



- *Chapter 51*
Behavioral Biology



Essential Knowledge

- 2.C.2 – Organisms respond to changes in their external environments
- 2.E.2 – Timing and coordination of physiological events are regulated by multiple mechanisms
- 2.E.3 – Timing and coordination of behavior are regulated by various mechanisms and are important in natural selection
- 3.D.1 – Cell communication processes share common features that reflect a shared evolutionary relationship
- 3.E.1 – Individuals can act on information and communicate it to others

What is behavior?

- Behavior =
- Innate
 - _____ inherited,
“ _____”, automatic and consistent
- Learned
 - Ability to learn is inherited, but the behavior develops during animal's lifetime
 - Variable and flexible –

Why study behavior?

- Evolutionary perspective...
 - Part of _____
 - Acted upon by natural selection
 - Lead to greater fitness?
 - Lead to greater survival?
 - Lead to greater reproductive success?



What questions can we ask?

- Proximate causes
 - Physiological & genetic mechanisms of behavior
 - _____ and _____ questions



Male songbird

- What triggers singing?
- How does he sing?
- Ultimately leads to, WHY does he sing?

What questions can we ask?

- Ultimate causes
 - Evolutionary significance of behavior
 - How does behavior contribute to survival and reproduction – adaptive value
 - _____ questions

Courtship behaviors in Sandhill Cranes:

- How does day length influence breeding?
- Why do cranes breed in spring?



Ethology

Pioneers in the

- Karl von Frisch – waggle dance communication
- Nikolaas Tinbergen – fixed action pattern and supernormal stimulus
- Konrad Lorenz - imprinting

What determines behavior?

- Genetics
- Developmental processes
- Physiological mechanisms
- Shaped by natural selection
- Social concerns

Behaviors and Genetic Determinants

- Breeding experiments can reveal whether a

is inherited
- Studying mutants can reveal the role of specific genes
- Knockout experiments in mice: some mice lack a receptor for pheromones and are unable to distinguish males from females
 - What implications does that have?

Evolutionary perspective

- Adaptive advantage?
 - Innate behaviors
 - _____, fixed, “built-in”, no learning curve
 - Despite different environments, all individuals exhibit the behavior
 - Ex: early survival, reproduction, kinesis, taxis
 - Learned behaviors
 - _____
 - Flexible with a complex and changing environment

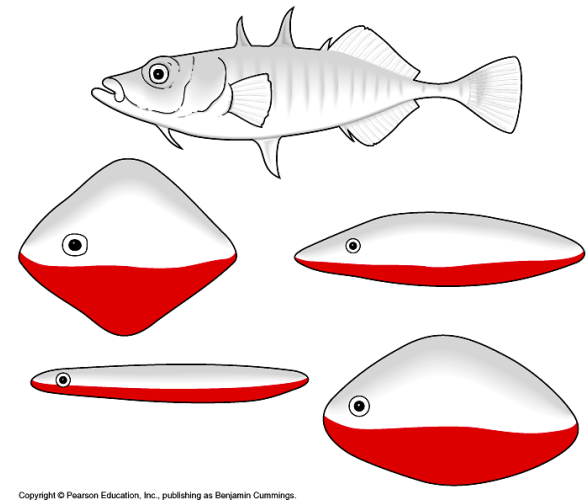
Developmental Processes

Shape Behavior

- Development and expression of behavior can be controlled by _____ (small chemical messengers in the body)
- Some behaviors can be acquired only at certain times

Innate Behaviors

- Fixed action patterns (FAP)



- Sign stimulus (releasers)
- Ex: 3-spined stickleback (Tinbergen '73 Nobel), egg rolling in geese, gull chicks respond to red dot on their parent's bills to get food

Do humans have Fixed Action Patterns?

- The _____

Supernormal Stimulus

- Responding _____ to a
-

- Ex: larger egg of a different species given to oyster catcher and bird will abandon their eggs to care for the larger
- Does lipstick create a supernormal stimulus in humans?

Innate: Directed movements

- Taxis



- Automatic movement toward or away from a stimulus
 - Ex: Fish orienting themselves upstream toward the current

- Kinesis

- Change in _____
in response to a stimulus
 - Ex: Change in humidity causes sow bugs to move when dry and rest when humid

Complex Innate Behaviors

- Migration
 - Complex behavior seen in a wide variety of animals
 - Navigation might be dictated by

sun, and stars
 - “Migratory restlessness” seen in birds bred and raised in captivity

Innate and Learning: Imprinting

- Learning to form

at a specific

- Both learning and innate components
- Ex: greylag geese and Konrad Lorenz



Conservation

- Conservation biologists have taken advantage of imprinting by aiding the _____ the whooping crane
- Birds are taught a new migration route by following a person flying a crane wearing a crane suit
 - Acts as a surrogate parent

Critical Period

-
-
-
- Some behavior must be learned during a receptive time period
 - Lorenz 73' Nobel
 - Bird songs learning involves genetics, imprinting, and hormonal control
 - If a bird is deafened before starting to sing, it will not the develop species-specific song

Imprinting or critical period in humans?

Physiological Mechanisms Underlie Behavior

- Biological rhythms coordinate behavior with environmental cycles
- Animals must find their way around their environment
- Animals use multiple modalities to communicate

Learned behavior: Spatial

- Establishment of a _____ that reflects the environment's _____ (piloting)
 - Ex: Tinbergen digger wasps 1932, gray whales finding their way from Mexico to the Bering Sea
- Homing – ability to return to a _____ from long distances
 - Ex: Female sea turtles return to shore they were hatched from , pigeons navigate by Earth's magnetic field

Circadian Rhythms

- Circadian rhythms – _____

- If mammals are kept in constant conditions, its circadian clock will run according to its natural period (_____)
 - Brain controls hormones that regulate night and dark cycle
- Circadian rhythms were restored experimentally with transplanted neural tissue, and recipients no rhythms of the donor tissue

Learned behavior

- Associative learning

- Learning to associate a _____ with a _____

- Operant conditioning (_____)

