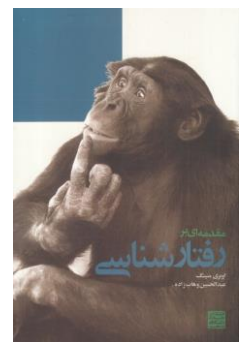
# ANIMAL BEHAVIOR

## منابع

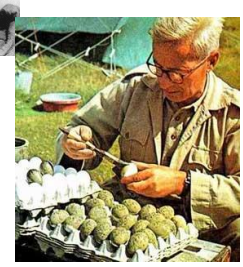

# Behavior: What is it?

- ❑ Behavior:
  - Everything an animal does & how it does it
    - – Study of Animal behavior is also referred to as Ethology.
    - – Scientists who study animal behavior are called Ethologists.
- ❑Ethology:
  - The scientific study of how animals behave, particularly in their natural environment

# Ethology: The pioneers in the study of animal behavior – 1973 Nobel Prize

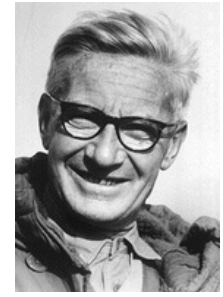
Karl von Frisch

Niko Tinbergen



Konrad Lorenz

Niko Tibergen(noble prize holder) pioneer (first to do something) in the field of ethology and ornithology.– Observed animals in their natural conditions, then manipulated the conditions to see how the animals responded



Niko Tinbergen(Dutch)

## Karl von Frisch

His work centered on investigations of the sensory perceptions of the honey bee and he was one of the first to translate the meaning of the waggle dance.

## Examining the Birdsong through Tinbergen's 4 Questions

- 1. Causation:
  - Complex vocal organ
  - Neural circuits activated by high hormone levels
- 2. Development:
  - Raised in environment full of conspecific songs
  - Learned
- 3. Evolution:
  - All birds have a syrinx
  - Evolved near beginning of bird evolution
- 4. Function?

**Behavior results as a reaction to a stimulus**

–A stimulus is a detectable change in the animal's internal or external environment.

–Hunger.
–Sound.
–Pain.
–Visual cues(stimulus).

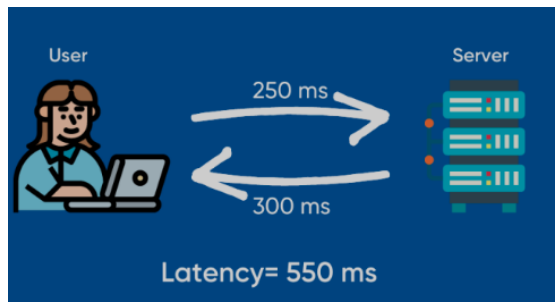
Type of behaviors

**رفتار های پیچیده** : حس گرسنگی و رفتار جفت گیری رفتار پیچیده است

**رفتارهای بازتاب** : رفتار های غیر ارادی هستند که در مراکز بالای سیستم عصبی یعنی مغز بررسی نمی شود



# latency



# Types of behaviors

**Innate behaviors**

- Automatic, developmentally fixed
- Despite different environments, all individuals exhibit the behavior

**Learned behaviors**

- Modified by experience
- Variable

# Animal Learning

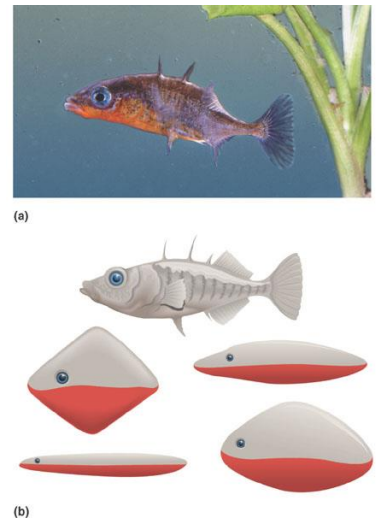
**Innate**

- Fixed action Pattern
- Imprinting

- **Learned**
- Associative learning
  ex: Classical conditioning
  ex: Operant conditioning
- Habituation
- Insight (cognitive) learning
- Observational learning

# Fixed Action Patterns

- Innate behavior
- Sequence of behaviors that are essentially unchangeable and conducted to completion once it is started
- Triggered by a sign stimulus
- Ex: Male stigglebacks exhibit aggressive territoriality…attack on red belly stimulus




# Fixed Action Patterns

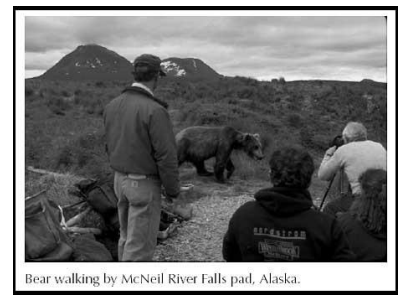
**Fixed-Action Pattern**: Graylag goose rolls the egg back to the nest using side-to-side head motions.

**Sign stimulus**: The appearance of an object near the nest. If the goose loses the egg during the retrieval process, it stops the head motion, but continues the "pulling" motion of retrieval.

- **Fixed-Action Pattern**: The begging behaviour of newly hatched chicks (raised heads, open mouths, and loud cheeps).
- **Sign stimulus:** Parent landing at the nest.

# Habituation

- **Loss of responsiveness to unimportant stimuli.**
- **“cry-wolf” effect**
- **Learn <u>not</u> to respond to repeated occurrences of stimulus**
- **Ex: Brown bear habituation - bear viewing leads to bear tolerating people at close range**



Bear walking by McNeil River Falls pad, Alaska.

# Imprinting

- Innate behavior that is learned during a critical period early in life
- Both learning and innate components
- Ex: Konrad Lorenz was “mother” to these imprinted graylag goslings

# Imprinting

- 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 ultra light plane acts as a surrogate parent.

Crane handlers wear special suits to prevent the cranes from imprinting on humans

# Insight Learning

- Is the ability to do something right the first time with no prior experience. It requires reasoning ability – the skill to look at a problem and come up with an appropriate solution.

# Observational Learning

- **Is the ability of an organism to learn how to do something by watching another individual do it first, even if they have never attempted it themselves.**

- chimps would observe the chimp in the cage that had insight learning and stacked the boxes to get to the bananas, see the failure, and then see the solution.
- When these chimps got in the cage, bang-zoom, they got to the solution a lot faster, arguably due to modeling effects.

# Observational learning

- Young chimpanzees who watch their mothers crack nuts with rock tools before learning the technique themselves

# Associative learning

Is the process by which animals take one stimulus and associate it with another. Or Associative learning, in animal behavior, any learning process in which a new response becomes associated with a particular stimulus. In its broadest sense, the term has been used to describe virtually all learning except simple habituation (q.v.). In a more restricted sense, it has been limited to learning that occurs through classical and instrumental conditioning

- Learned behavior
- Examples:

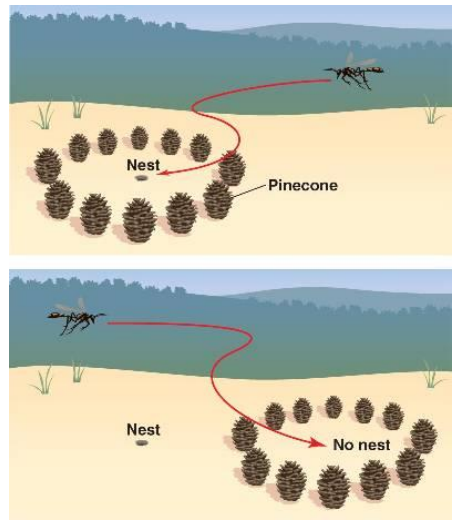
    Classical conditioning

    Operant conditioning

# External stimulator

- Arouse
- Elicit
- Orientate

# Tinbergen experiment




## Consequence of any stimulator on mind
(in mammals)

- Specific sensory pathway
- Non-specific pathway

## Different sensory capacity

- Compound eyes:
  - Infrared detection  honeybee or light frequency

## Other examples

- Cat
- Dog
- Electric Muscle for orientation

# Animal Communication

- Animals communicate in many ways…communication need not always be vocal

➢Chemical communication

➢Visual communication

➢Auditory communication

➢Tactile communication

## Chemical communication

– Pheromones

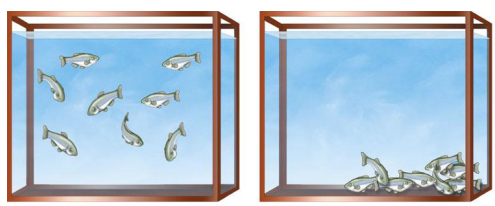
Alarm pheromones

Sex pheromones

Trail pheromones

Trail pheromones

Alarm pheromones - minnows



**(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.

Sex pheromones - insects

# Visual Communication

- Communication through the use of visual cues
- Ex: Tail feather displays of male peacocks

# Auditory Communication

- Bird song:
- Mixed learned and innate
- Most have a critical learning period

Red winged blackbird

- Insect Song:
- Innate, genetically controlled
- Frogs croaking in the spring

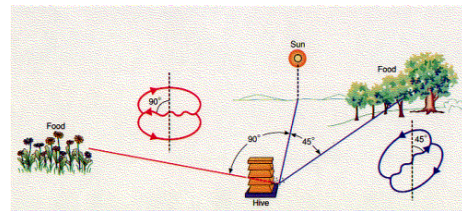
# Tactile communication

- Communication through the use of touch
- A major form of primate tactile communication is grooming

A subordinate monkey grooming a dominant monkey.

# Honeybee Communication

- Bees provide an example of communication that involves chemical, tactile, and auditory components.
- Bees do a “waggle dance” to communicate location of food
- Dance provides distance and directional cues
- Chemical cues – regurgitation of food source provides information “what kind of food”



# Animal Social Behaviors

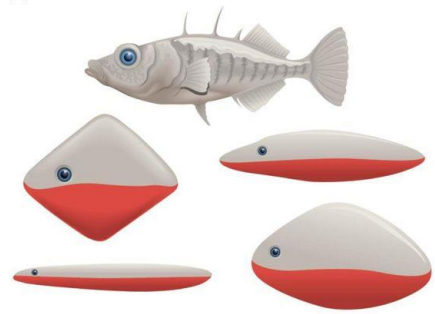
## **Agonistic behavior**:

- Results from conflict over resources
- Often involves intimidation and submission
- Often a matter of which animal can mount the most threatening display and scare the other into submission (symbolic: ususually no harm done)

## Sign stimuli

Sign stimuli in a classic FAP fixed action pattern

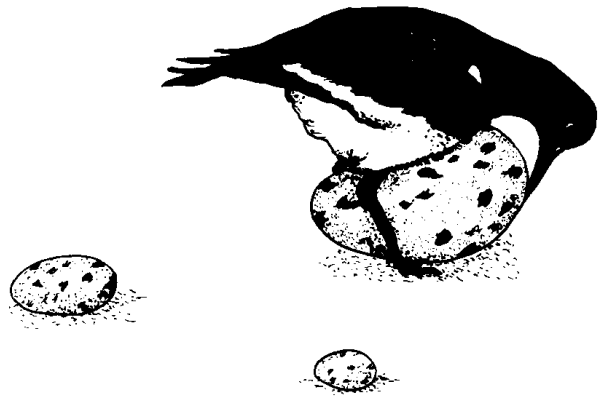
(a)



(b)

## محرک های فوق طبیعی(Supernormal stimuli)

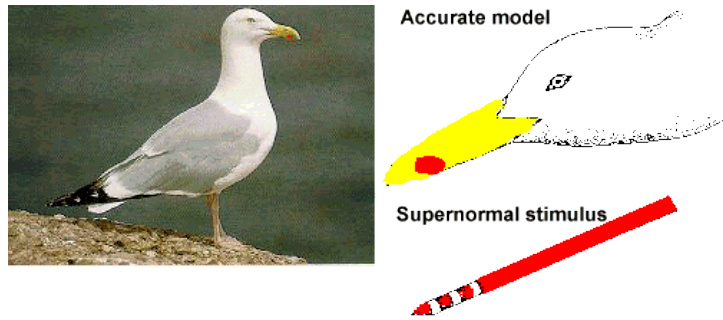
- Egg size
  - Size
  - Number



## محرک های فوق طبیعی

- Silver gull

# Supernormal stimuli




# محرک های فوق طبیعی

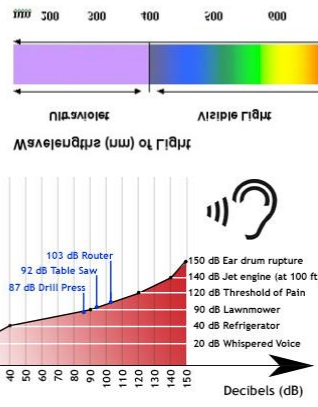
- fritillary butterfly

# غربال محرک ها

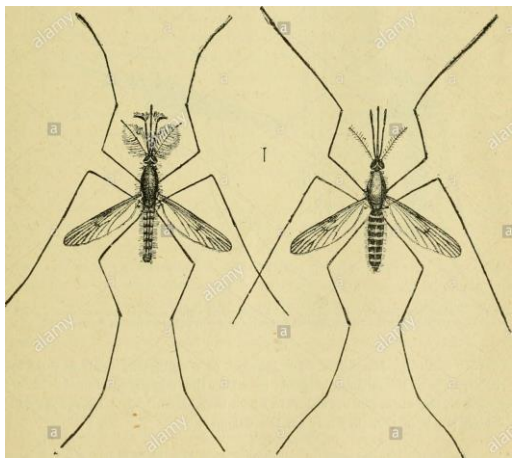
- ۳ میلیون رشته های عصبی ورودی مغز هستند
- هر یک یک کلید روشن و خاموش ۲ به توان ۳۰۰۰۰۰۰
- مغز ۱۰ به توان ۱۰ نرون دارد
- پس تعداد نرون از عدد قبلی کوچکتر است
  - لذا غربال کردن:
    - محیطی
    - مرکزی

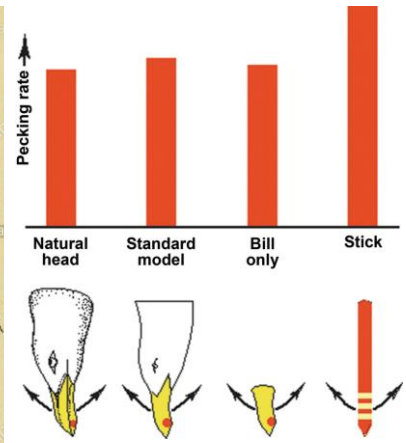
# غربال کردن محیطی

- Ultra violate wavelength
- Hearing limitation
- Male mosquito react the sound of female wing beats



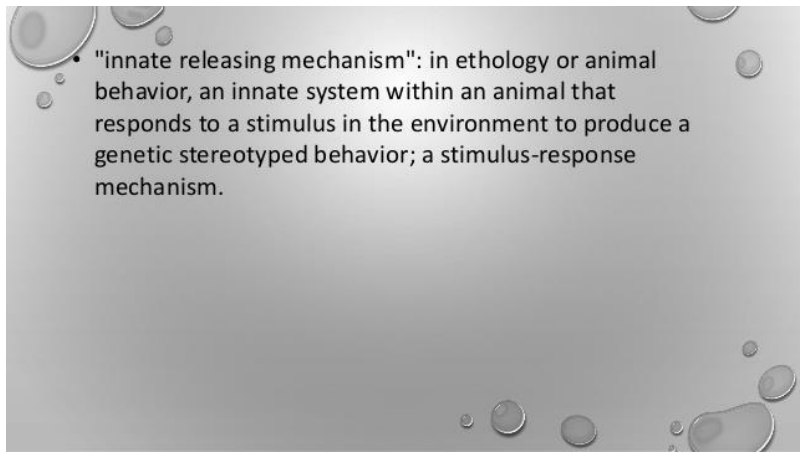

Peripheral filtration

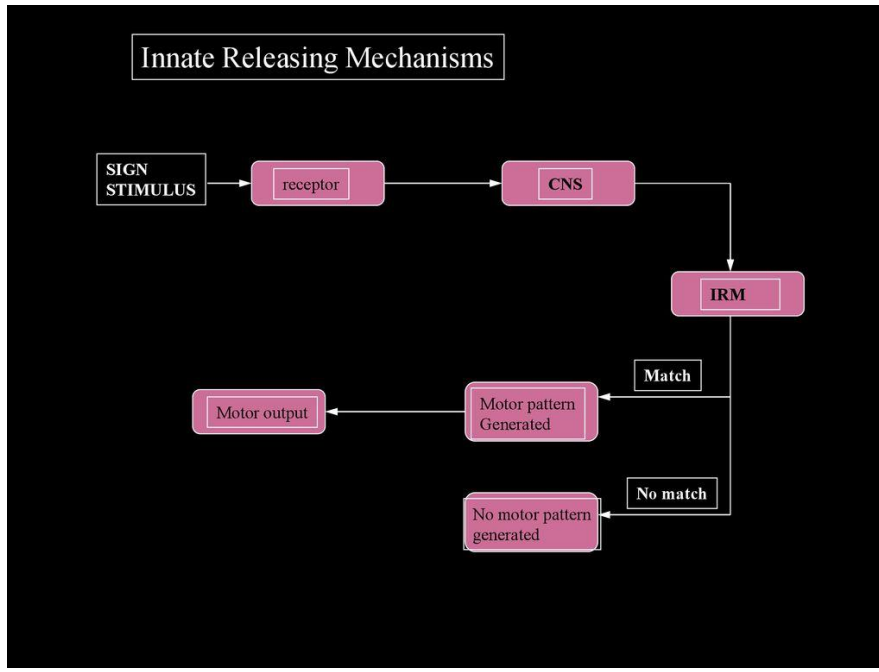





# غربال کردن مرکزی

- IRM innate releasing mechanism

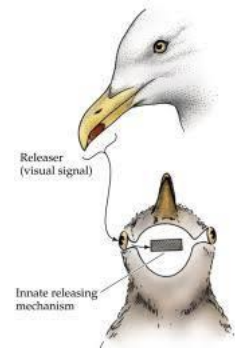





- Innate Releasing Mechanism (IRM)
- Neural mechanism ("hardware") that is genetically determined.
- It triggers behavioral response in the presence of SS.
- This dependence is however not very strict.
- In the presence of an additional stimulus, It may be a conditioning case.

