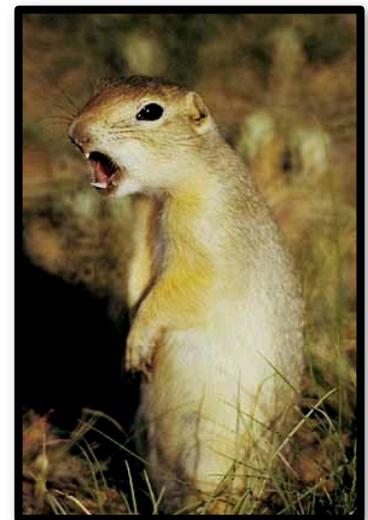


# Social behaviors

- Interactions between individuals
  - ◆ develop as evolutionary adaptations
    - Play behavior
    - communication / language
    - agonistic behaviors
    - dominance hierarchy
    - cooperation
    - altruistic behavior



# Play Behavior

Play behavior among animals often involves moves that look like moves animals use when attacking prey.



Play consumes energy and can even risk hurting the animal.



What may be the ultimate cause of play behavior?

# Play Behavior - “Practice Hypothesis”

Allows animals to practice behaviors required for Survival.

## Supporting evidence:

Observations show that play is most common in younger animals.

## Contradictory evidence:

However, curiously, play doesn't not seem to improve their moves much.



**If play was to practice it should make them better right?**

# Play Behavior - “Exercise Hypothesis”

Play is an adaptation that keeps the animal’s muscles and cardiovascular system in good condition.

We expect then play to be common in young animals because they do not spent energy on the useful activities of adults yet as is observed.



**Both hypothesis predict young animals will exhibit more play behavior than older animals.**

**The data supports the prediction but this means neither hypothesis so far can be rejected. They are both supported by data and valid explanations.**

# Social Behaviors

**Social Behaviors: Interactions between two more individuals of the same species.**

Though there are benefits to living together, animals in social groups must also compete at times for resources (food, space, mates)...

**Aggressive Behavior: Physical struggles or threatening behaviors between animals.**

- Tests of Strength
- Displays that show who is stronger or more determined
- Often one animal will 'surrender'

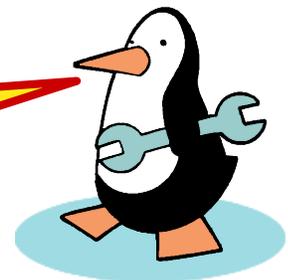


# Social behaviors

- **Agonistic behaviors** (*aggression*)
  - ◆ **threatening & submissive rituals**
    - Usually symbolic, usually no harm done
      - ◆ ex: territoriality, competitor aggression



You wanna  
piece of me?!



# Dominance Hierarchies

**Dominance Hierarchy:** The ranking of individuals from most dominant to most submissive within a group. (*A social pecking order*)



The higher up an animal ranks, the greater access to resources they get and the others respect that status.

What may be a benefit of such a hierarchy?

Animals do not need to spend time fighting each other and can instead concentrate on finding food and raising young.

This increases one's fitness...



# Territorial Behavior



**Territory:** An area that individuals defend and from which other members of the same species are usually excluded.



May vary in size, function, resources...

**Animal will defend its territory continually.**

**Ex:** Bird songs, mammals marking with scent.

There is a **cost** to having to defend a territory: **Energy is spent.**

But the **benefits** outweigh the costs: **Exclusive access to food, breeding grounds, or areas to raise young.**



# Foraging & Mate Choice

Two behaviors that can affect fitness most directly are foraging and mate choice



Adequate nutrition is essential to survival and reproduction

- One should expect therefore natural selection to refine behaviors that enhance the efficiency of feeding, food-obtaining behavior, or **foraging** (includes recognizing, capturing, and eating).



