Behavior
The way an organism responds to stimuli in its environment
Patterns of behavior may be simple or complex

Explanations of Behavior
*Proximate causation* - how behavior works/happens, internal state provides physiological basis,
study by measuring physiological events - nervous activity, hormone levels
Example: Male songbird sings during mating season - why?
Due to level of sex hormone, testosterone
Binds to receptors in brain, triggers production of song

*Ultimate causation* - explains why a behavior evolved - the evolutionary advantages of exhibiting the behavior
study by measuring influence on survival or reproduction
Example: females in mating condition attracted by singing - male birds that sing have more offspring than those that don’t
Influences that shape behavior

**Nature**: Instinct and genes determine behavior

**Nurture**: Experience and learning influence behavior

Two extremes are not mutually exclusive, but often work together to influence behavior

Subfields of Behavioral Studies:
Ethology, Comparative Psychology, Behavioral Ecology
Ethology
Study of the natural history of behavior
earliest field of behavioral studies: explained stereotyped behavior
Much behavior is instinctive or innate, due to natural selection
Appears in same form in different individuals of a species
pre-programmed neural circuits from genetic blueprints
Example: Goose returns egg to nest in a fixed behavior pattern
completes behavior even if egg is removed during retrieval
Sign stimulus (key stimulus)- egg out of nest - triggers
retrieval behavior
The sign leads to an Innate releasing mechanism-
Provides neural instructions for motor program
Fixed action pattern: Uniform program for behavior
Behavioral Genetics - Examining the Genetic Basis for Behavior

Example: Tryon's rat maze breeding experiments chose parents that were quicker or slower learners shows: ability to learn is genetically determined to some degree
Example: Hybrid love-bird nesting experiments
Two species differ in carrying materials used to build nest

*A. personata* holds materials in beak
*A. roseicollis* tucks materials under flank feathers

Hybrids carry materials in intermediate manner, shift between two locations - behaviors can be programmed in genes

Similar hybrid intermediate behaviors in courtship songs of crickets, tree frogs
Comparative Psychology
Focus on learning - early work was mostly on laboratory rats
Identified how animals learn - how experience modifies behavior

Nonassociative learning
- No connection formed between stimulus and response
  Habituation - learning to not respond to a stimulus
  Decrease in response with repeated stimulation
  Stimulus without reinforcement
    Initially evokes strong response,
    magnitude declines with repeated exposure
  Example: Bird response to falling objects

Sensitization - learning to respond a stimulus
  increased response with subsequent stimulation
**Associative learning**

Behavior modified or conditioned through association of two stimuli or a stimulus and a response

More complex than habituation or sensitization types - classical conditioning, operant conditioning

**Classical conditioning** = “Pavlovian” conditioning

Repeated presentation of stimulus in conjunction with another stimulus that evokes a response causes formation of association between them

Example: Pavlov's dog salivation experiments

Bell ringing every time a dog is presented with food.

Presentation of food normally evokes salivation

Bell ringing with feeding results in association of bell ringing and food

Eventually bell ringing evokes salivation even in absence of food
Operant conditioning
Reward or punishment follows desired behavioral response
Association must be made for reinforcing stimulus (reward/punishment) to occur
Example: Skinner's rat experiments
Rats learned to press a lever (behavioral response) to obtain food (reward)
Trial-and-error often leads to operant conditioning

Some animals develop conditioned habits that may not relate to reward due to chance associations between behavior and reward
**Instinct**

Some animals have innate predisposition to form certain associations

**Example: Pigeons**

- Learn to associate color and food, but not sound and food
- Learn to associate sound and danger, but not color and danger

Although they can learn some things readily, the type of learning they exhibit is limited genetically

Some animals can exhibit remarkable abilities for learning in limited cases

Usually associated with conditions of importance to survival or reproduction

Due to neural anatomy and physiology specialized for learning specific associations
Parent Offspring Interactions

Imprinting - social attachments formed during maturation

Filial imprinting - between parents and offspring

Occurs during sensitive phase or critical period after birth

Young birds follow any moving figure within hours of hatching, bond forms

Example: Lorenz imprinting with geese
In mammals, maternal interaction is required for normal development and social behavior in offspring.

