Ch. 51 - discussion questions

1. What is something that you can do that you have been able to do since birth?
2. What is one behavior that you learned by watching someone else?
3. List some ways that animals communicate.

Chapter 51
Animal Behavior

You Must Know:

- How behaviors are the result of natural selection
- How innate and learned behaviors increase survival and reproductive fitness
- How organisms use communication to increase fitness
- The role of altruism and inclusive fitness in kin selection

Introduction

- Ethology: study of animal behavior
- Behavior: what an animal does and how it does it
  - Both genetic & environmental factors
  - Essential for survival and reproduction
  - Subject to natural selection over time

Understanding behavior

- **Proximate causation**: "how" a behavior occurs or is modified (hormones change with length of day they breed in spring and early summer)
- **Ultimate causation**: "why" a behavior in context of natural selection (more food available during these periods)

A courting pair of East Asian red-crowned cranes.

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

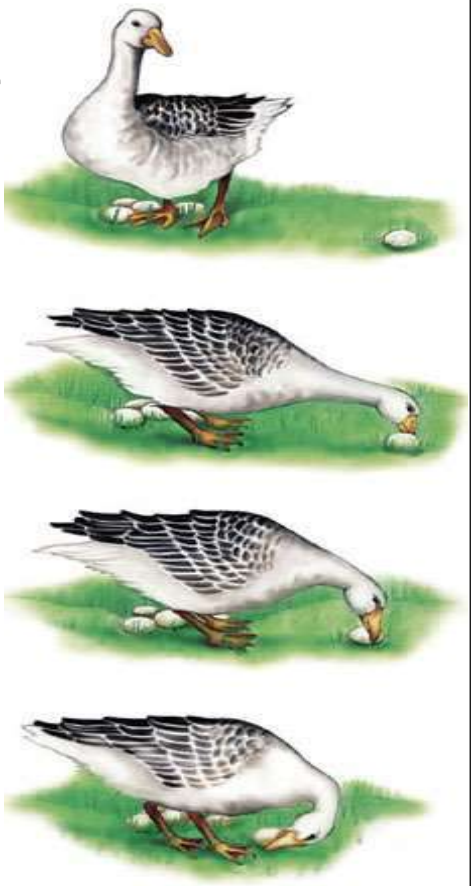
PROXIMATE CAUSE: The red belly of the intruding male acts as a sign stimulus that releases aggression in a male stickleback.

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.

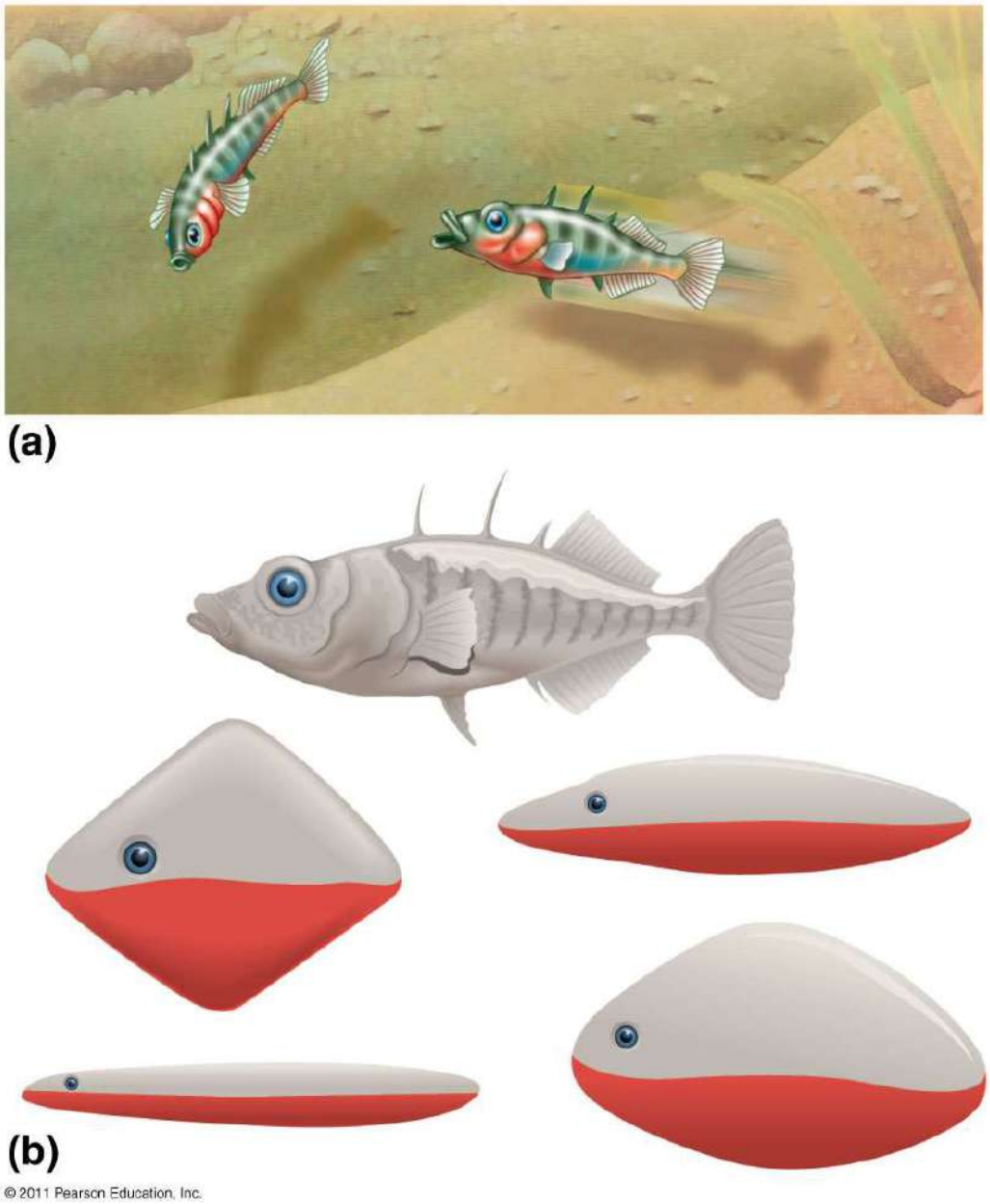
Innate behaviors: developmentally fixed and are not learned