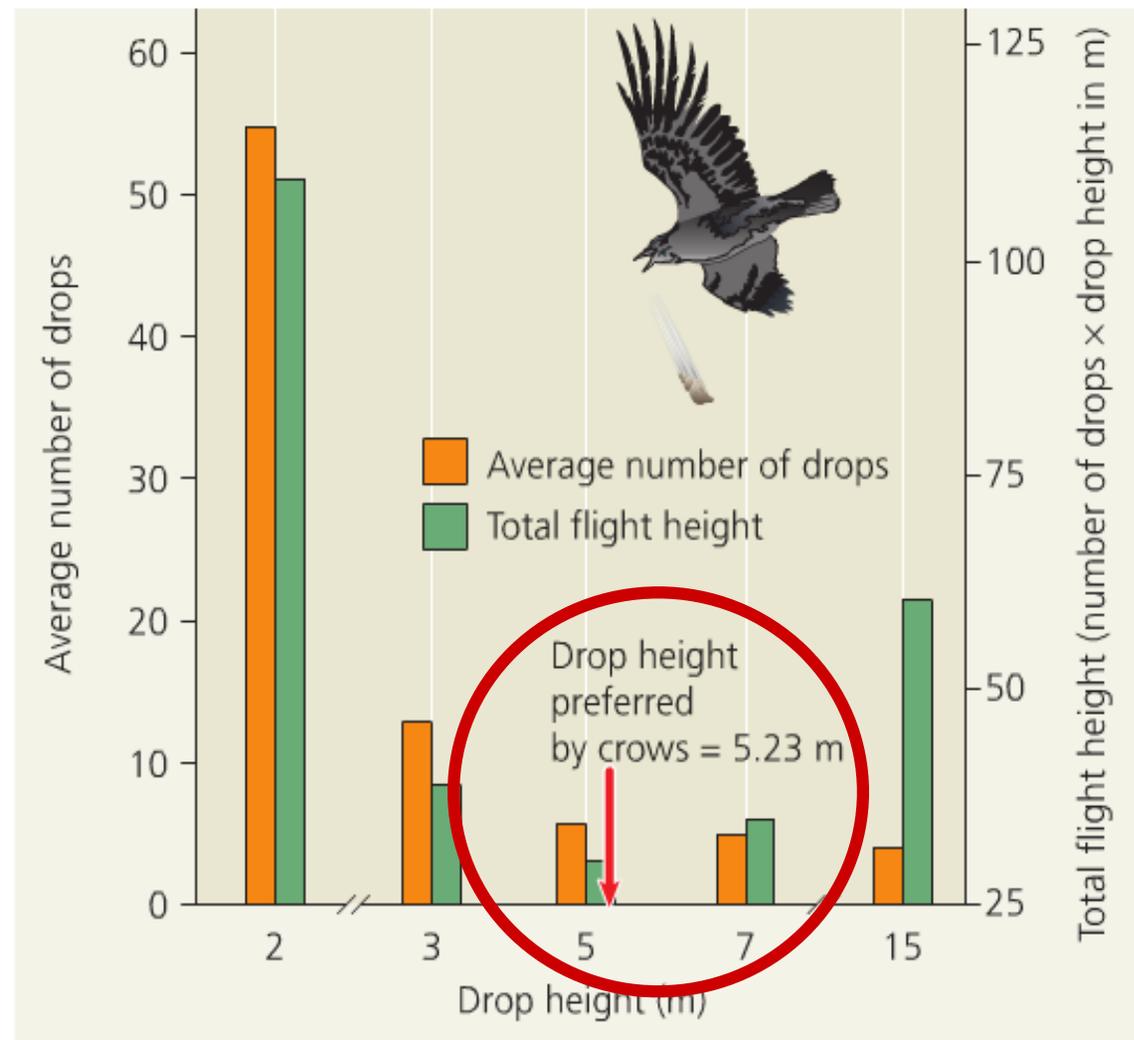
- **Optimal Foraging Model** = states that foraging behavior is a compromise between the benefits of nutrition and the cost of obtaining food.
  - Natural selection favors behaviors that maximize benefit & minimize risk
    - Risks might include being eaten while foraging, spending more energy than is obtained by eating



# Foraging behavior

## Northwestern crow

- Lives on the islands of British Columbia
- Search rocky tide pools for gastropod molluscs called whelks
  - Pick up whelk, flies up, drops whelk onto rock to break open the shell and gain access to the animals soft parts
- Increasing height, increases the force of impact, increasing the likelihood of opening the shell on the first try
  - However, flying higher also consumes more energy

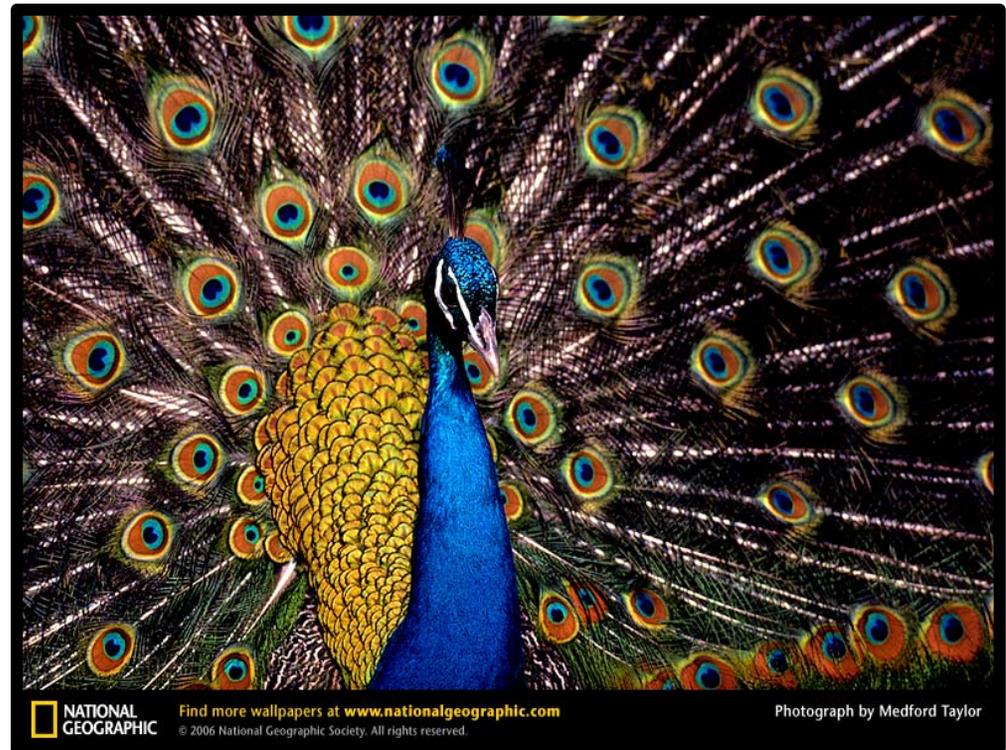


▲ **Figure 51.19 Energy costs and benefits in foraging behavior.** Experimental results indicate that dropping shells from a height of 5 m results in breakage with the least amount of work. The actual drop height preferred by crows corresponds almost exactly to the height that minimizes total flight height.

