



UNIT 5

BEHAVIOR

4/16/2015

By Y. Mulissa

What is behavior?

- The observable response a person makes to any situation
- A manner of acting or conducting yourself
- The way a person behaves towards other people
- The action or reactions of a person or animal in response to external or internal stimuli
- The response or reactions or movements made by an organism in any situation.

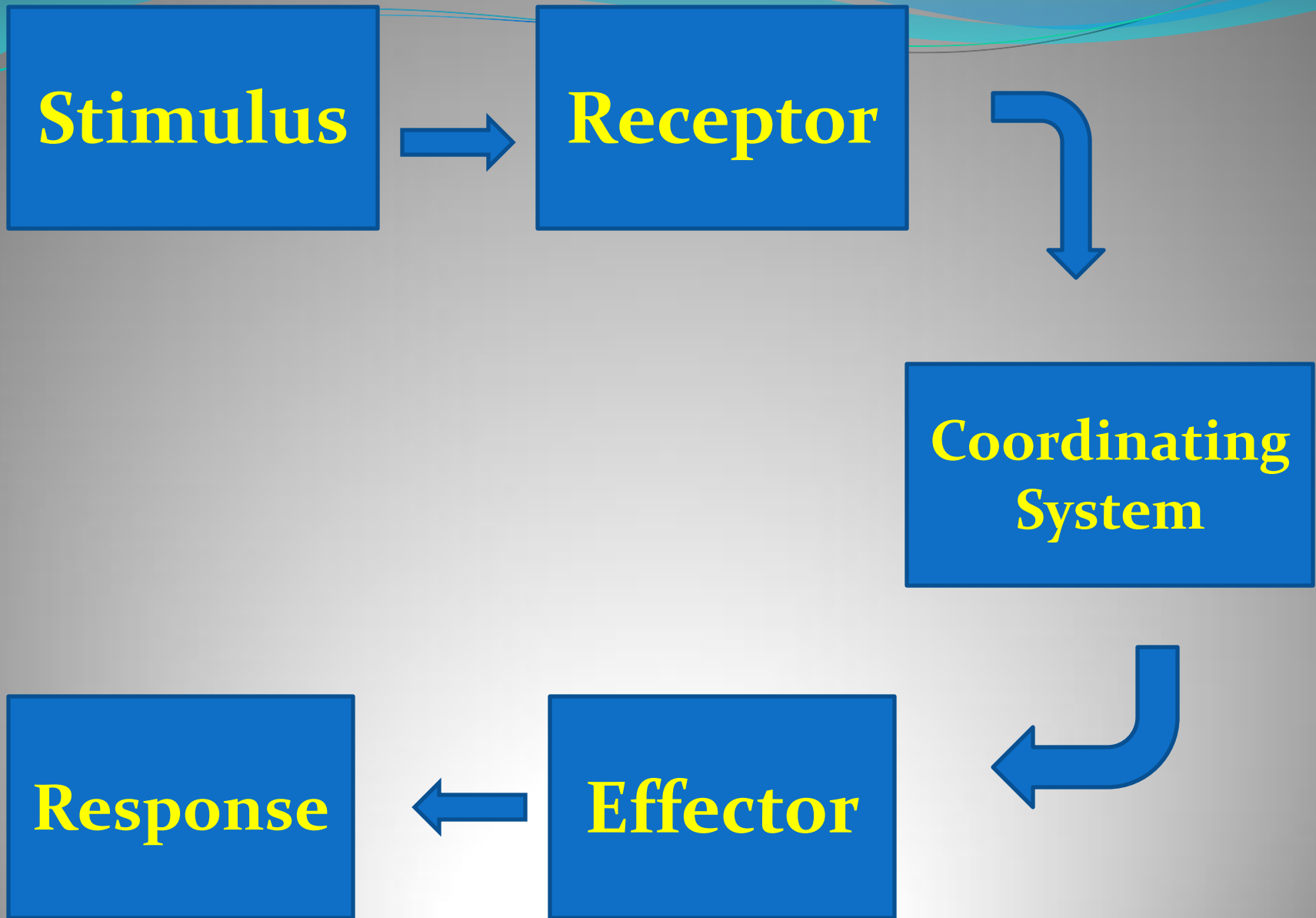


- From biological point of view it is defined as
- **The coordinated response of an organism to an internal or external stimulus.**
- For an organism to show a coordinated response, then any behavior must have these components.