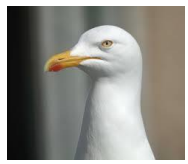
**Instinctive Behavior**

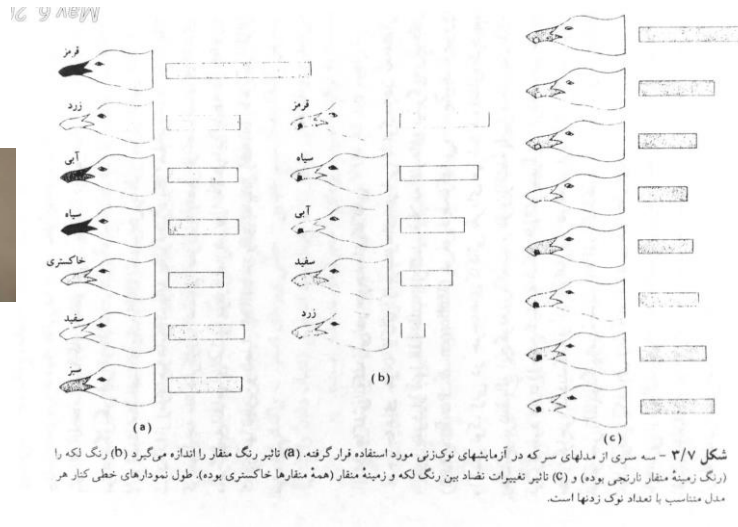
- Fixed Action Pattern (FAP)-
- If there is enough ASE and the SS is present, the organism will exhibit well-defined, species-specific behavior sequences.
- Different individuals in a species produce nearly identical behavior to a SS. Once initiated, FAPs continue until completion. Or until exhaustion of the energy.



**واکنش نوک زنی در جوجه های کاکایی(غربالگری مرکزی و محیطی)**

- Red spot on the tip of beak






**شکل ۳/۷** – سه سری از مدلهای سر که در آزمایشهای نوک‌زنی مورد استفاده قرار گرفته. (a) تاثیر رنگ منقار را اندازه می‌گیرد (b) رنگ لکه را (رنگ زمینهٔ منقار نارنجی بوده) و (c) تاثیر تغییرات تضاد بین رنگ لکه و زمینهٔ منقار (همهٔ منقارها خاکستری بوده). طول نمودارهای خطی کنار هر مدل متناسب با تعداد نوک زدنها است.

# سازگاری متقابل رهاساز و IRM

واکنش هشدار به پرواز پرنده شکاری

Common linnet

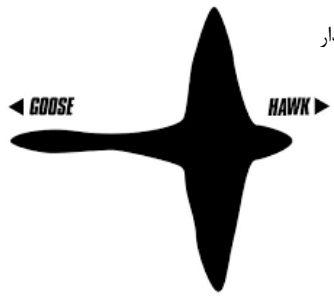
# Audio stimuli

# Sign stimuli in moth

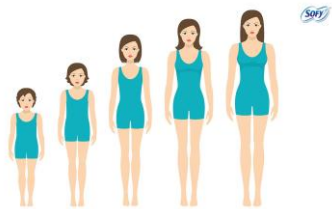
# Gull : egg incubation or eating

# Alarm call

- در پرندگان زمینی: قرقاول، غاز، اردک
- ازمایشات صورت گرفته و نتایج آنها:
- گردن کوتاه و سرعت نسبی و کز کردن و اوای هشدار



## Stimulator and different response



- Motivation
- Learning
- Puberty
- Synaptic fatigue

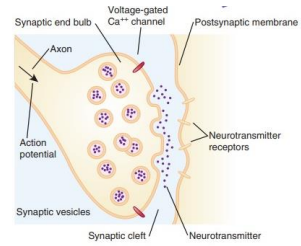


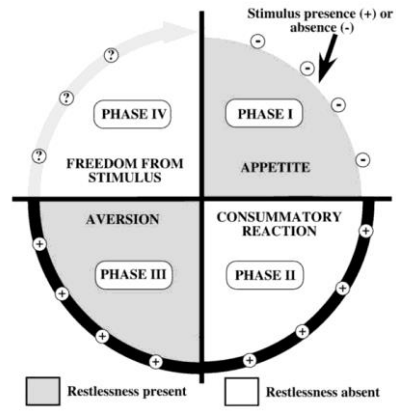

FIGURE 11-10 Chemical synapse.

# Motivation

- Complex behavior
  - هر محرک نوعی برانگیختگی از طریق تشکیلات مشبک ایجاد می کند و باعث ایجاد **انگیزش عمومی** می شود.
  - یک انگیزش تخصصی را **میل یا Drive** می نامند
  - هر انگیزش همراه با احساس نیرومند ذهنی است که عاطفه نام دارد.

