

Honors Biology – Unit 5 – Chapter 35  
"BEHAVIORAL ADAPTATIONS TO THE ENVIRONMENT"

1. stimulus vs. response
2. nature vs. nurture
3. fixed action pattern, innate behaviors
4. imprinting vs. learning
5. types of learning:
  - habituation
  - classical conditioning
  - operant conditioning
  - insight learning
6. proximate causes vs. ultimate causes
7. communication: source, signal recipient
8. 4 types of communication signals: visual, sound, chemical, electrical
9. foraging, cost-benefit analysis
10. other types of animal behavior:
  - migration
  - circadian rhythms
  - courtship
  - animal societies
  - aggression
  - dominance hierarchy
11. kinesis, taxes
12. polygamy vs. monogamy in nature

Honors Biology – Chapter 35 Word Roots

“BEHAVIORAL ADAPTATIONS TO THE ENVIRONMENT”

**agon-** = a contest (*agonistic behavior*: confrontational behavior involving a contest waged by threats, displays, or actual combat, which settles disputes over limited resources, such as food or mates)

**alter-** = other (*altruism*: behavior that reduces an individual’s fitness while increasing the fitness of another individual)

**kine-** = move (*kinesis*: a change in activity in response to a stimulus)

**mono-** = one; **-gamy** = reproduction (*monogamous*: a type of relationship in which one male mates with just one female)

**poly-** = many (*polygamous*: a type of relationship in which an individual of one sex mates with several of the other sex)

**socio-** = a companion (*sociobiology*: the study of the evolutionary basis of social behavior)

PROPERTY OF:

HONORS BIOLOGY – UNIT 5 – CHAPTER 35 NOTES

BEHAVIORAL ADAPTATIONS TO THE ENVIRONMENT

Elements of Behavior

- Behavior = the way an organism reacts to changes in its internal condition or external environment; usually performed when an animal reacts to a stimulus
- Stimulus = any type of signal that carries information and can be detected
- Response = a single, specific reaction to a stimulus
- EX: An alarm clock wakes you up.  
The sound of the alarm is the stimulus. The response is waking up.
- Types of stimuli: light, sound, smell, heat, touch, taste, sight, hearing
- EX: Dogs can respond to high frequency sounds that humans cannot hear (dog whistle).
- EX: Some birds can detect Earth's magnetic field, and use that information for migration.
- A response involves 3 parts of the body:
  1. sensory organ (eyes, tongue, ears, skin, etc. receive the stimulus)
  2. nervous system (brain and nerves coordinate the stimulus and response)
  3. muscles (produce movement that is typical of a response)
- Simple organisms have a simple nervous system, and only produce simple responses.
- More advanced organisms have a complex nervous system, and produce complex responses.
- Behaviors can be both inherited and learned.

Nature Versus Nurture

- Is our behavior determined by nature (genetics) or nurture (the environment)?
- LOVEBIRDS:  
Lovebirds build nests using either long strips of paper or short strips of paper. The Fischer's lovebirds tear off long strips of paper and carry them in their beak. The peach-faced lovebirds tear off short strips of paper and tuck them in their feathers. During the tucking process, they turn their head to the back. Scientists mated these 2 birds and created a "hybrid" lovebird. They tore off medium-sized strips of paper. They had difficulty carrying them in their beaks and tucking them in their feathers. After a long period of time, they learned to carry them in their beaks. However, they still turned to the back every time, just as if they were tucking the strips in their feathers.
- ARE THESE CARRYING BEHAVIORS CAUSED BY NATURE OR NURTURE?
- ARE THESE BEHAVIORS DETERMINED BY GENETICS OR BY THE ENVIRONMENT?
- DISCUSS THE EXAMPLE OF IDENTICAL TWINS RAISED IN DIFFERENT AREAS.

Innate Behaviors/Instincts

- These are behaviors that are built into an animal's nervous system and cannot be changed.
- These behaviors are genetic – passed on from the parents to the offspring.
- These behaviors are passed on according to Darwin's 5 steps of natural selection.
- These behaviors generally increase the fitness of an organism.
- EX: A baby instinctively knows to suckle for milk as soon as its born.
- EX: A spider instinctively knows how to build a web.
- EX: A newly hatched bird instinctively knows how to beg for food as soon as it hatched.

## Learned Behaviors

- Learned behaviors are also called acquired behaviors (you are not born with them).
- Just like with LaMarck's "acquired traits", you cannot genetically pass on learned behaviors.
- Learning is the way that animals change their behavior as a result of experience.
- Simple animals can only learn simple behaviors.
- More advanced animals are capable of learning much more complex behaviors.
- 4 types of learning: habituation, classical conditioning, operant conditioning, insight learning
- 1 type of learning combined with innate behavior: imprinting

## Habituation

- Habituation is when an animal decreases or stops its response to a repetitive stimulus that neither rewards nor harms the animal.
- Animals should not waste their time or energy responding to a neutral stimulus.
- neutral stimulus = a stimulus that does not help (reward) or hurt (harm) the animal
- EX: A worm is buried in the sand. As it starts to come out of its burrow (wormhole), it sees a shadow and goes back into the sand. After this occurs a few times, the worm starts to ignore the shadow. It has been habituated to the shadow. It has learned that the shadow is neither a predator (harm) nor a prey (reward).

## Classical Conditioning

- Classical conditioning is when an animal makes a mental connection between a stimulus and an event (reward or punishment).
- The animal learns to associate the stimulus with a response.
- EX: A dog attacks a skunk and gets sprayed with a substance that smells terrible. The dog does not attack the skunk again because it does not want to get sprayed. The dog has learned to associate a stimulus (attack the skunk) with a response (get sprayed).
- EX: A dog owner always puts the leash on the dog before taking it for a walk. Eventually, the dog starts jumping and gets excited when it sees the owner takes out the leash. The dog has learned to associate a stimulus (it sees the leash) with a response (it goes for a walk).
- EX: PAVLOV'S DOGS: A scientist (Ivan Pavlov, around 1900) rings a bell and gives a dog some food. The scientist does this over and over and over. Eventually, he rings the bell, but does not give the dog any food. The dog still drooled after hearing the bell, even though it did not receive anything. The dog has learned to associate a stimulus (it hears the bell) with a response (it gets food).

## Operant Conditioning

- Operant conditioning is basically a trial-and-error type of learning.
- The animal learns to associate a practiced behavior with a reward (or lack of a punishment).
- EX: A mouse is put into a maze with a piece of cheese at the end. It goes through the maze slowly at first because it hasn't learned how to get to the cheese. After some practice, it will complete the maze much faster because it has learned through trial-and-error. It has learned how to associate a behavior (completing a maze) with a reward (getting cheese).
- EX: SKINNER BOX: A scientist (B. F. Skinner, 1940's) built a box with a colored button or lever that delivers food to an animal when it is pressed. After the animal randomly pushes it a few times, it associates the button/lever with the food response. It is learned through trial-and-error. It has learned how to associate a behavior (pushing the button/lever) with a reward (getting the food).

### Insight Learning

- Insight learning is when an animal applies previous knowledge to a new situation in order to solve a new problem without using trial-and-error.
- Insight learning is common among humans and other primates.
- EX: You are given a new type of math problem on a test. You know some background knowledge and general ways of solving problems. You are able to use your previous knowledge to solve a new problem. You did not simply guess using trial-and-error.
- EX: A scientist hangs bananas from the ceiling and puts some boxes in the corner of the room. A hungry chimpanzee will take the boxes and stack them up in order to reach the bananas. It used its previous knowledge (how to climb and stack things) to solve a new problem (how to get the bananas).

