


Chapter 51 Animal Behavior



meerkats


What is behavior? Why study it?

- **Behavior**
 - ◆ everything an animal does & how it does it
 - response to stimuli in 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" & "what" questions
- **Ultimate** causes
 - ◆ **evolutionary significance**
 - ◆ how does behavior contribute to survival & reproduction
 - adaptive value
 - ◆ "why" questions



male songbird




Courtship behavior in cranes


Ethology 1941 | 1973

- **pioneers in the study of animal behavior**


Karl von Frisch



Niko Tinbergen



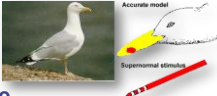
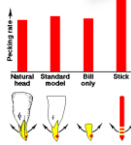
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Types of Behaviors

- **Innate behaviors**
 - ◆ **automatic, fixed, "built-in"**
 - despite different environments, all individuals exhibit the behavior
 - triggered by a stimulus
- **Learned behaviors**
 - ◆ **modified by experience**
 - triggered by a stimulus
 - variable





Innate Behavior

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



PROXIMATE CAUSE: The red belly of the attacking male acts as a sign stimulus that releases aggression in a male stickleback.

ULTIMATE CAUSE: By driving away other male sticklebacks, it helps decrease the chance that eggs laid in his nesting territory will be fertilized by another male.

<p>Actual colour & shape:</p>  <p>Male stickleback: red belly, bluish-white back</p>	<p>Female stickleback: greyish-green body, swollen silvery belly.</p>  <p>Female stickleback: greyish-green body, swollen silvery belly.</p>
<p>Model characteristics:</p>  <p>Red belly</p>	<p>Swollen belly</p>  <p>Swollen belly</p>
<p>Reaction of males to model:</p> <p>Attack</p>	<p>Court</p>

attack on red belly stimulus
court on swollen belly stimulus

Fixed Action Patterns (FAP)

Digger wasp

egg rolling in geese

The "eyebrow-flash"

Directed Movements

- **Taxis**
 - ◆ change in direction
 - ◆ automatic movement toward (positive taxis) or away from (negative taxis) a stimulus
 - phototaxis
 - chemotaxis
- **Kinesis**
 - ◆ change in rate of movement in response to a stimulus

(b) Positive rheotaxis keeps trout facing into the current, the direction from which most food comes.

(a) Kinesis increases the chance that a sow bug will encounter and stay in a moist environment.

Migration

- Complex behavior, but still innate
 - ◆ "migratory restlessness" seen in birds bred & raised in captivity
 - ◆ navigate by sun, stars, Earth magnetic fields

Monarch migration

Sandpiper

Bobolink

Golden plover

Imprinting

- Learning at a specific critical time forming social attachments
 - ◆ both learning & innate components

Konrad Lorenz

PROXIMATE CAUSE: During an early, critical developmental stage, the young geese observe their mother moving away from them and calling.

ULTIMATE CAUSE: On average, geese that follow and imprint on their mother receive more care and learn necessary skills, and thus have a greater chance of surviving than those that do not follow their mother.

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.

ARKive

Wattled crane conservation

teaching cranes to migrate

Critical Period

- Sensitive phase for optimal imprinting

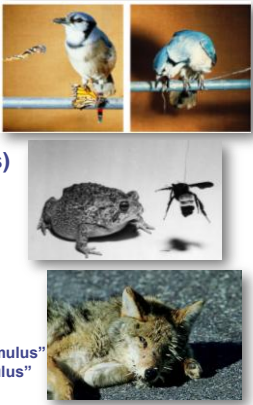
(a) Learning in the sensitive period

(b) Open-ended learning

As a brood parasite, the Cuckoo never learn the song of their species as a nestling. Song development is totally innate.

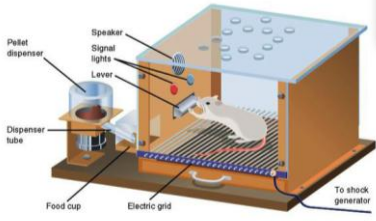

Learned Behavior

- **Associative learning**
 - ◆ learning to associate one feature of the environment (stimulus) with another
 - **operant conditioning**
 - ◆ trial & error learning
 - ◆ associate behavior with reward or punishment
 - **classical conditioning**
 - ◆ Pavlovian conditioning
 - ◆ associate a "neutral stimulus" with a "significant stimulus"



Operant Conditioning

- **Skinner box**

mouse learns to associate behavior (pressing lever) with reward (food pellet)

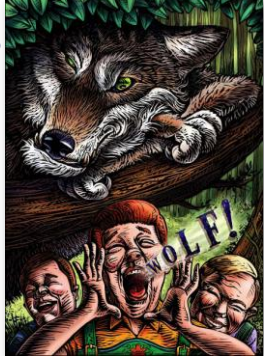
Classical Conditioning

- **Ivan Pavlov's dogs**
- ◆ connect reflex behavior (salivating at sight of food) to associated stimulus (ringing bell)



Habituation

- **Loss of response to stimulus**
 - ◆ "cry-wolf" effect
 - ◆ learn *not* to respond to repeated occurrences of stimulus



Thinking & Problem-Solving

- **Do other animals think?**



tool use

problem-solving

Social Behaviors

- **Interactions between individuals**
 - ◆ develop as evolutionary adaptations
 - ◆ **language**
 - ◆ **agonistic behaviors**
 - ◆ **dominance hierarchy**
 - ◆ **altruistic behavior**



Language

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

(a) Bees clustering around a recently returned worker (b) Round dance

(c) Waggle dance

Communication by Song

- 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

- 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

Belding ground squirrel




How can this be of adaptive value?

Social Behaviors

- Cooperation**
 - pack of African dogs hunting wildebeest cooperatively
 - white pelicans "herding" school of fish





Social Interaction & Communication

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


Pheromones

- Female mosquito use CO₂ concentrations to locate victims
- marking territory
- The female lion lures male by spreading sex pheromones, but also by posture & movements
- Spider using moth sex pheromones, as **allomones**, to lure its prey.

Mating & Parental Behavior

- Genetic influences**
 - changes in behavior at different stages of mating
 - pair bonding
 - competitor aggression
- Environmental influences**
 - modifies behavior
 - quality of diet
 - social interactions
 - learning opportunities



Colonial Mammals




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

convergent evolution: bees, ants, termites... mole rats

"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."



Patterns of Dispersal

- Spacing patterns within a population**
 - (a) Clumped**

 - (b) Uniform**

 - (c) Random**


Provides insight into the environmental associations & social interactions of individuals in population

Circadian Rhythms

- daily cycles of behavior
- most are **entrained** to light dark cycles of animals environment