Fixed action patterns (FAPs): sequence of unlearned acts that are unchangeable and usually carried to completion

- Triggered by sign stimulus
- Ensures that activities essential to survival are performed correctly without practice
- Eg. goose & egg

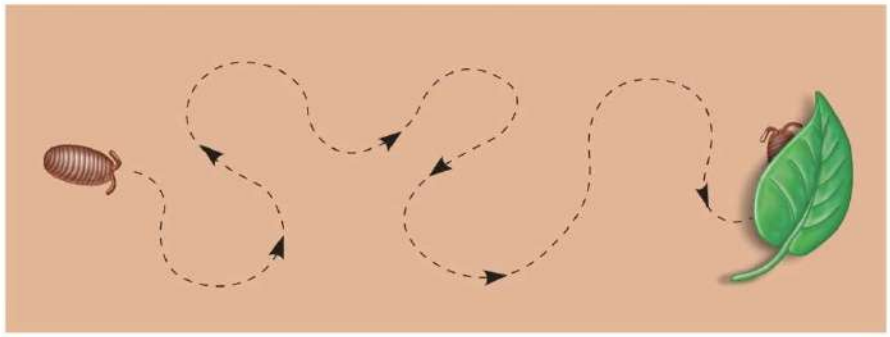


Sign stimuli in a classic fixed action pattern



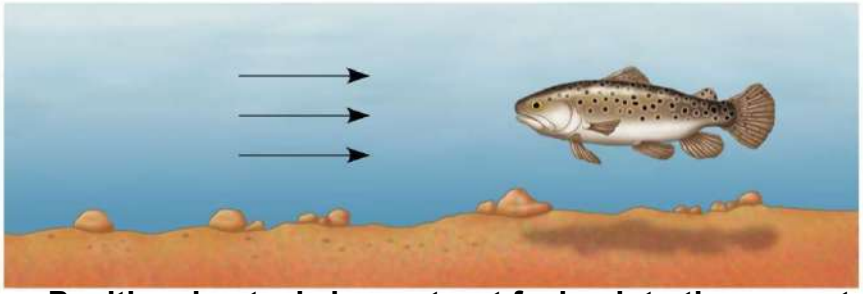
Directed Movements

- **Kinesis**: simple change in activity or turning rate in response to a stimulus (random movement)



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

- **Taxis**: automatic movement, oriented movement +/- from stimulus (eg. phototaxis, chemotaxis, geotaxis)

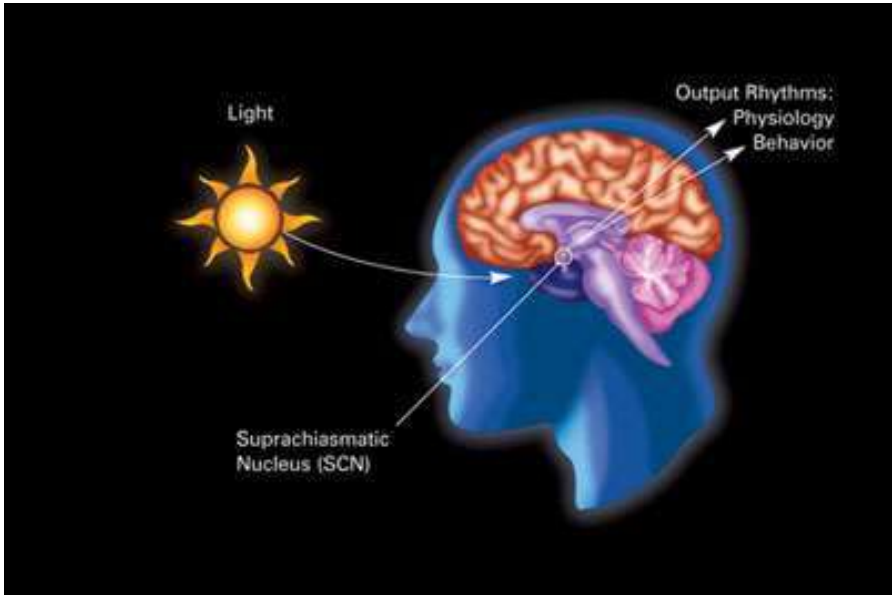


(b) **Positive rheotaxis keeps trout facing into the current, the direction from which most food comes.**

Migration

- Regular, long-distance change in location
- Environmental cues: sun, stars, earth's magnetic field, landmarks

Circadian Rhythm: internal biological clock



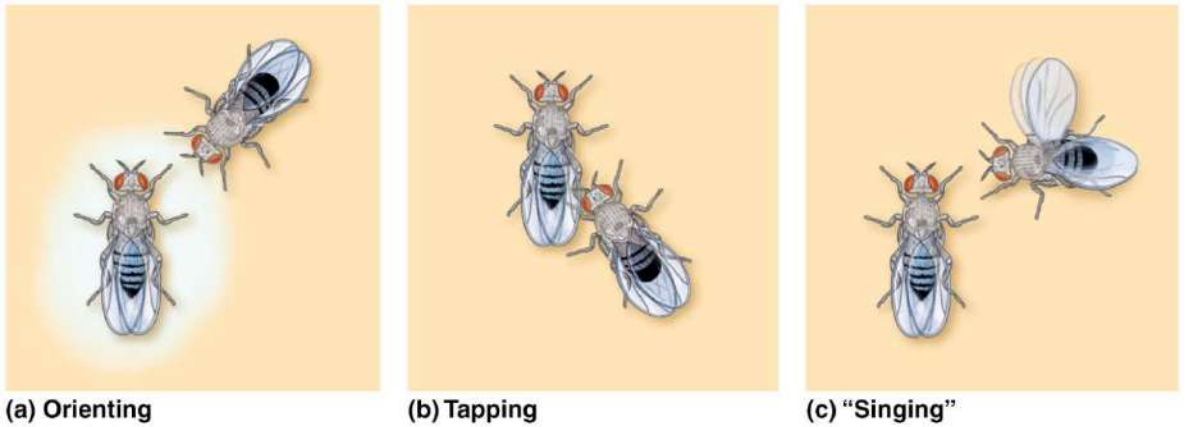
The Suprachiasmatic nuclei (SCN) region is located in the hypothalamus of the brain. The SCN sends signals throughout the body in response to dark and light.

The circadian clock in the hamster brain signals a change in coat color according to season by releasing the hormone melatonin.

Plants can have two internal clocks: one sensitive to light and the other sensitive to temperature

Signal: stimulus that causes a change in behavior; basis of *animal communication*

- **Pheromones** – chemicals emitted by members of one species that affect other members of the species (eg. Queen bee, fruit fly, fish, termites, trees, humans)
- **Visual signals** – eg. Warning flash of white of a mockingbird's wing
- **Tactile** (touch) – eg. Male fruit fly taps female fly
- **Auditory signals** – screech of blue jay or song of warbler



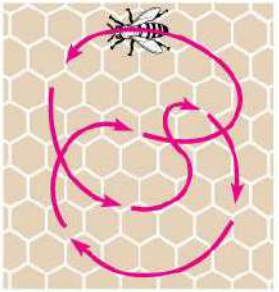
Courtship behavior of fruit flies


(a) Worker bees

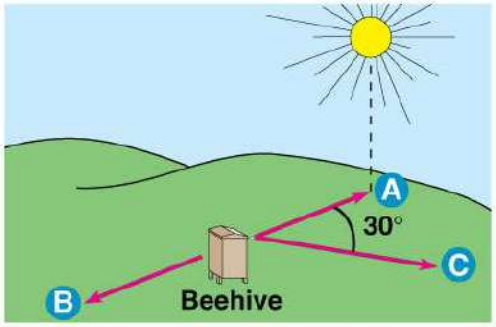
Honeybee dance language

- Used to inform other bees about distance and direction of travel to food sources

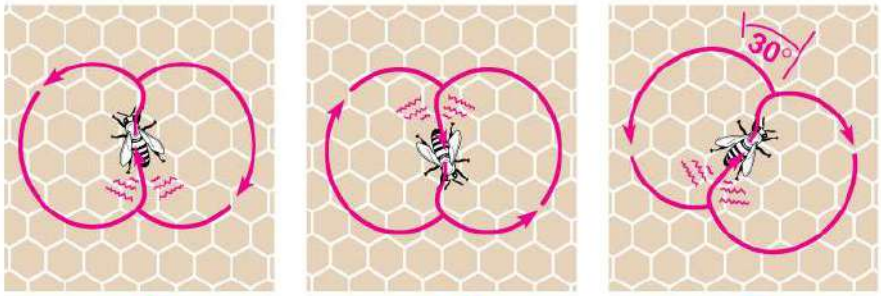
(a) Worker bees



(b) Round dance (food near)

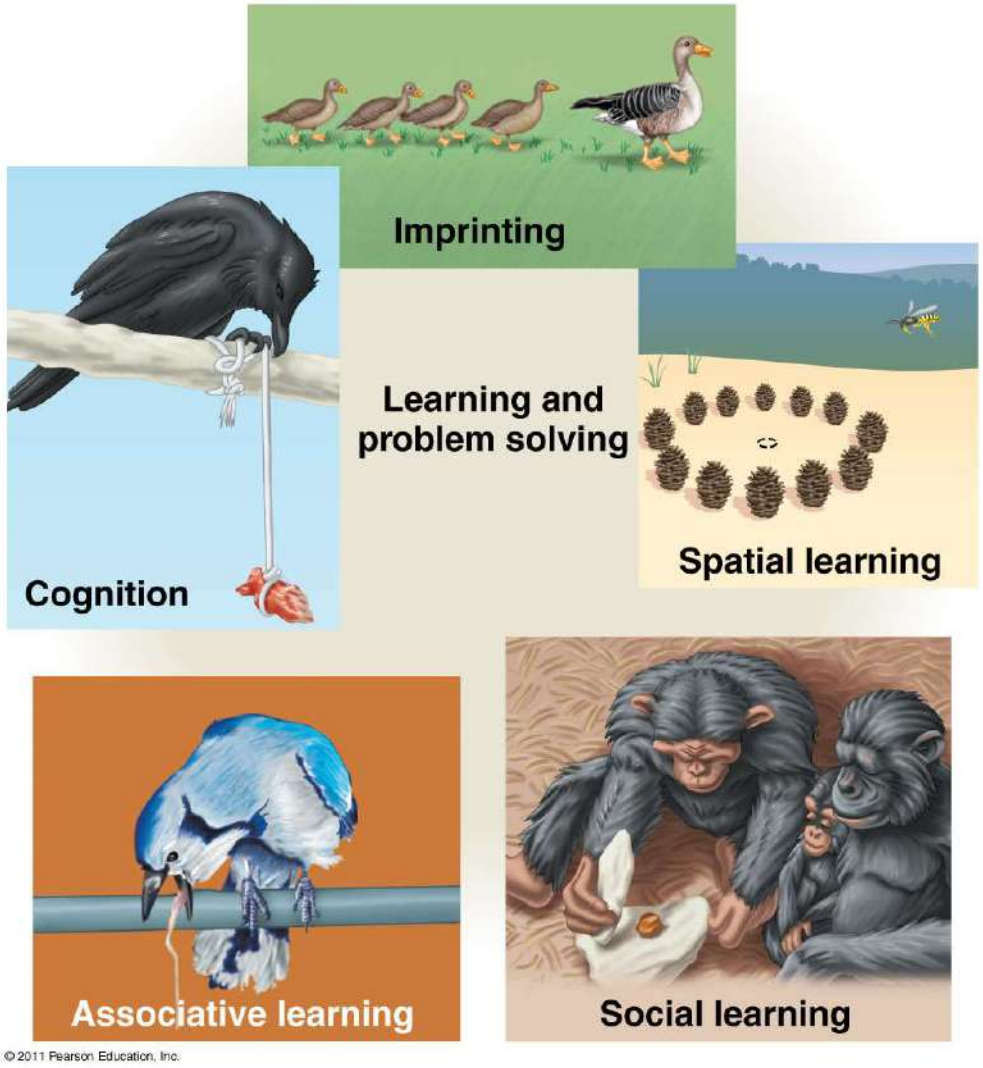


(c) Waggle dance (food distant)



Location A | Location B | Location C

Learned behaviors: behaviors that are modified based on *specific experiences*

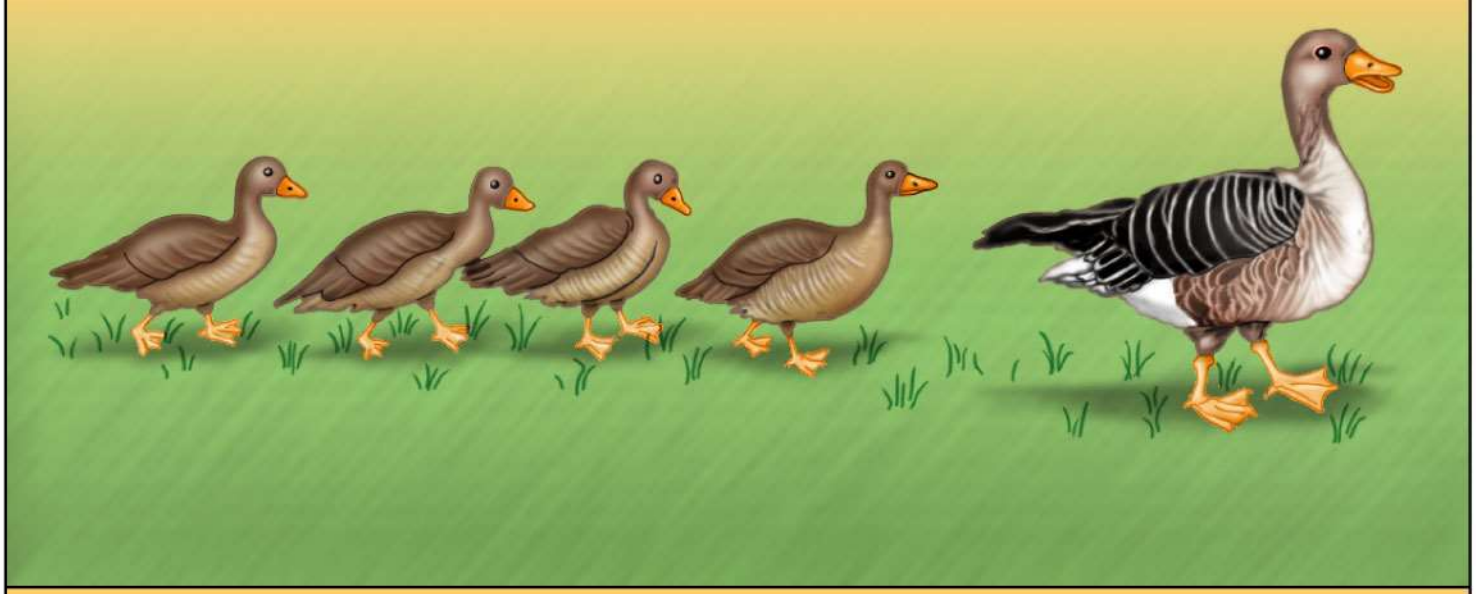


Types of Learning

1. Habituation: loss of responsiveness to stimuli that convey little or no information
   - Simple form of learning
2. Imprinting: learning + innate components
   - Limited to **sensitive period** in life, generally irreversible
   - ie. Lorenz' imprinting in greylag geese

(a) Konrad Lorenz and geese

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.

- Captive breeding programs for endangered species must provide proper imprinting models

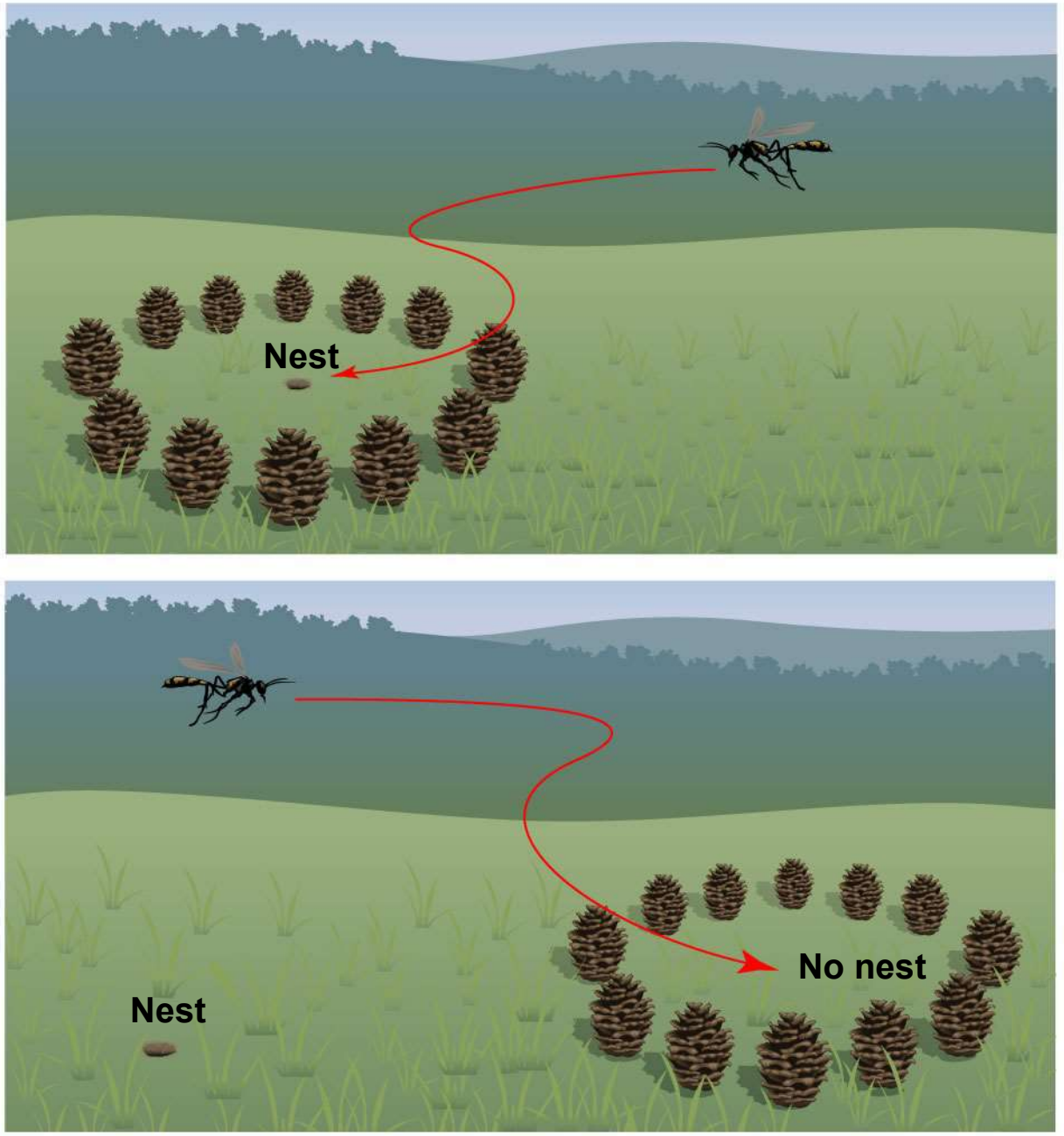
Pilot wearing crane suit acts as a surrogate parent to teach young whooping cranes a migration route

3. Spatial Learning

- Cognitive Map: internal representation of spatial relationship among objects in an animal's surroundings

Birds use spatial maps to relocate nut caches

Some organisms move in response to a recognized object or environmental cue, a **landmark**.

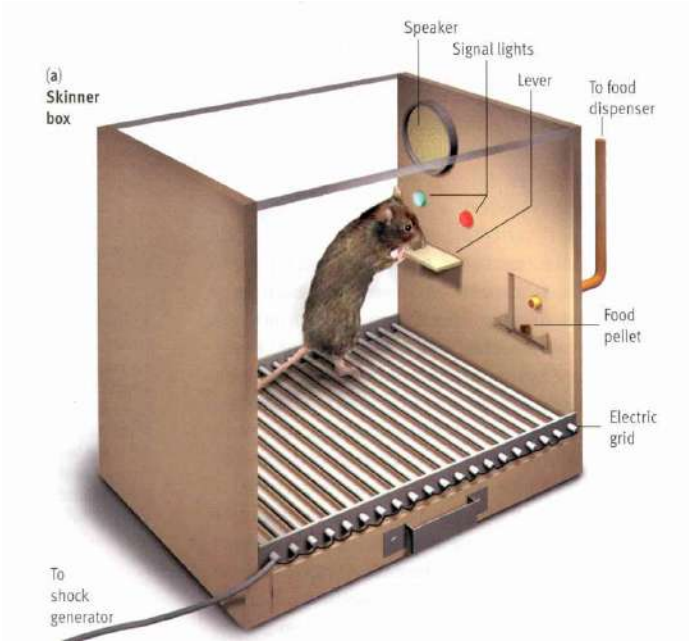


4. Associative Learning: ability to associate one stimulus with another (eg. monarchs = foul taste)

A. Classical conditioning**:** arbitrary stimulus associated with particular outcome (eg. Pavlov's dogs: salivate with ringing bell)

B. Operant conditioning: another type of associative learning

- **Trial-and-error learning**
- Associate its own behavior with reward or punishment



5. Cognition: process of knowing that involves awareness, reasoning, recollection, judgment

- Problem-solving behavior relies on cognition

6. Social learning: learning by observing others

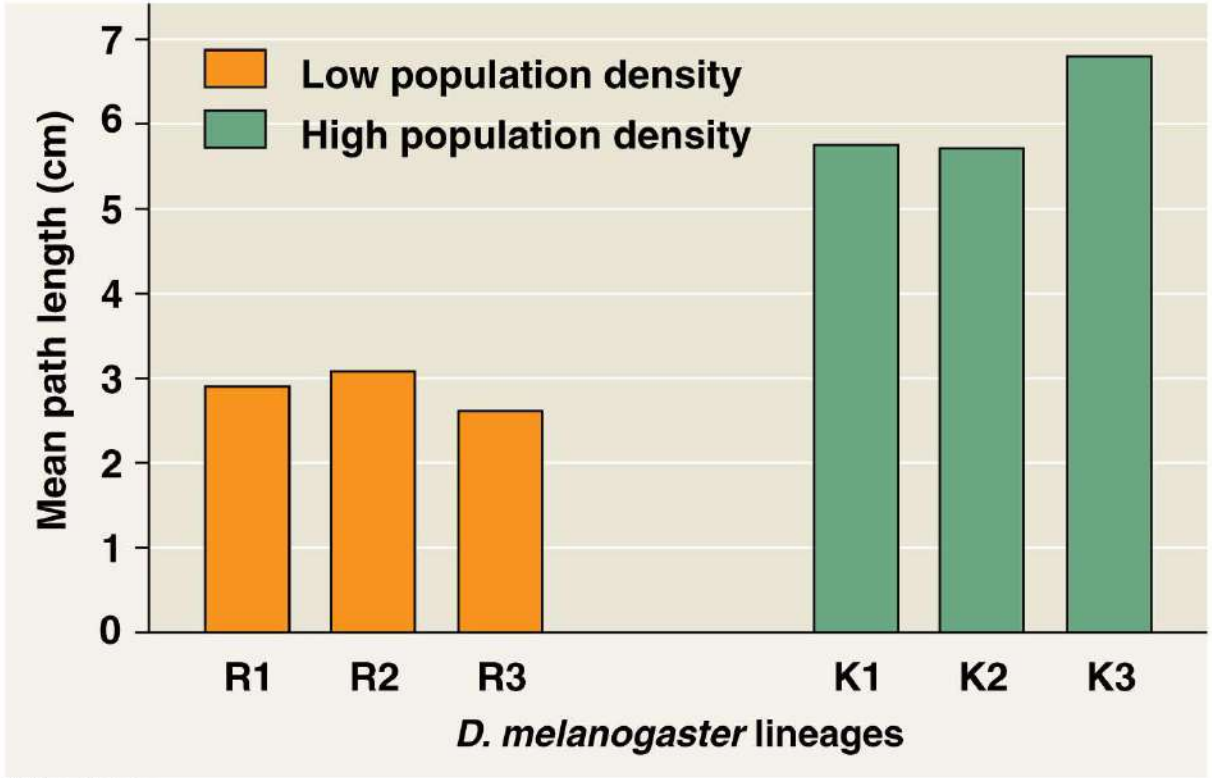
Vervet monkeys learning correct use of alarm calls.

Examples of learned animal behavior

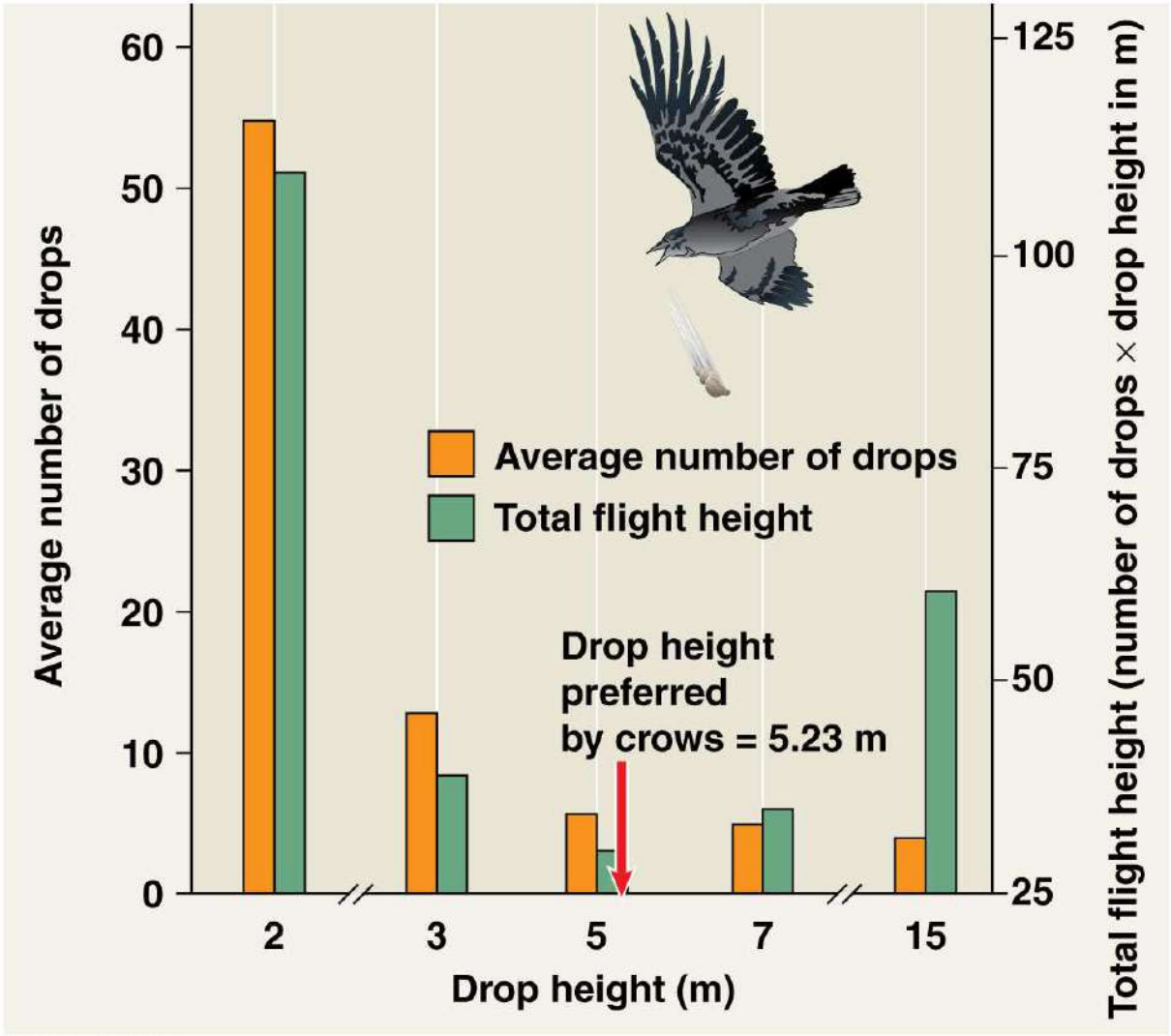
- Nut-cracking crow (2:16)
- TED Talk: Amazing intelligence of crows (11:34)

Foraging: food-obtaining behavior

- Recognize, search for, capturing, and consuming food
- Optimal foraging model - Minimize costs / Maximize benefits



Energy costs and benefits in foraging behavior



Mating Behavior & Mate Choice

- Sexual selection: seeking and attracting mates, choosing and competing for mates