A/ A receptor

B/An effector

C/Some kind of linking system or coordinating system that is influenced by the receptor and can influence the effector.



How do plants respond unidirectional stimuli?

- Tropism-is the directional growth movement in plants

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graph TD; A["Tropism  
Tropism"] --> B["Positive  
If the directional growth movement is towards the stimulus"]; A --> C["Negative  
If the directional growth movement is away from the stimulus"];
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Tropism

Positive

If the directional growth movement is towards the stimulus

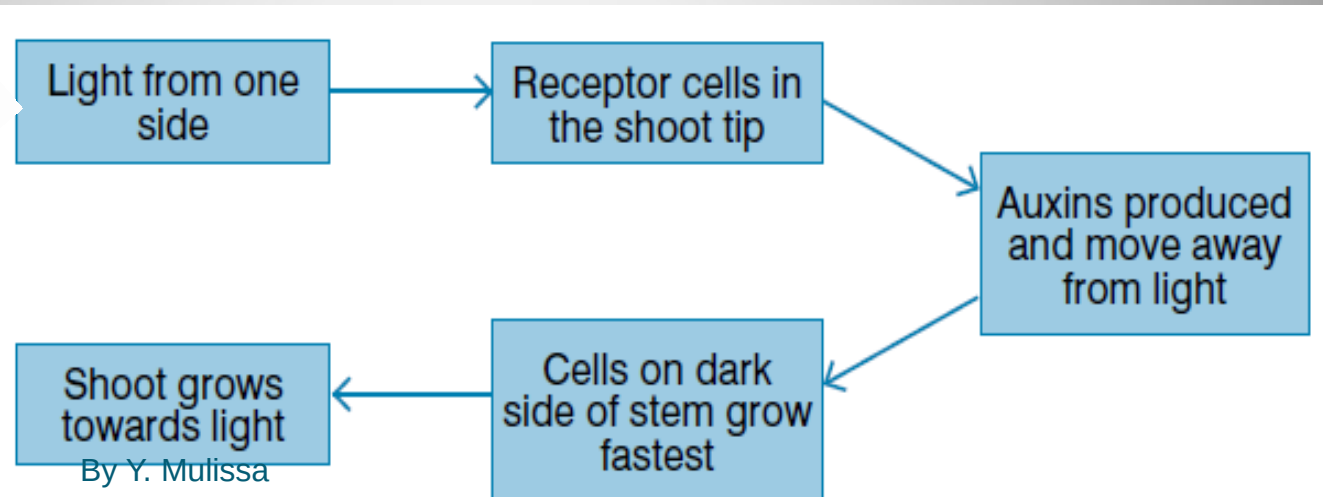
Negative

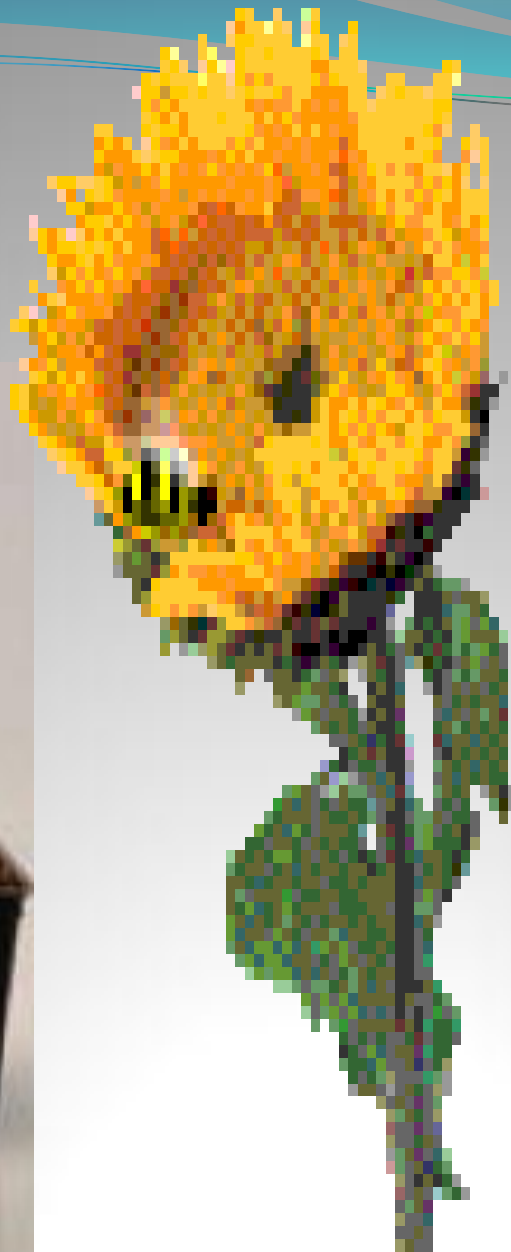
If the directional growth movement is away from the stimulus

Five types of tropisms in Plants

1. Phototropism
2. Hydrotropism
3. Geotropism/gravitotropism
4. Thigmotropism
5. Chemotropism

Figure 5.3 Phototropism in plant shoots





How do simple animals respond to stimuli?

A/Taxes(Singular taxis)

- Animals moves along a gradient of intensity of the stimulus (+ve taxis)
- Away from the greatest intensity(-ve taxes)

Ex. Euglena swims towards areas of increased light intensity

B/Kineses(Singular kinesis)

- Change in the light intensity (stimulus) brings about a change in the rate of movement
- Not in the change of direction of movement

Example -Woodlice increase their rate of movement in bright light.

What is innate behavior?

- It is inborn
- Present at birth or hatching
- Does not have to be learned

Ex. The young herring gull 'knows' if it pecks the orange spot on the beak of the adult gull, it will receive food.

- There is no gene that is directly codes for pecking mother's beak but there are genes that code for the development of the appropriate neural pathways to allow the behavior to be carried out



By Y. Mulissa

Types of innate behavior

1. Reflex actions

- Simplest innate behavior

Ex. Knee jark, sneezing, blinking of an eye

2. Orientational

- More complex behavior

Ex. Kineses ,Taxes

3. Instinctive behaviors

- Involve most complex behaviors, but there is always a fixed action pattern(FAP)
- Once begun ,the FAP is carried out to completion ,even if other stimuli intervene



Examples

1. The withdrawal of your hand from a hot object (reflex)
2. Blinking when some dust gets in your eye (reflex)
3. The kinesis of woodlice in responding to changes in light intensity & humidity (**Orientalional**)
4. Nest building (instinctive)
5. Imprinting (inst)
6. Weaving a web (instinctive)



How are human reflex actions brought about?

Reflex action

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graph TD; RA[Reflex action] --> S[Somatic]; RA --> A[Autonomic]; A --> SD[Sensory division]; A --> Sy[Sympathetic]; A --> Pa[Parasympathetic];
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Somatic

- Involve special senses like eyes, ears, pressure detectors etc.
- Produce response by a muscle.
- Uses SNS that integrates information from the special senses to produce responses in skeletal muscles.

Autonomic

- Involve sensors in internal organs.
- Produce response in internal organs.
- Uses ANS that integrates information from receptors in the internal organs & produce responses in organs or glands

Sensory division

Transmits sensory nerve impulses in to CNS

Sympathetic

- Transmits impulses from the CNS to organs
- Prepares the body for fight or flight

Parasympathetic

- Acts antagonistically to the sympathetic
- Prepares the body for rest and repair

How are human reflex actions brought about?

➤ Two kinds of reflex actions.

A. Somatic reflexes

- ❖ Involve special senses like eyes, ears, pressure detectors etc.
- ❖ Produce response by a muscle.
- ❖ Uses SNS that integrates information from the special senses to produce responses in skeletal muscles.

Ex. Knee-jerk & withdrawal from hot object reflexes.

B. Autonomic reflexes

- ❖ Involve sensors in internal organs.
- ❖ Produce response in internal organs.
- ❖ Uses ANS that integrates information from receptors in the internal organs & produce responses in organs or glands

Classes of Autonomic nervous system

A. Sensory division

- Transmits sensory nerve impulses in to CNS

B. Sympathetic

- Transmits impulses from the CNS to organs
- Prepares the body for fight or flight

Example

- By increasing the cardiac out put & pulmonary ventilation

C. Parasympathetic

- Acts antagonistically to the sympathetic
- Prepares the body for rest and repair

Example by decreasing cardiac out put & pulmonary ventilation

What are biological clocks?

- They are internal regulatory mechanisms that controls different cyclical responses in living things
- Can be daily, monthly or yearly
- Are genetically programmed

A. Circadian rhythms

- *Circa* = about *dies* = a day
- Have two main features
 1. They will continue with a period of about a 24 hrs in the absence of environmental cues
 2. They can synchronize to an 24 hrs cue, such as the light –dark cycles & this is called **entrainment**.

- The biological clock of mammals and other animals is found in a small area of the hypothalamus of the brain called **suprachiasmatic nucleus**.
- Sends impulse to a gland known as **pineal gland** that secretes a hormone called **melatonin** during the night & then promotes sleep fullness
- Controls the sleep wake time.

B.Circannual (yearly) rhythms

- As the day length changes ,so will the duration of melatonin secretion

Example- Reproductive behavior of animals

- Long day (summer breeders)
- Short day (winter breeders)
- ✓ Day length triggers these changes
- Many other animals show circannual rhythms in behaviors such as
 - a) Migration
 - b) Hibernation
 - c) Coat growth
 - d) Camouflage coloring

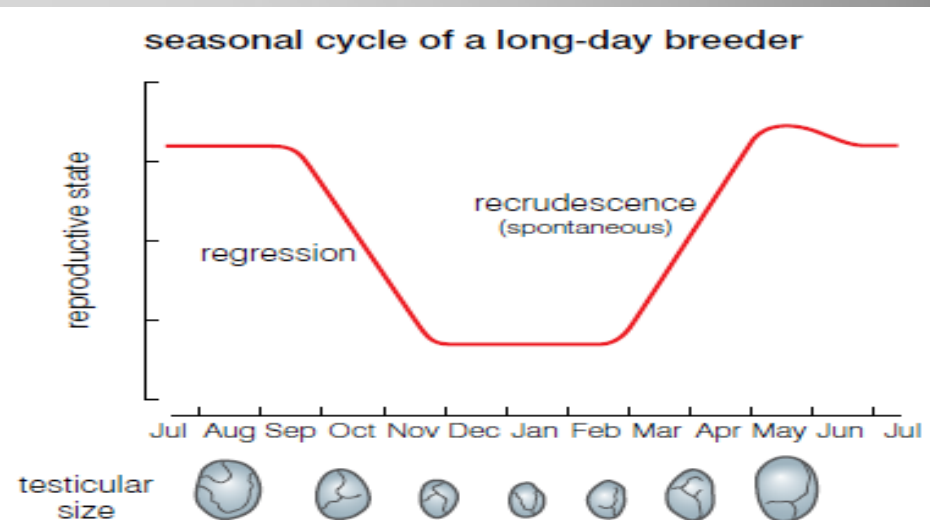


Figure 5.11 The relationship between size of testis and time of year in a hamster (a long-day breeder)

INSTINCTIVE BEHAVIOR

- ✓ Are pre programmed patterns of behavior.
- ✓ Involve a complex sequence of actions.
- ✓ Does not have to learn how it do it.

Ex. The spinning of a web by spider .

- It spins a perfect web the very first time as well as every other time afterwards.



Instinctive behaviors have the following xcs.

1. Common to all member of the species.
2. Fully functional the first time they are performed(require no learning)
3. There is a key stimulus that triggers the behavior
4. There is an innate releasing mechanism that links the stimulus to the response(nervous /hormonal)
5. There is a FAP in response to the key stimulus that is always the same.
6. Are adaptive –they have been retained in the species by natural selection because they confer a survival advantage.

Ex.

- A. The feeding behavior of herring gulls .
- B. Aggressive behavior in Stickle backs fish
- Niko Tinbergen (Ethologist) – male Stickle backs fish are very territorial; they will attack any other male invading their territory.(Red color on the male is the stimulus that triggers the behavior).

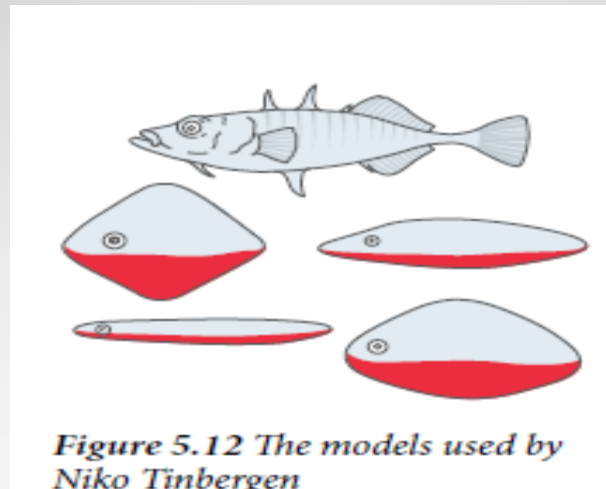
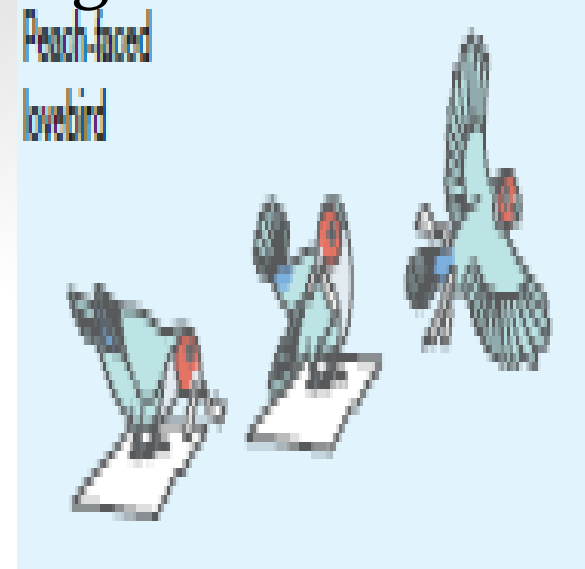


Figure 5.12 The models used by Niko Tinbergen

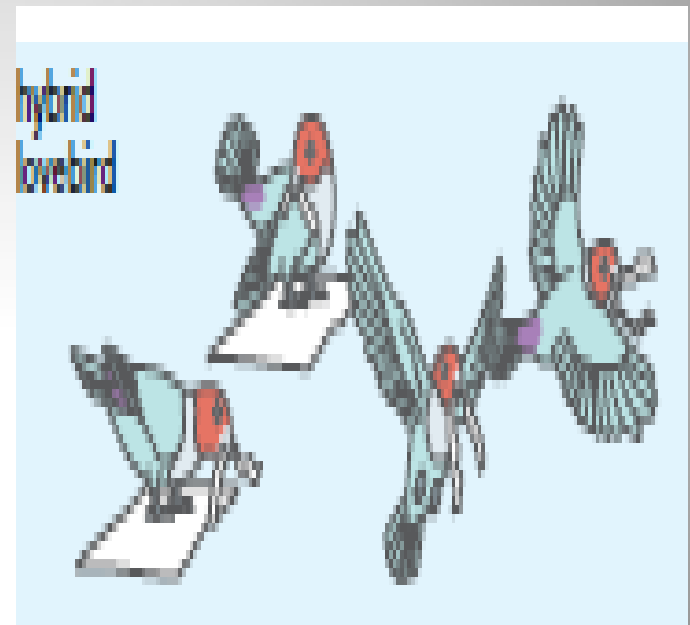
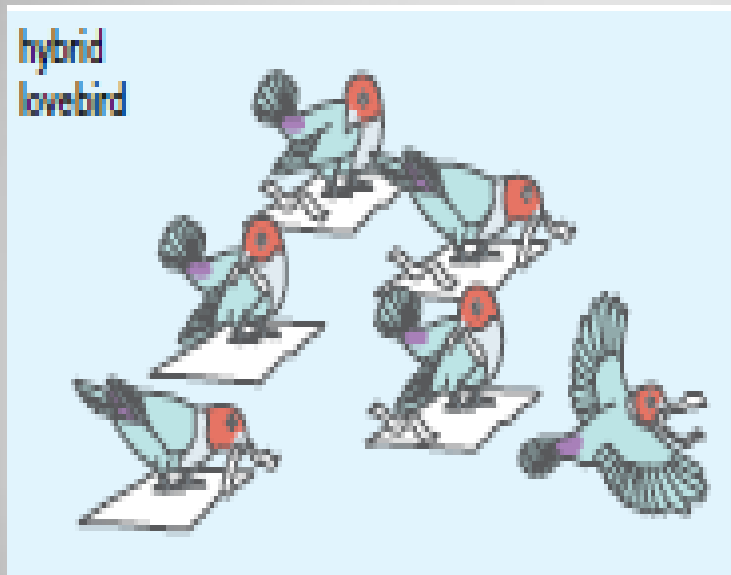
Nesting behavior of loving birds.