# Courtship Behavior

**Courtship Ritual: Performance of elaborate behaviors before mating.**

- They can let an animal know that another animal is a potential mate from the **same species and the opposite sex.**
- They can announce that a animal is **ready to mate.**
- They help **advertise health and fertility.**



# Do female Barn Swallows prefer long tails?

Animals choosing a healthy mate based on appearance does not mean they do so through high level thinking.

Natural Selection has refined the courtship rituals so that they lead to reproductive success.



## Study on Male Barn Swallow Mating Success:

In barn swallows, males display their long tails and females choose the mates.



Hypothesis: The longer the male's tail, the More attractive females find him.



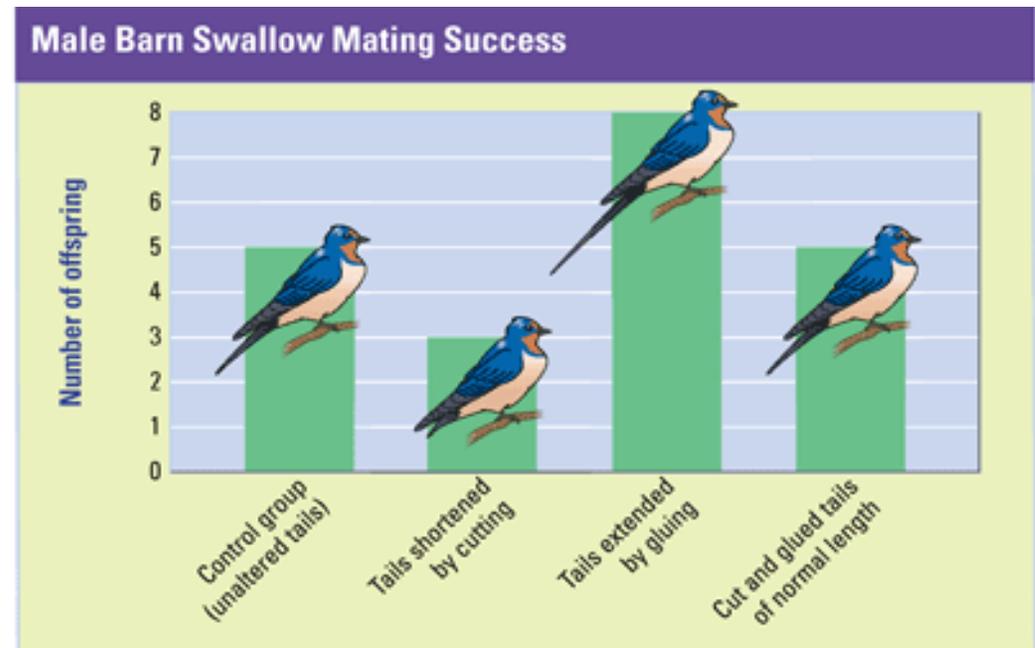
# Does female Barn Swallows prefer long tails?

- **Control Group:** Male swallows with natural-length tale
- **Experimental Groups:**
  - One with tails cut short
  - One with tails glued longer
  - One with cut and glued tails of natural length (**\*\*\*Why this group?\*\*)**



## Results:

The group with the extended tails had more offspring and mating success.



## Does physical appearance indicate mating success?

- **Hypothesis:** Good health is required to produce long feathers.
- **Test:** Studied birds with naturally varying tail lengths.

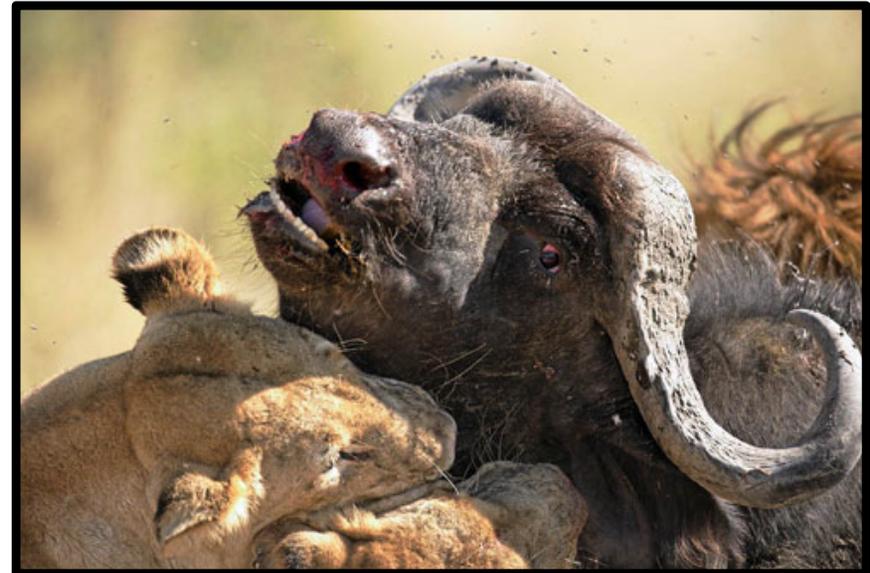
**Results:** Long-tailed swallows and their offspring had **fewer parasites** than short-tailed swallows.



# Cooperative Behavior

- **Cooperation:** Individuals work together in a way that is beneficial to the group.
- **Ex:** When musk oxen form a ring of adults around their young in the presence of predator.

**Lions Hunting as a Cooperative unit helps lions bring down prey that otherwise is much larger than one individual lion alone.**



# Social behaviors

- Cooperation

- ◆ working

together in

coordination



Pack of African dogs hunting wildebeest cooperatively



White pelicans “herding” school of fish

# Social interaction requires COMMUNICATION

- Communication: The transmission and reception of signals among animals that include sounds, odors, visual displays, and touches
  - **Signal = a stimulus transmitted from one animal to another**
- Species with complex social structures tend to have complex communication systems.

Example: Honeybees

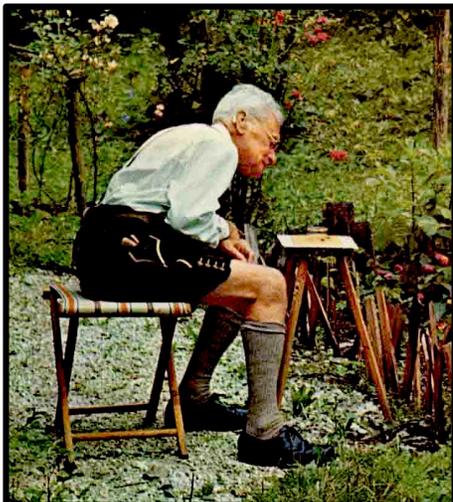
In the 1940s, biologist Karl von Frisch carried out several experiments to study bee communication.



# Language



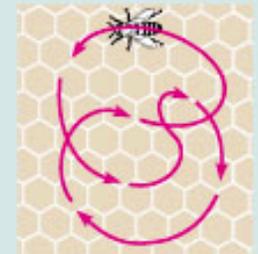
- Honey bee communication
  - ◆ dance to communicate location of food source
    - Symbolic language = wobble dance



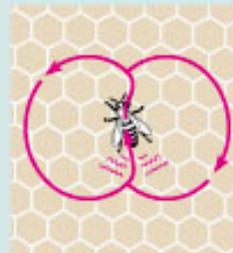
Buzzzzzz...



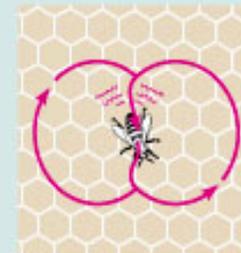
(a) Bees clustering around a recently returned worker



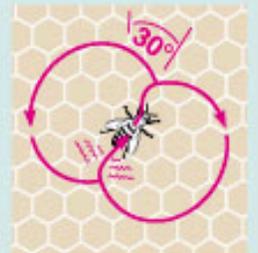
(b) Round dance



1

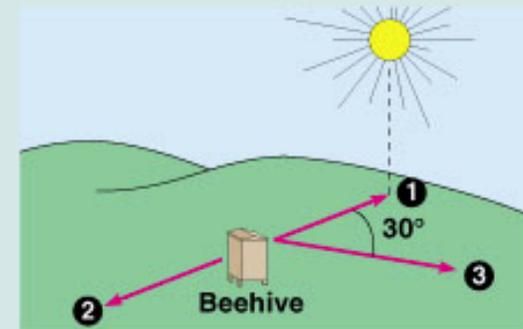


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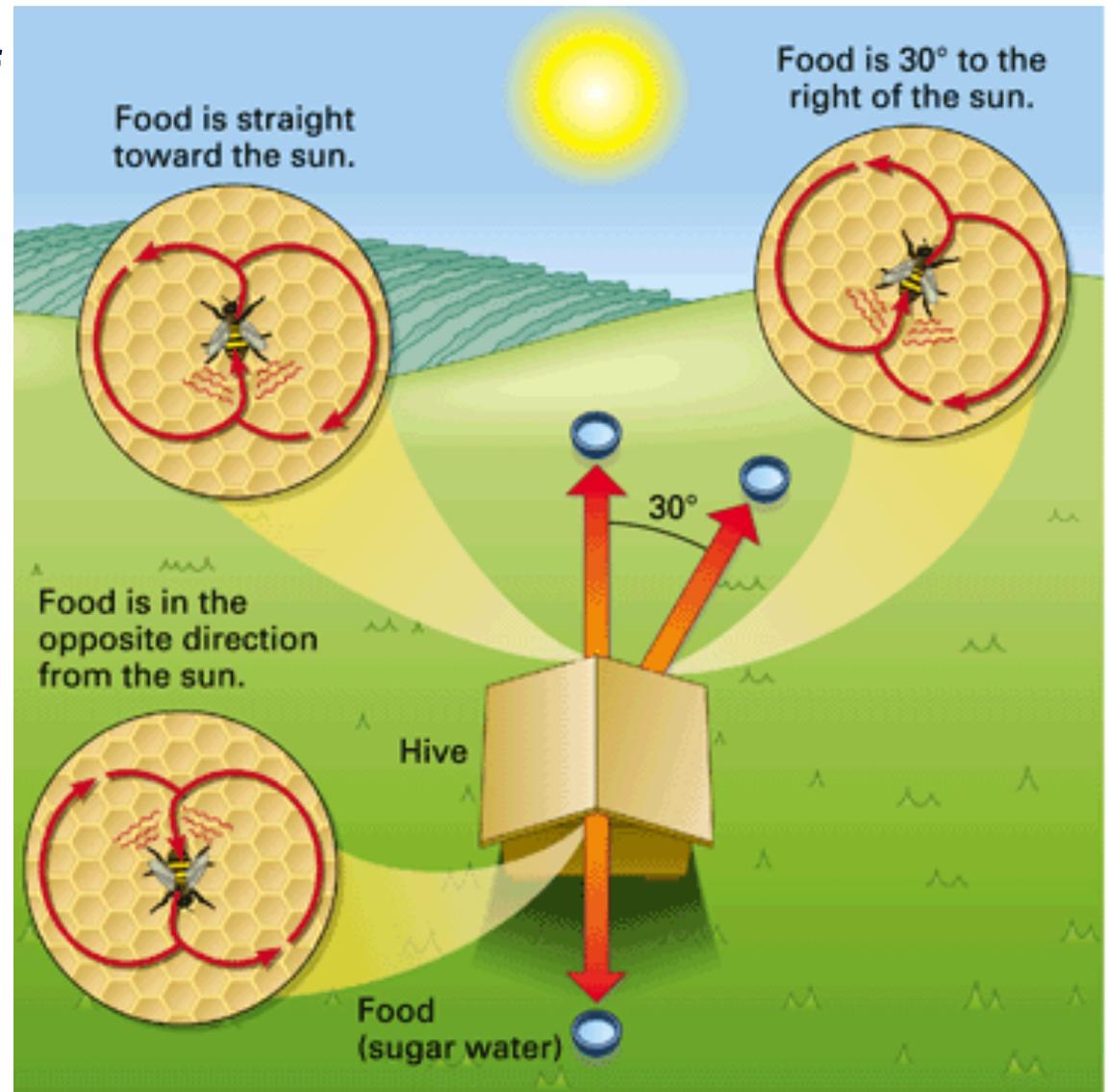
3