### Imprinting

- Imprinting is a type of learning that occurs in the very beginning of an animal's life.
- Imprinting occurs during a specific period of time early in the animal's life, called a "sensitive period".
- Imprinting is a combination of innate (instinct) behaviors and acquired (learned) behaviors.
- EX: Newly hatched salmon imprint on the odor (smell) of the stream in which they hatch. Years later, they remember the odor of their home stream. They return there to reproduce.
- EX: Young sparrows (birds) are instinctively able to recognize their own species' song. In order to sing the complete song, it has to hear it sung by the adults. Part of this behavior is genetic (recognizing the song), and part of it is learned (singing the song).
- EX: Ducks, geese, and chicks will follow the first moving thing they see after hatching. They think that it is their mother. A scientist (Konrad Lorenz, 1903-1989) stayed in the water as geese eggs hatched. The baby goslings followed him around, thinking that he was their mother.

### Communication

- Communication is the passing of information from one animal to another.
- Communication requires 3 components:
  1. source = the animal that creates the signal
  2. signal = the information that is passed from one animal to another
  3. recipient = the animal that receives the signal
- There are 4 types of signals: visual, sound, chemical, electrical.
- visual signals = signals that can be seen by others
  - EX: A cuttlefish can change the colors, texture, and patterns of its skin.
  - EX: The honeybee performs the waggle dance to communicate the location of food.
- sound signals = signals that can be heard by others
  - EX: Dolphins whistle when they are in the deep parts of the ocean that are dark.
- chemical signals = signals that are passed on in the form of PHEROMONES
- pheromone = a chemical that is produced by one animal and sensed by another
  - EX: A dog urinates on a fire hydrant to "mark its territory".
- electrical signals = signals that are passed on in the form of electrical currents
  - EX: Eels send out electric pulses that help it find prey, kill prey, and find mates.

## Other Types of Behavior

1. Migration
  - the periodic movement of an animal from one place to another
  - EX: Birds fly south for the winter.
  - EX: Every year, between December and June, green sea turtles migrate about 1200 miles from the coast of Brazil to Ascension Island, where it mates
2. Circadian Rhythms
  - a behavioral cycle that occurs in a daily pattern
  - EX: You sleep at night and are awake during the day.
3. Courtship
  - a behavior in which an animal sends out stimuli (visual, sound, chemical, or electrical signals) in order to attract a member of the opposite sex.
  - EX: Fireflies flash a distinct series of light signals in order to attract a mate.
  - EX: Frogs and toads produce sounds or songs in order to attract a mate.
  - EX: The peahen mates with the peacock with the most beautiful feathers.
4. Animal Societies
  - a group of related animals of the same species that interact closely and often cooperate with each other
  - Closely related animals typically share most of each other's genes. It is in their best interest to help each other so that their genes can be passed on to their offspring. (This is an example of Darwin's fitness.)
  - EX: Zebras group together while grazing.
  - EX: Primates group together and tend to live in societies.
5. Aggression
  - a threatening behavior that one animal uses to gain control over another
  - EX: Before a pride of lions settles down to eat, individuals may snarl or growl at each other. The most aggressive lion eats first, and the least aggressive lions eat last.
  - EX: A female animal will be aggressive to a predator that attacks her offspring.
6. Dominance Hierarchy
  - a social organization in which certain animals control the resources of the group
  - formed when groups of individuals of the same species share a territory
  - the dominant animal is "in charge" of the group
  - EX: Chickens have a pecking order. The top chicken can "peck" any other chicken. The 2<sup>nd</sup> chicken can "peck" any chicken except for the top chicken. The bottom chicken can get pecked by all other chickens, but cannot peck any. The pecking order determines things such as which chicken gets to eat first.

## Animal Movement and Activity

1. taxis = movement toward or away from a stimulus
  - EX: insects that move toward a light (positive phototaxis)
  - EX: insects that move away from a light (negative phototaxis)
2. kinesis = an increase or decrease of an activity as a result of a stimulus
  - Animals move faster when they are in an uncomfortable situation (to try to get away).
  - Animals slow down when they are in a comfortable situation (no reason to move away).
  - EX: A reptile slows down in the presence of the sun. It doesn't move away because it wants to be there. (negative photokinesis)
  - EX: Mealworms move quickly in the presence of sunlight (positive photokinesis)