- Associate behavior with reward or punishment

- Classical conditioning

- Associate a neural stimulus with a significant stimulus

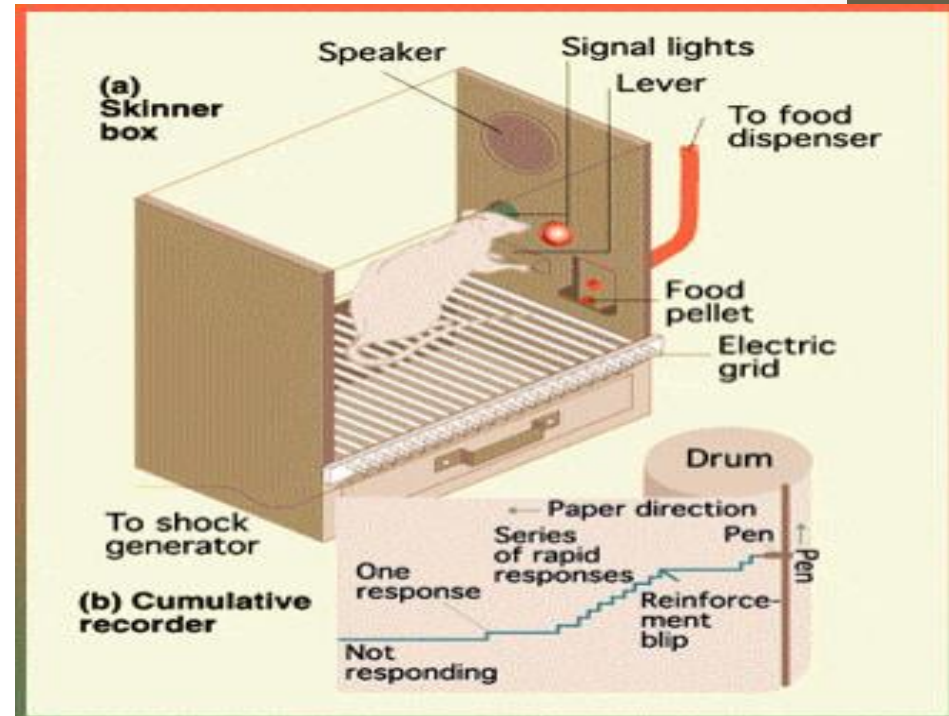
Operant conditioning

- Skinner box

- Mouse learns to

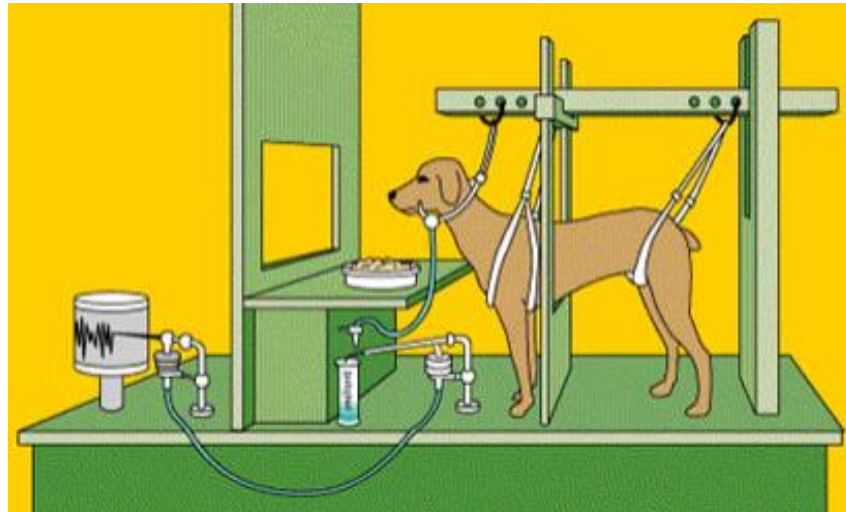
(pressing lever) with

(food pellet)



Classical conditioning

- Ivan Pavlov's dogs
 - Connect _____
(salivating at sight of food) to associated
_____ (ringing bell)



Learning: Habituation

- ---

 - “cry-wolf” effect
 - Decrease in response to repeated occurrences of stimulus
 - Enables animals to

- ---

 - Ex: Falling leaves not triggering fear response in baby birds

Learning: Problem-solving

- Cognition = _____
_____ represented by
awareness, reasoning, recollection, and
judgment
- Do other animals reason?

Behavior is Shaped by Natural Selection

- ---
- Energetic cost – expending energy to do the behavior
- Risk cost – chance of being injured or killed to perform the behavior
- Opportunity cost – benefit forfeited by not performing the behavior

Social behaviors

- Interactions between individuals
 - Develop as evolutionary adaptations
 - Communication / language
 - Agonistic behaviors
 - Dominance hierarchy
 - Cooperation
 - Altruistic behavior

Language

- Honeybee communication
 - Waggle dance: behavior that communicates the _____ and _____ of a food source
 - Foraging = _____
 - Oyster catchers (shore bird) teach young for hours how to open an oyster by opening and closing the same oyster
- Communication by song
 - Bird songs – species identification, mating rituals
 - Mixed learned and innate
 - Insect songs – mating rituals and song
 - Innate, genetically controlled

Social behaviors

- Agonistic behavior

- Contest behavior determining _____

- Threatening and submissive rituals
 - Symbolic, usually no harm done

- Territorial behavior

- An area an individual _____
_____ to exclude others

Social behaviors

- Dominance hierarchy

- Linear “pecking order”



within a group



- Mating systems:

- Promiscuous – no strong pair bonds
- Monogamous – one male/one female
- Polygamous – one with many
 - Polygyny – one male/many females
 - Polyandry – one female/many males

Social behavior

- Cooperation
 - Working together in

- Ex: pack of wolfs hunting in a pack, whales “herding” schools of fish

Social behavior

- Altruistic behavior (Altruism)
- Kin selection
- Ex: Mole rat and Belding's ground squirrel