(c) Wobble dance



# Communication in bees

- Von Frisch put dishes of **sugar water** at different **distances** and in different **directions** from a hive.
- **Worker bees that return to the hive, performed various 'waggle dances'**
  - Angle of a returning honeybee's 'waggle dance' signals the direction of the food source from the hive compared to the position of the sun.

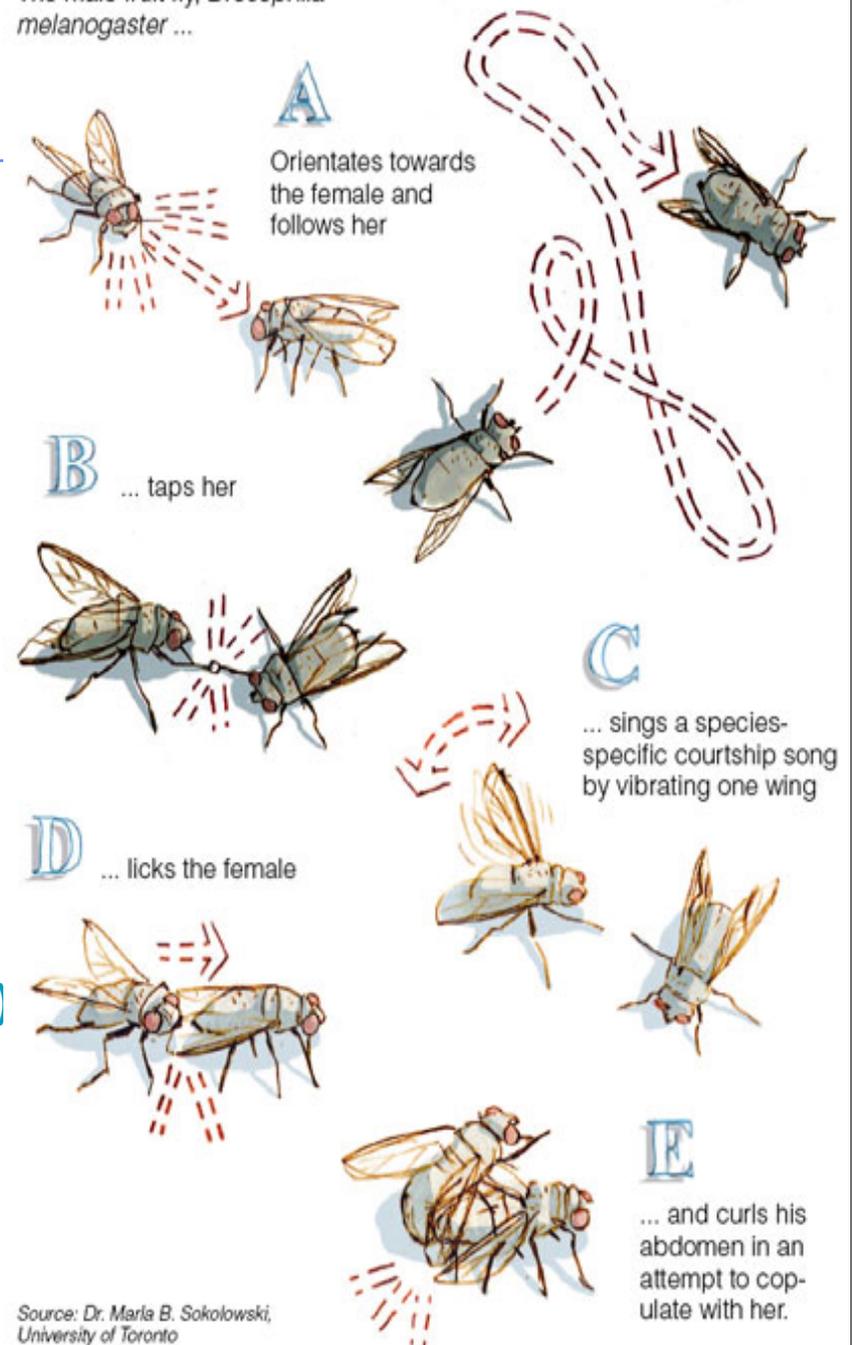


# Animals may use one or more modes of communication

- **Courtship Behavior of the Fruit fly involves a fixed set of behaviors in a fixed order = stimulus-response chain**
  - ◆ the response to each stimulus is itself the stimulus for the next behavior
    - **Male uses:**
      - ◆ Visual communication
      - ◆ Chemical communication (olfactory)
      - ◆ Tactile communication (gustatory)
      - ◆ Auditory communication (audition)
        - wing vibration allows the female to identify the male as part of the same species
    - **If communication unsuccessful, female will not copulate/mate.**

## The Mating Dance of the Fruit Fly

The male fruit fly, *Drosophila melanogaster* ...