- Harlow's monkey baby with surrogate mother experiments
  - Orphaned baby monkeys form social attachments with cloth or wire mothers - cloth preferred because of tactile interaction

- Female rats lick pups after birth
  - Stimulation inhibits release of hormones that block growth
  - Licked pups have more brain receptors for glucocorticoid hormones - results in greater tolerance for stress
Sexual imprinting
During rearing individual learns to direct sexual behavior to parental species
Cross-fostering studies - young raised by another species
  Recognizes foster species as its own
  When sexually mature, will attempt to mate with foster species
Interaction Between Instinct and Learning

Sometimes behavior is completely programmed - e.g. Cuckoo songs and mating behavior.

In other cases some components of behavior are innate but modified by social interactions e.g. Song sparrows. Mature males have species-specific song - have innate tendency to sing but learn to sing their species song if exposed when young. When exposed to songs of their own species and a different species, they learn their own.
**Behavioral Rhythms** - periodic cycles of behavior

**Circadian** - behaviors repeated with about a 24 hour cycle

**Circannual** - behaviors repeated on an annual cycle

Other behaviors keyed to tidal, lunar, and other external cycles

**Biological Clock** - an internal time-keeper that governs cycling of behavior

- many behaviors are repeated with a regular cycle even when deprived of external cues
- but they drift from the external cycle
- clock cycle can be reset by exposure to external cue

For circadian rhythms the most common clue is light

The biological clock for humans is found in a specific area of the brain - the superchiasmatic nucleus (SCN) of the hypothalamus connected to the optic nerve

controls the secretion of melatonin (sleep hormone) by the pineal gland (third eye)
Animal Communication

Courtship - events that lead to mating often follow a set sequence of behavioral exchanges before mating can take place
“stimulus-response chain”
e.g. Sticklebacks - head-up display by female, followed by zigzag dance by male, proceeds to nest, female enters, male nips female’s tail, eggs are laid, male enters nest and fertilizes eggs

“Releasers” - behavior cues that elicit specific behavior - anything that looks swollen will cause male to do zigzag dance
anything red is attacked by male
Pheromones - chemical communication
egg attracts sperm with chemicals
e.g. Silk moths - produce sex pheromone bombykol
    Male antennae have specific sensory receptors

Acoustic communication
Songs produced by many species to attract mates

Communication of specific cues ensures that mates occur between members of the same species - mating between individuals of different species often produces inviable or infertile offspring
It is usually the female that discriminates cues
Social Communication - generally helps to ensure survival or reproduction of members of groups of related individuals. Mammal groups often have guards that give alarm calls to warn of predators. Social insects release alarm pheromones that trigger attack behavior. Ants deposit trail pheromone between food and nest.
Honey bees exhibit complex dance language

Scouts search for food and return to hive
Dance in the dark on vertical surface of honeycomb -
vertical dance indicates the food can be found by flying toward the sun
20° off vertical communicates that food can be found by flying 20° to the right of the direction of the sun
Distance to food is communicated by speed and vigor of dance
vigorous dance indicates that food is nearby
Orientation requires tracking stimuli in the environment.

*Taxis* - movement towards or away from stimulus.
- Positive phototaxis, moving toward light.
- Negative phototaxis, move away from light.

*Kinesis* - changes in activity with change in stimulus intensity.
- Positive photokinesis - greater activity in the light.
- Pillbugs move more and turn less often in light.
- In dark they move less and turn more often.
Animal Awareness and Cognition

Some animals appear to have cognitive abilities

- Some birds learn to remove milk bottle foil caps to drink milk
- Macaques learn to wash sand from potatoes and grain
- Chimpanzees probe for termites with twigs - tool use
- Vervet monkeys identify predators with vocalizations
Some animals give false information to manipulate others
Deception may occur in baboons and chimpanzees

Clear examples of complex problem solving abilities in animals: