

Chapter 51.



Animal Behavior



AP Biology

2004-2005

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?



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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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→ consider how & why questions

1941|1973

Ethology

pioneers in the study of animal behavior

Karl von Frisch



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Niko Tinbergen



Konrad Lorenz



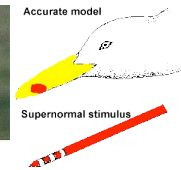
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Types of behaviors

- **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

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



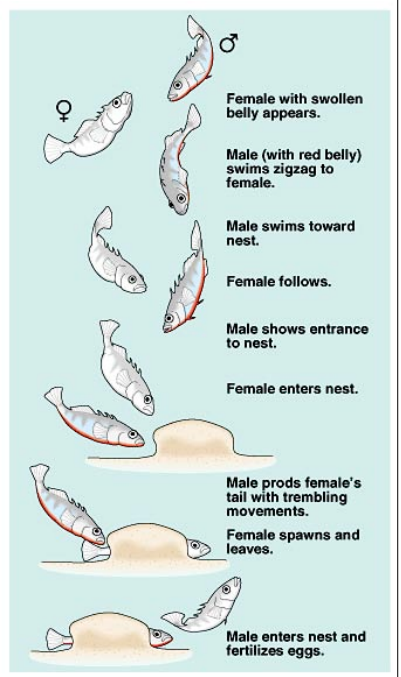
attack on red belly stimulus
court on swollen belly stimulus

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 sign stimulus that releases aggression in a male stickleback.

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



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courtship display in sticklebacks

Fixed Action Patterns (FAP)



Do humans exhibit Fixed Action Patterns?

The "eyebrow-flash"



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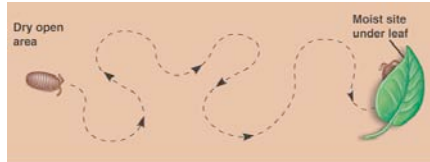
Directed movements

- **Kinesis**

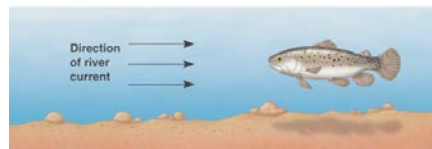
- ◆ simple change in activity or turning rate in response to a stimulus

- **Taxis**

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



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



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

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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



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Konrad Lorenz was “mother” to these imprinted graylag goslings
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Imprinting

BEHAVIOR: Young geese follow and imprint on their mother.



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.

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.



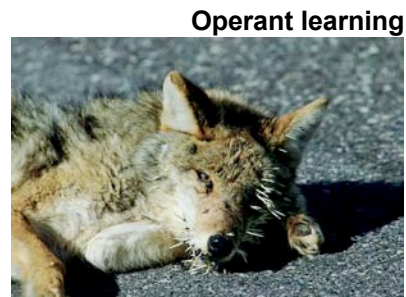
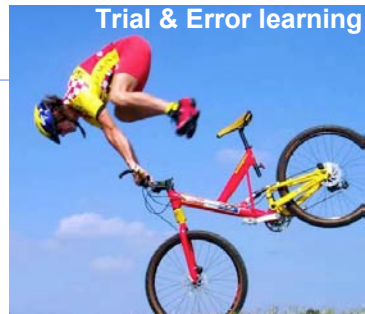
Wattled crane conservation



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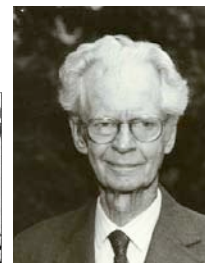
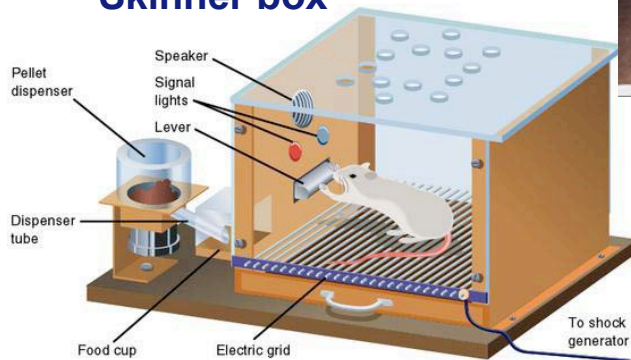
Learned behavior

- **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



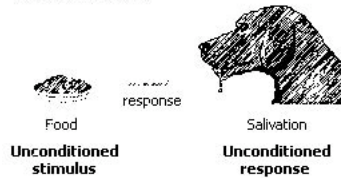
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Classical conditioning