Source: Dr. Marla B. Sokolowski,  
University of Toronto

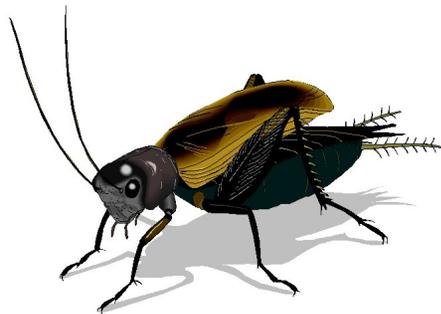
# Communication by song

## ■ Bird songs

- ◆ Used for species identification, territory defense, & mating rituals
  - Often a mixture of learned &/or innate behavior
    - ◆ May involve critical learning period

## ■ Insect song

- ◆ mating ritual & song
  - Usually innate, genetically controlled



Red-winged blackbird



# Communication by chemical means

## ■ Pheromones

- ◆ chemical signal that stimulates a response from other individuals
  - alarm pheromones
    - ◆ Ex: when minnows are injured, an alarm substance is dispersed from their skin - triggers flight response in others
  - sex pheromones - Ex: attract mates in moths



(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.



# Chemical signals

human sex pheromone?

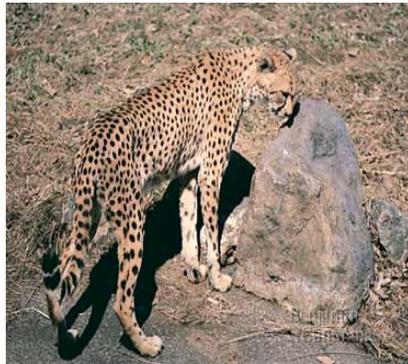
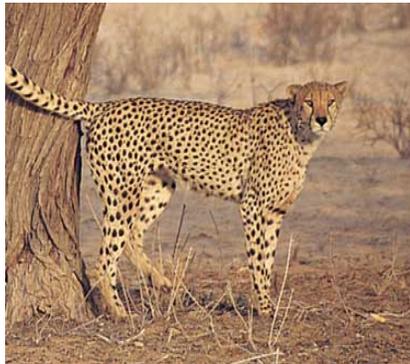


Female mosquito use  $\text{CO}_2$  concentrations to locate victims

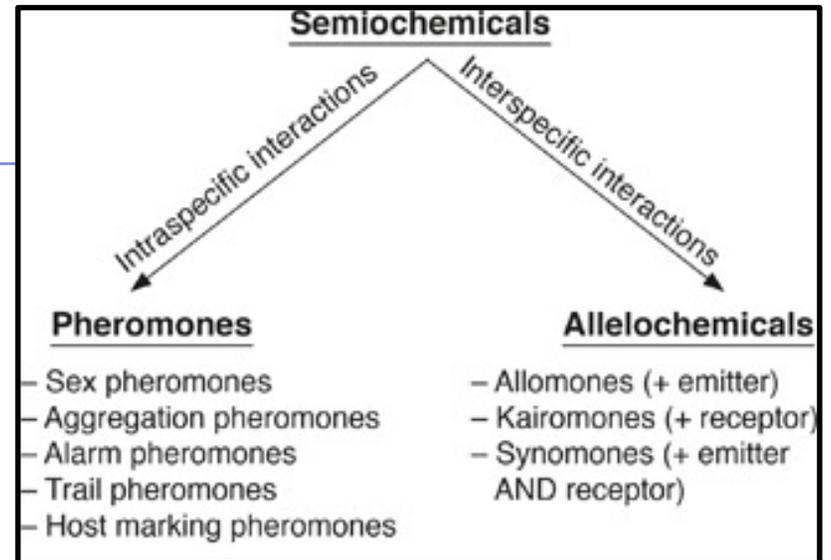


The female lion lures male by spreading sex pheromones, but also by posture & movements

marking territory



# Chemical signals



**Spider using moth sex pheromones it secretes, as allomones, to lure its prey - the moth who is tricked into thinking he will be mating**



## Honey Bee Chemical Messages

PHEROMONE	FUNCTION	SOURCE
Sex Attractant	Sex attraction	Mandibular glands
Aphrodisiac	Sexual stimulation of drones	Mandibular glands
Swarm orientation substance	Orientation of flying swarm	Mandibular glands
Swarm stabilisation substance	Stabilisation of landed swarm	Mandibular glands
Queen substance	Inhibit queen replacement & worker ovary development	Mandibular glands
Alarm Odour	Defence alarm	Vicinity of worker sting
Alarm Tag Odour	Mark site of attack	Vicinity of sting chamber
Alarm substance	Provokes attack	Mandible gland of worker
Scent gland secretion	Orientation of position and direction.	Nasanov gland of worker

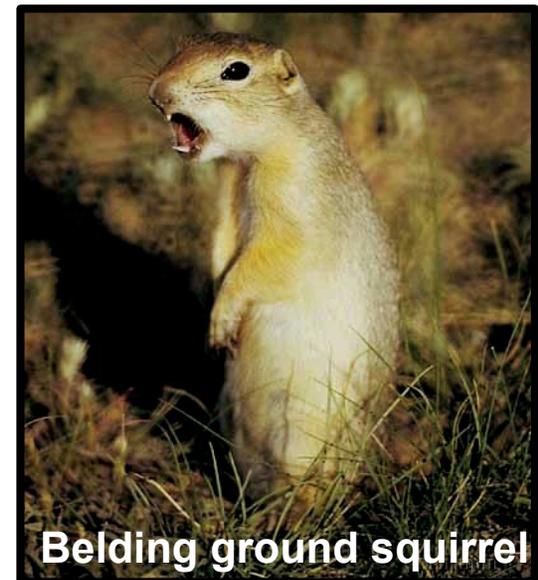
# Selflessness behaviors



- **Belding ground squirrels live in mountainous regions of western US**
  - ◆ **Predator = coyotes and hawks**
    - A squirrel that sees a predator approach gives a high pitched alarm all that alerts unaware individuals to retreat to their burrows
    - ◆ **Conspicuous alarm behavior however increases the risk of this particular squirrel being killed by drawing attention to its location!!!**
      - **This seems to go against what is expected from natural selection!**



**How can this be of adaptive value?**

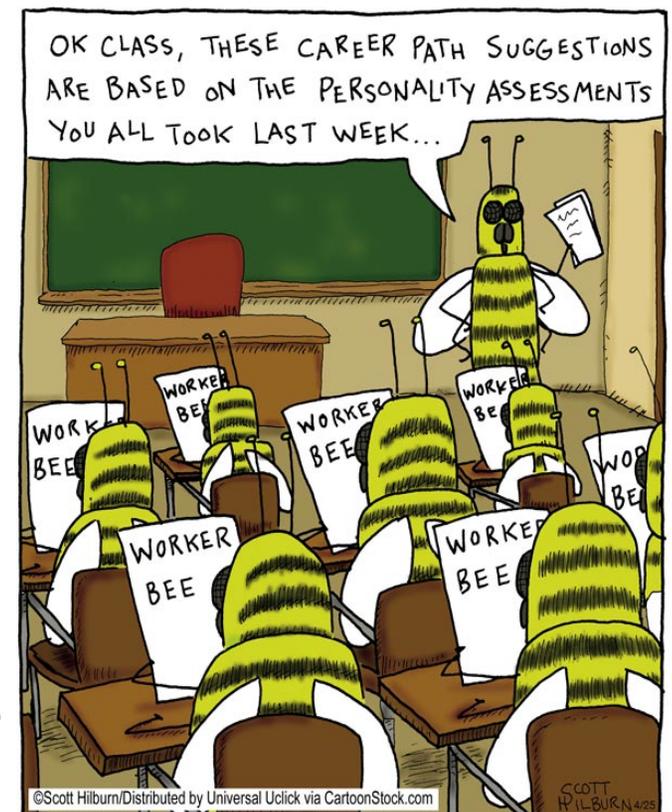


**Belding ground squirrel**

# Kin Selection



- When parents sacrifice for their offspring, they increase their fitness by maximizing genetic representation in the population
  - ◆ Altruistic behavior
    - reduces individual fitness but increases fitness of recipient
- Biologist William Hamilton proposed that animals could similarly increase their genetic representation in the next generation by helping close relatives
  - ◆ Selection might also favor helping siblings or helping one's parents produce more siblings
  - ◆ KIN SELECTION = the natural selection that favors altruistic behavior by enhancing reproductive success of relatives
    - Ex: In a honey bee colony, have one queen that mates while all her daughters are sterile worker bees. These sisters sacrifice their lives to protect the hive or die working for the benefit of the queen.



# Inclusive Fitness

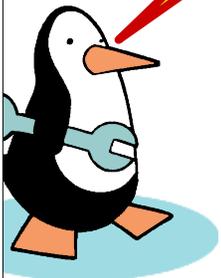
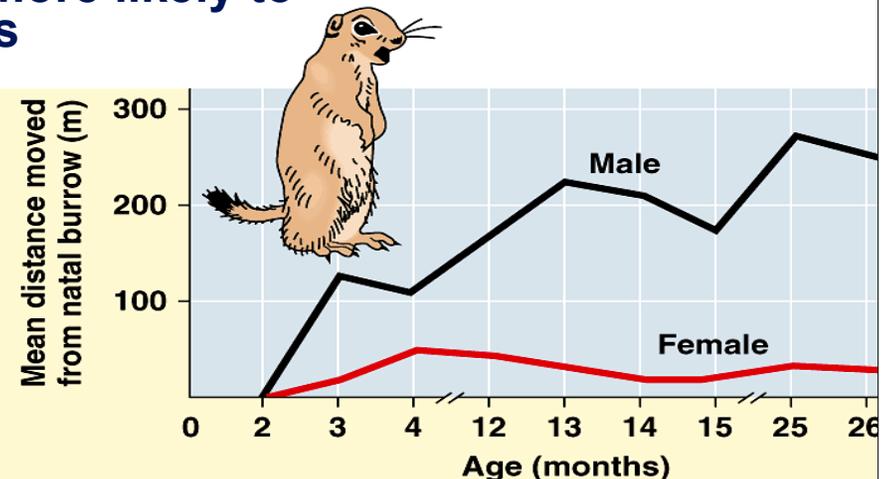
- Hamilton developed the idea of **Inclusive fitness** = the total effect an individual has on proliferating its genes by **1.** producing its own offspring **AND** **2.** by providing aid that enables other close relatives, who share many of those genes, to produce offspring

I would lay down my life for 2 brothers or 8 cousins! **NO LESS!**

**Kin selection weakens with hereditary distance!!!**

- In the ground squirrels we see an example of **KIN SELECTION**
  - BUT females are more likely to be altruistic than males among these squirrels... Why?**
    - Females after weaning are more likely to keep living close to relatives
    - alarm calls** increase the survival of close relatives and thus passes mutually shared genes on to the next generation

