Chapter 51.

Animal Behavior

What is behavior & Why study it?

- **Behavior**
  - everything an animal does & how it does it
    - link between animal & its environment
  - innate = inherited or developmentally fixed
  - learned = develop during animal’s lifetime

- **Why study behavior?**
  - part of phenotype
  - acted upon by natural selection
    - lead to greater fitness?
    - greater reproductive success?
    - greater survival?
What questions do we ask?

- **Proximate causes**
  - immediate stimulus & mechanism
  - “how” questions

- **Ultimate causes**
  - evolutionary significance
  - how does behavior contribute to survival & reproduction
  - “why” questions

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**Ethology**

pioneers in the study of animal behavior

- Karl von Frisch
- Niko Tinbergen
- Konrad Lorenz

1941|1973
Types of behaviors

- **Innate behaviors**
  - automatic, developmentally fixed
    - despite different environments, all individuals exhibit the behavior
    - triggered by a stimulus

- **Learned behaviors**
  - modified by experience
    - variable
    - triggered by a stimulus

Innate behavior

- **Fixed action patterns (FAP)**
  - sequence of behaviors essentially unchangeable & usually conducted to completion once it is started
  - sign stimulus
    - releaser that triggers FAP

Male sticklebacks exhibit aggressive territoriality

Attack on red belly stimulus
Court on swollen belly stimulus
Fixed Action Pattern

**BEHAVIOR:** A male stickleback fish attacks other male sticklebacks that invade its nesting territory.

**PROXIMATE CAUSE:** The red belly of the intruding male acts as a signal that releases aggression in a male stickleback.

**ULTIMATE CAUSE:** By chasing away other male sticklebacks, a male increases the chance that an egg laid in his nesting territory will be fertilized by another male.

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Fixed Action Patterns (FAP)

**Digger wasp**

**Egg rolling in geese**

**Do humans exhibit Fixed Action Patterns?**

**The “eyebrow-flash”**
Directed movements

- **Kinesis**
  - simple change in activity or turning rate in response to a stimulus

- **Taxis**
  - more or less automatic, oriented movement toward (positive taxis) or away from (negative taxis) a stimulus

Migration

- **Complex behavior, but still under genetic control**
  - “migratory restlessness” exhibits Mendelian inheritance patterns

Monarch migration

migrating western sandpipers
Imprinting

- Learning at a specific critical time & forms social attachments to another
  - both learning & innate components

Konrad Lorenz was “mother” to these imprinted graylag goslings

Imprinting for conservation

Conservation biologists have taken advantage of imprinting by young whooping cranes as a means to teach the birds a migration route. A pilot wearing a crane suit in an ultralight plane acts as a surrogate parent.
Learned behavior

- Associative learning
  - learning to associate 1 feature of the environment (stimulus) with another
    - operant conditioning
      - trial & error learning
    - classical conditioning
      - stimulus & reward/punishment

Operant conditioning

- Skinner box
Classical conditioning

- Ivan Pavlov’s dogs
  - connect reflex behavior to conditioned stimulus

1. Before conditioning
   - Food
     - Unconditioned stimulus
     - Conditioned stimulus
   - Tuning fork
     - Neutral stimulus
     - Conditioned stimulus

2. Before conditioning
   - Salivation
     - Unconditioned response
     - Conditioned response

3. During conditioning
   - Tuning fork
     - Neutral response
     - Conditioned response
   - Food
     - Unconditioned response
     - Conditioned response

4. After conditioning
   - Tuning fork
     - Neutral response
     - Conditioned response
   - Salivation
     - Unconditioned response
     - Conditioned response

Habituation

- Loss of response to stimulus
  - “cry-wolf” effect
  - learn not to respond to repeated occurrences of stimulus
Cognition & problem-solving

- Connecting behavior with nervous system

Genetic & environmental interaction

(a) Learning in the sensitive period

(b) Open-ended learning
Social behaviors

- Contests for resources
  - develop as evolutionary adaptations
  - agonistic behaviors
    - threatening & submissive rituals
    - symbolic, usually no harm done

Social behaviors

- Dominance hierarchy
  - social ranking within a group
    - pecking order
Social behaviors

- Altruistic behavior
  - reduces individual fitness but increases fitness of recipient
  - kin selection

How can this be of adaptive value?

Social behaviors

- Territoriality
  - nesting in birds
Territoriality

Mating & parental behavior

- Genetic influences
  - changes in behavior in different stages of mating
    - pair bonding
    - competitor aggression

- Environmental influences
  - modifies behavior
    - quality of diet
    - social interactions
    - learning opportunities
Social interaction requires communication

- **Pheromones**
  - chemical signal that stimulates a response from other individuals
    - alarm pheromones
    - sex pheromones

(a) Minnows are widely dispersed in an aquarium before an alarm substance is introduced.
(b) Within seconds of the alarm substance being introduced, minnows aggregate near the bottom of the aquarium and reduce their movement.

Pheromones

Female mosquito use CO₂ concentrations to locate victims

Spider using moth sex pheromones, as allomones, to lure its prey

The female lion lures male by spreading sex pheromones, but also by posture & movements
Pheromones

Human pheromones?

"Hold it right there, young lady! Before you go out, you take off some of that makeup and wash off that gallon of pheromones!"

HA...! COME AND SEE WHAT HAPPENS IN THAT CROWDED MARKETPLACE DOWN THERE WHEN I SPRAY ABOUT A FEW HUMAN SEX-PHEROMONES...!"
**Honeybee communication**

- Honey bee dance to communicate location of food source
  - waggle dance

**Auditory communication**

- **Bird song**
  - species identification & mating ritual
  - mixed learned & innate
  - critical learning period

- **Insect song**
  - mating ritual & song
  - innate, genetically controlled

Red-winged blackbird
Social behaviors

- Cooperation

Pack of African dogs hunting wildebeest cooperatively

White pelicans “herding” school of fish

Colonial mammals

- Naked mole rats
  - underground colony, tunnels
  - queen, breeding males, non-breeding workers
  - hairless, blind

“Picture a hot dog that’s been left in a microwave a little too long, add some buck teeth at one end, and you’ve got a fairly good idea of what a Naked Mole Rat looks like.”
Cognition

- **Do animals have consciousness?**

  - Koko
  - Smiling dog?
  - Killdeer
  - Killdeer feigning injury