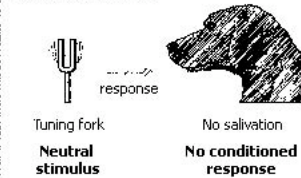
Ivan Pavlov's dogs

connect reflex behavior to conditioned stimulus

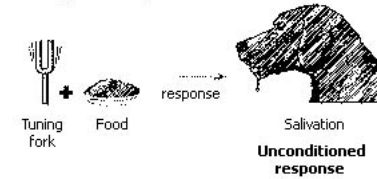
1. Before conditioning



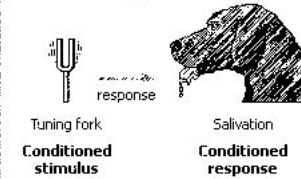
2. Before conditioning



3. During conditioning



4. After conditioning



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Habituation

Loss of response to stimulus

- ◆ “cry-wolf” effect
- ◆ learn not to respond to repeated occurrences of stimulus



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Cognition & problem-solving

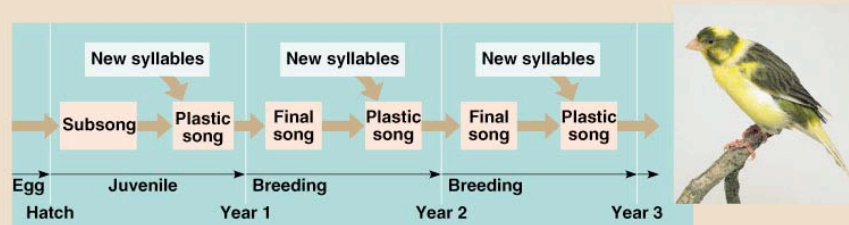
- Connecting behavior with nervous system



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

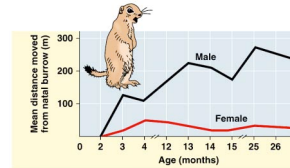
- **Dominance hierarchy**
 - ◆ social ranking within a group
 - pecking order



Social behaviors

Altruistic behavior

- ◆ reduces individual fitness but increases fitness of recipient
- ◆ kin selection



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Social behaviors

Territoriality

nesting in birds



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Territoriality



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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



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Social interaction requires communication

■ Pheromones

◆ chemical signal that stimulates a response from other individuals

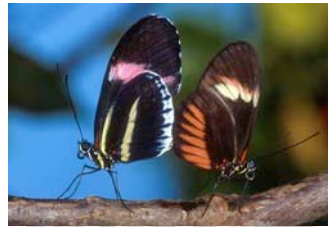
- alarm pheromones
- sex pheromones



(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 CO_2 concentrations to locate victims

marking territory



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



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Pheromones

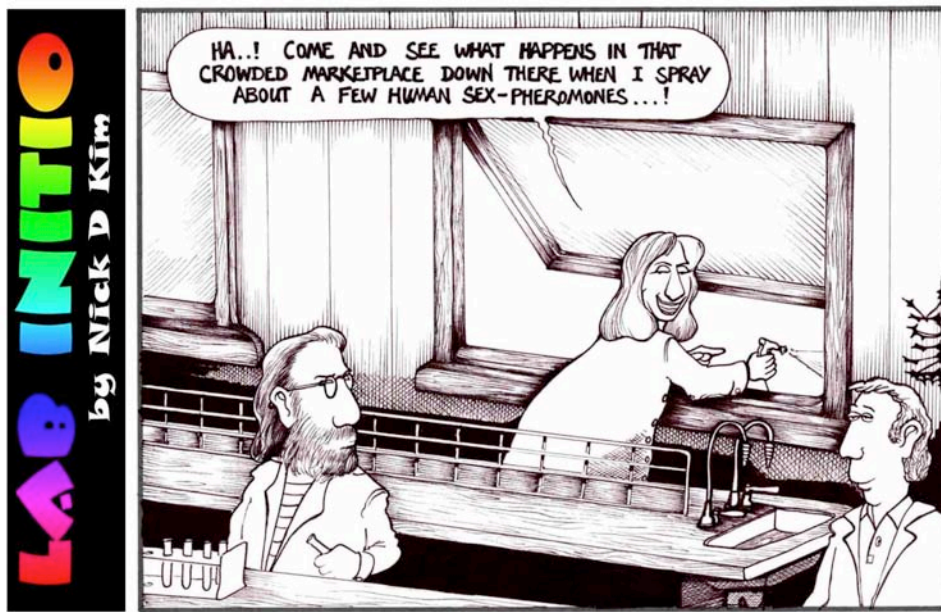
Human pheromones?



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



Honeybee communication



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



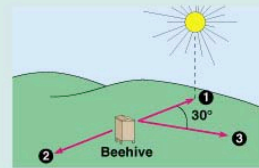
(a) Bees clustering around a recently returned worker



(b) Round dance



(c) 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



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Social behaviors

■ Cooperation

Pack of African dogs hunting wildebeest cooperatively



White pelicans "herding" school of fish



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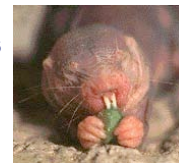
Colonial mammals

■ 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."



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Cognition

Do animals have consciousness?



Koko



smiling dog?



killdeer



killdeer feigning injury

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