of flies that had been exposed to radiation no longer exhibit geotaxis. How could you provide further evidence that this behavior is innate and not learned?

 4. Human behavior is difficult to study for ethical reasons. One famous experiment attempted to determine if a fear of snakes was an innate or learned behavior in humans. Suggest a way that this question could be answered.



Follow the link in the QR code ([or this hyperlink](https://www.sciencedaily.com/releases/2008/02/080227121840.htm)) to read about the real investigation. What does this experiment say about fear of snakes?

**Part 2: How (and Why) is Behavior Studied?**

**Ethology** is the study of animal behavior and is most often concerned with the innate behaviors. Biologists study animal behavior from two different points of view:

**Proximate questions** address the mechanisms that produce a behavior: the environmental stimuli that trigger a behavior and the genetic and physiological mechanisms that make it possible. For example, *how* does an animal carry out a behavior?

**Ultimate questions** address the evolutionary significance of a behavior: how a behavior increases the evolutionary fitness of the animal demonstrating it, helping it to survive and reproduce in its environment. For example, *why* does the animal show this behavior?

**What regulates behavior?**

**Homeostatic mechanisms** across phyla reflect both continuity due to common ancestry and change due to evolution. In plants and animals, defense mechanisms against disruptions of dynamic homeostasis have evolved. The timing and coordination of developmental, physiological, and behavior events are regulated, increasing fitness of individuals and long-term survival of populations.

Organisms use **feedback mechanisms** to regulate growth and reproduction and to maintain dynamic homeostasis. Organisms respond to changes in their internal and external environments through behavior and physiological mechanisms. In animals, these mechanisms include migration, sweating, shivering, or going into hibernation. Organisms use **negative feedback** mechanisms to maintain their internal environments by returning the changing condition back to its set point. Examples of negative feedback responses include temperature regulation in animals, and responses to drought in plants.

Orientation is a process by which animals position themselves with respect to spatial features of their environments. **Taxis** involves the turning of an animal's body relative to a stimulus - either toward or away, like the fruit flies that move in response to gravity. There are several types of taxis (geotaxis, phototaxis, chemotaxis).

Taxis can also be **negative** where the animal avoids the stimulus, or **positive**, where the animal moves toward the stimulus. **Kinesis** is a random movement of an animal in relation to a stimulus, like cockroaches scattering when the light is turned on.

5. Consider the fear of snakes that may (or may not) have been observed in humans. Is the question in the investigation a proximate or an ultimate question? Defend your choice.

6. Suggest an evolutionary reason that fruit flies exhibit geotaxis.

7. Brainstorm various types of taxis that can be observed in animals. Describe two that have not been previously mentioned and indicate if they are positive or negative.

8. Consider the following example: A researcher places a dead rotting mouse on one side of a testing chamber and then adds 10 beetles to each side of the chamber. The beetles can either choose to go in the direction of the rotting mouse or away from the rotting mouse. The researcher than collects data on the movements of the beetle, recording how many beetles were on which side of the chamber.

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| --- | --- |
|   | Number of Beetles Observed on Each Side |
| Time | Rotting Mouse | Empty |
| 0 minute (start) | 5 | 5 |
| 1 minute | 4 | 6 |
| 2 minutes | 6 | 4 |
| 3 minutes | 8 | 2 |
| 4 minutes | 9 | 1 |
| 5 minutes | 8 | 2 |

What equation could you use to in order to determine if they exhibit taxis? What would let you know that they did versus didn’t?

9. Propose an ultimate question for this investigation and a proximate question.