➤ Two different species with different nesting behaviors were interbreed.

1. Female Fischer's lovebirds cut long strips of nesting material, which are carried individually to the nest.
2. Female peach faced lovebirds cut short strips and carry several at a time by tucking them in to their back feathers.



- ❖ Hybrid females from the cross exhibited the following behaviors .
 - a. cut intermediate length strips
 - b. Tried ,but failed to transport them by tucking in to back feathers
 - c. Learned to carry strips in their beaks



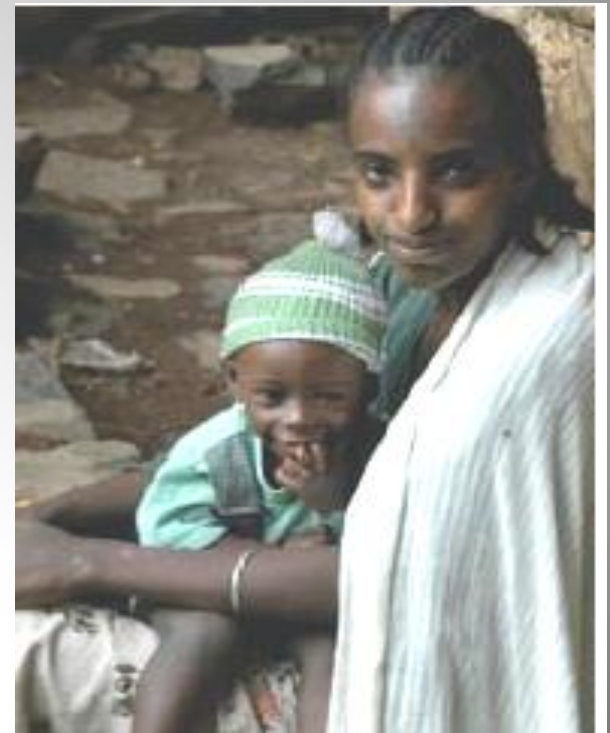
Imprinting

- Is another type of instinctive behavior.
- Is the type of behavior in which newly born/hatched organisms imprint on or attached to the first thing they see.
- It is rapid, irreversible unrewarded and occurs at sensitive period.

Example – The famous experimenter Konrad Lorenz experiment on imprinting behavior of geese/gosling

- One batch was normally hatched by the geese.
- The other batch was hatched by Lorenz in an incubator.
- ❖ Result- those gosling hatched by k. Lorenz finally imprint on him while the others normally imprint on the geese.
- There is a time gap for imprinting.
- If it does not take place in the first two days after hatching ,then the gosling will not imprint

- So, imprinting have too survival value.
- Similar pattern of behavior is found in human infants .
- It is called **attachment formation**.
- Involves the formation of a strong emotional bond between the infant and its primary care givers /mothers.



Three stages.

i. **0-2 months** – pre attachment

- ❖ The infant prefers people to objects
- ❖ Does not really discriminate between **different** peoples.

ii. **2-7 months** – indiscriminate attachment

- ❖ The infant begins to show a preference for familiar people

iii. **7 months onward** - true emotional attachment to one person initially, although multiple attachment often from soon afterwards

What is learned behavior?