**This increases the inclusive fitness of the female alarm caller.**



# Reciprocal Altruism

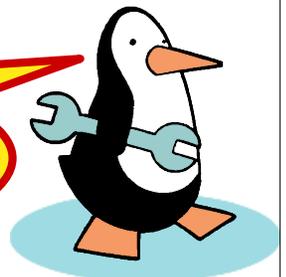


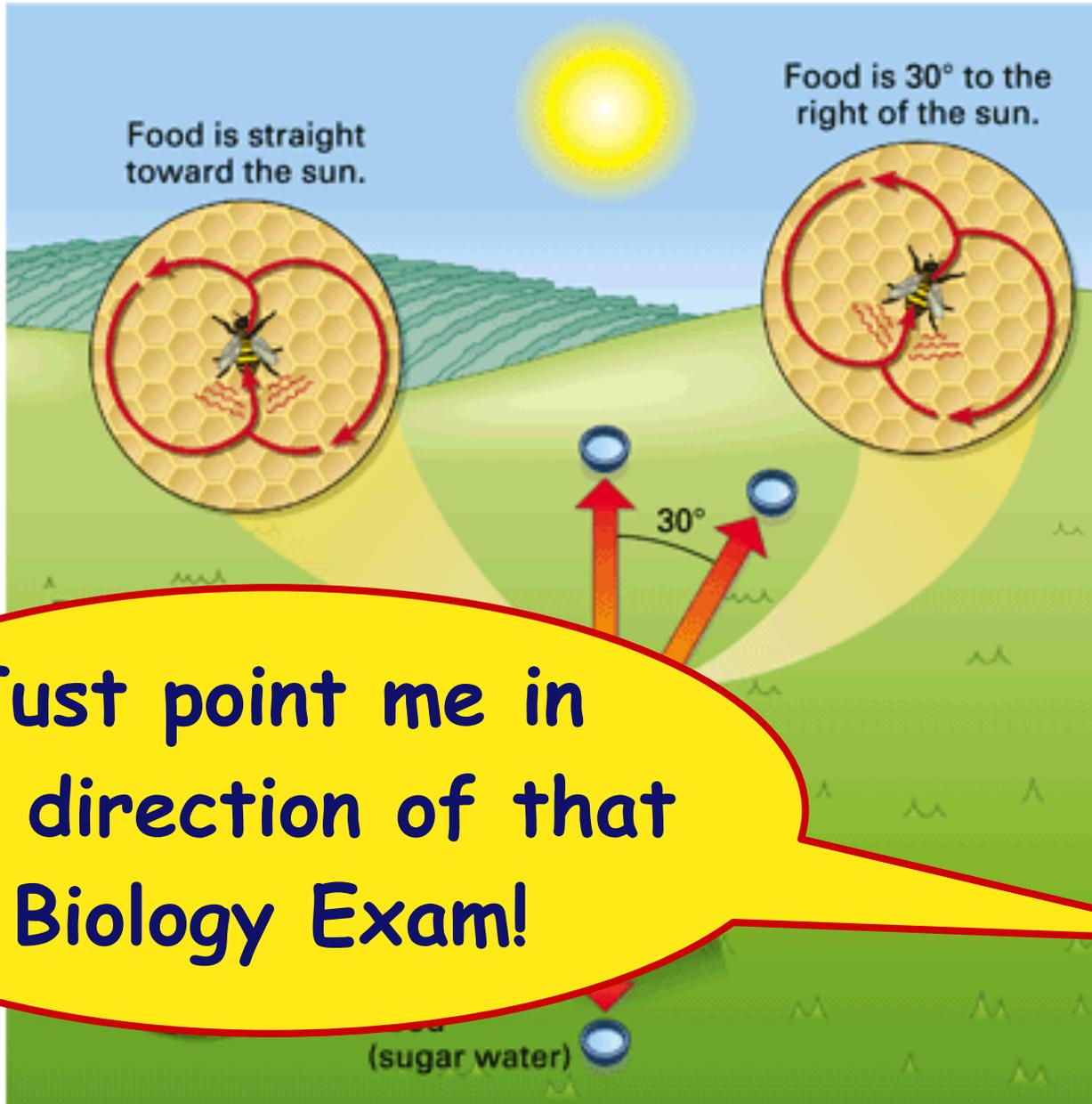
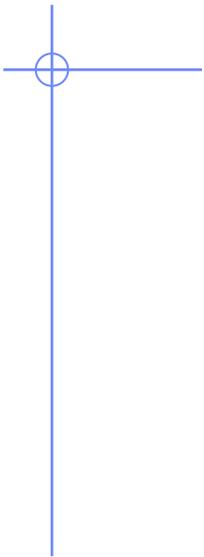
- ◆ In **Kin Selection**, natural selection that favors altruistic behavior that enhances the reproductive success of relatives (*and therefore yourself*)
- ◆ **Reciprocal Altruism** = A behavior whereby an organism acts in a manner that temporarily reduces its fitness while increasing another organism's fitness, with the expectation that the other organism will act in a similar manner at a later time.
  - ◆ **This involves altruism between non-relatives.**
  - ◆ Such altruism is limited largely to species like with social groups stable enough that individuals have many chances to exchange aid over the course of a lifetime.
    - ◆ **Chimpanzees & humans for instance.**



There would be a negative consequence associated with not returning favors to individuals who had been helpful in the past.

I'll scratch your back so hopefully one day you'll scratch my back in return.





**Just point me in  
the direction of that  
Biology Exam!**