## رفتار بعد از انگیزش (تغییرات انگیزشی)

- Appetitive behavior
  - searching phase of a **behavioral** sequence
- Consummatory acts
  - the stereotypic phase and tend to result in the termination of a **behavioral** sequence
  - Freedom




## سازمان اجتماعی

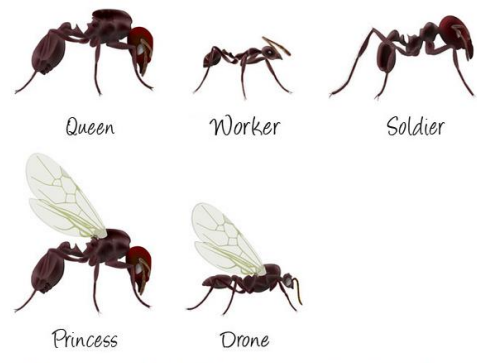
- Soft and hard social organization
- Natural selection act on individual

# چهار قله تکامل اجتماعی

- بی مهرگان کلنی زی
- حشرات اجتماعی
- پستانداران غیر انسان
- انسان

# Social association in invertebrate

- Colony member relationship
  - Joining to next colonies
  - Kinship
  - Number
  - Stereotype
  - Group member recognition



# Social association in vertebrate

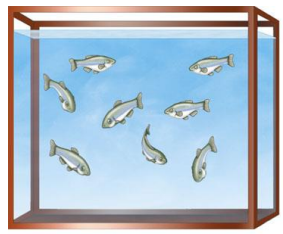
- Number
- Kinship
- Flexible
- Joining to the other groups
- Group member recognition


# Aggregation

## Flock of fish or bird

## Benefits of social life

- بالا بردن سازگاری
- بهینه کردن شرایط محیطی
- حفاظت در مقابل صیادان
- تامین غذا
- تحریک و همزمانی تولید مثل



**(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.

# Herd nutrition

- Attraction by the others
- Prey displacement

# حشرات اجتماعی

- تقسیم کار و ارتباط اجتماعی
- افزایش طول عمر از طریق همپوشانی نسل ها
  - موریانه
  - سوسری ها

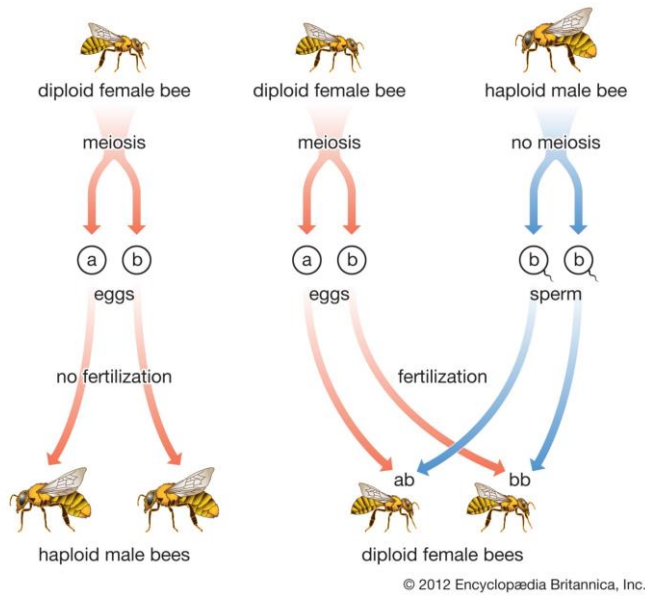
## جوامع واقعی حشرات Eusocial animal

- Isoptera
- Hymenoptera

# ویژگی کلنی های حشرات

- خویشاوندی
- تعداد
- تولید مثل
- تقسیم کار و نقش
-

## Sex determination in hymenoptera



# تاسیس کلنی جدید

- زنبور عسل
- دیگر حشرات اجتماعی

# تکامل رفتار