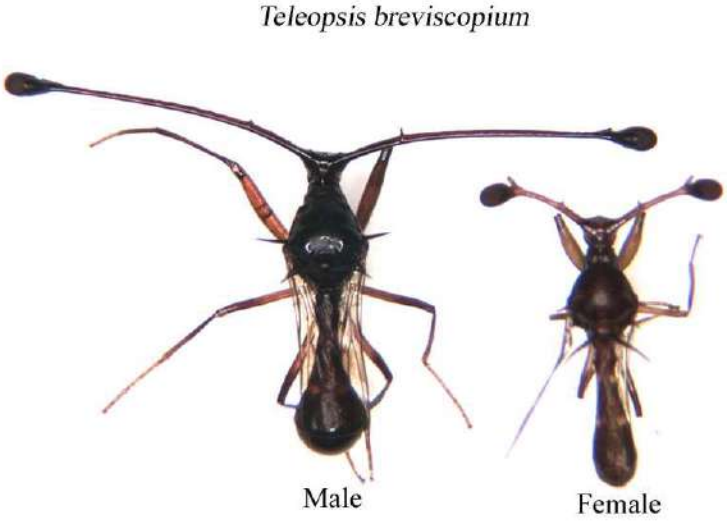
	Promiscuous	Monogamous	Polygamous (polygynous)	Polyandry
Partners	Many	One	1 M + many F	1F + many M
Structure	Showy	Similar	Showy male	Showy female
Care	None	Much	Male = little	Male = none

(a) Monogamous species

(b) Polygynous species

(c) Polyandrous species

Sexual selection



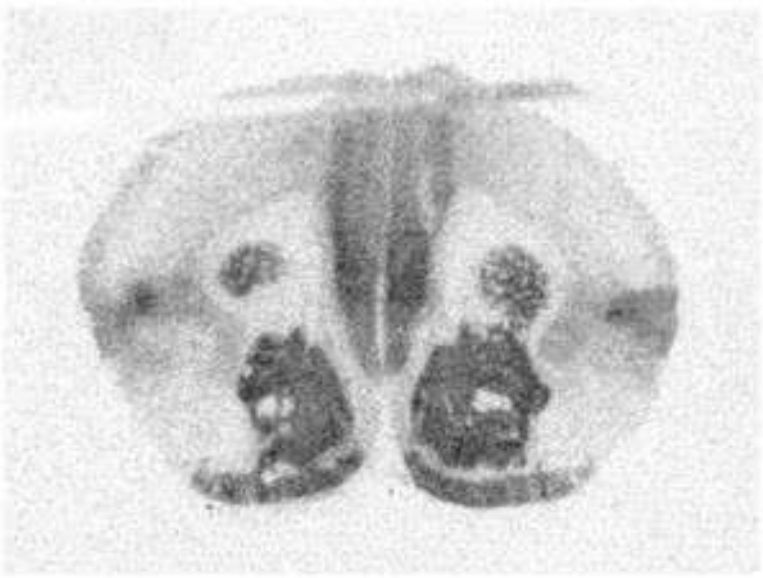
- Ornaments correlate in general with health and vitality

Agonistic behavior: threats, rituals, and sometimes combat; settles disputes over resources (mates)

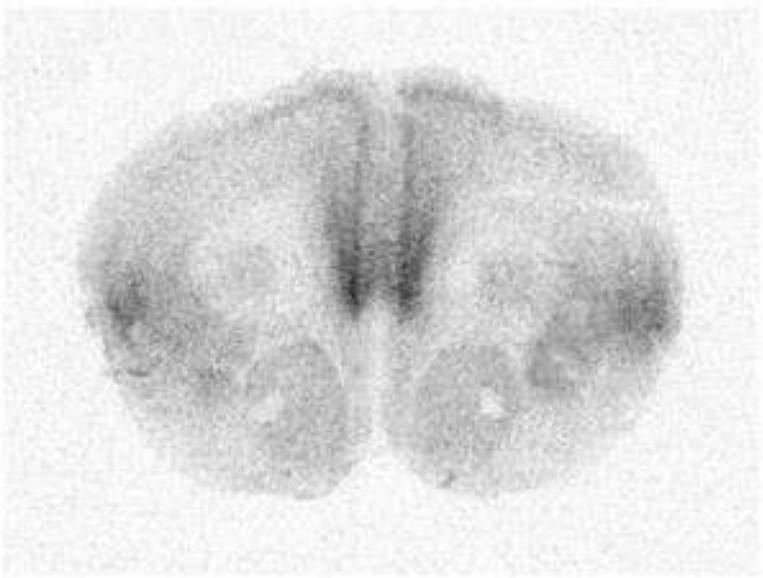
Behaviors can be directed by genes

- Certain behaviors in prairie voles are under relatively strong genetic control
- ADH (vasopressin) triggers pair-bond formation and aggression by male voles

- Differences in vasopressin receptors in 2 species of voles
- Monogamous prairie voles vs. promiscuous meadow voles



High vasopressin levels in prairie voles



Low vasopressin levels in meadow voles

Altruistic social behavior

- **Altruism** = selfless behavior
- *Reduce* individual fitness but *increase* fitness of others in population
  - i.e. bee societies; naked mole rats

- **Inclusive fitness**: total effect of producing own offspring (pass on genes) + helping close relatives
- **Kin selection**: type of natural selection; altruistic behavior enhances reproductive success of relatives

What does this mean? Explain.

- Geneticist J.B.S. Haldane: "I won't lay down my life for one brother, but I would lay down my life for two brothers or eight cousins."

Review Question

Natural selection favors behaviors that increase survival and reproductive behaviors. For each of the following types of behaviors, describe an example in nature, and justify how this behavior is adaptive.

(a) Innate behavior

(b) Learned behavior

(c) Cooperative behavior

(d) Chemical signals