- The strengthening of existing responses or the formation of new responses to existing stimuli that occurs because of practice or repetition
- Rarely fully functional the first time they are performed.
- Trial and error brings about an improvement in the effectiveness of the behavior pattern.



Figure 5.16 Prairie dogs in their burrow

Innate behavior

- Genetically determined & common to all members of a species
- Fully functional at the first attempt
- No modification of the behavior
- Adaptive behavior that has been retained as a result of natural selection

Learned behavior

- The behavior is changed by or develops through, experience & may vary from individual to individual
- The animal develops the behavior via trial and error or by insight
- May be modified by new experiences
- Learned anew by each member of the species and may not be adaptive

Types of learned behavior

1. Habituation

- Progressive loss of responsiveness to repeated stimulation
- Is the fall or elimination of response to frequently occurring stimuli that have no effect on the animals well being
- An act or process of becoming accustomed to something
- Is simply dropping responses instead of adding stimulation, which is not followed by any kind of reinforcement.

Q. What is the benefit of habituation?

2. Sensitization

- Is almost opposite phenomenon of habituation
- is a period of high responsiveness to stimuli less
- is an increase in the response to a harm stimulus when that stimulus occurs after a harm full stimulus.

3. Associative learning

- involves modifying an innate response by pairing it with a previously neutral stimulus.

A. Classical conditioning

- A naturally occurring stimulus becomes associated with a different stimulus.
- Classical conditioning involves modifying an innate response by pairing it with a previously neutral stimulus.
- Discovered by Russian physiologist Ivan Pavlov
- Involves various stimulus and responses including

I. The unconditioned stimulus (US)

- Unconditionally, naturally & automatically triggers a response
- Example - Smelling favorite food

II. Unconditioned response (UR)

- Unlearned response that occurs naturally to the unconditioned stimulus
- Example – feeling hunger

III. Conditioned stimulus(CS)

- Neutral stimulus
- Does not initially produce the unconditioned response (UR)
- It triggers the same response after association with the unconditioned stimulus (US)

IV. Conditioned response (CR)

- Is the response to the previously neutral stimulus

➤ Pavlov's research involved the following phases:

- a. He fed the dogs at regular intervals to establish a routine; as he fed them, they salivated: this is a natural unconditioned response to the (natural) unconditioned stimulus of food.
- b. Then, as he fed them, he rang a bell; they continued to produce the same unconditioned response (salivation) as the food was presented and the bell was rung.
- c. After a period, the dogs salivated when the bell was rung without food being presented; this is now a conditioned response to a conditioned stimulus.

1. Before conditioning



food



response



salivation

unconditioned
response

unconditioned
stimulus

2. Before conditioning

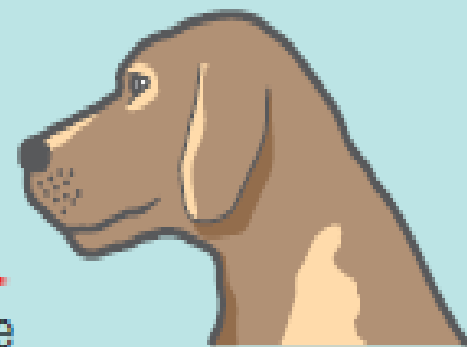


handbell

neutral
stimulus



response



no salivation

no conditioned
response

3. During conditioning



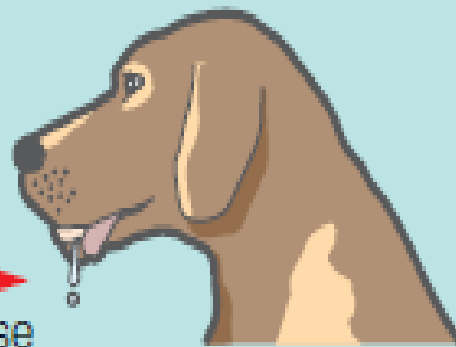
handbell



food



response



salivation

unconditioned
response

4. After conditioning

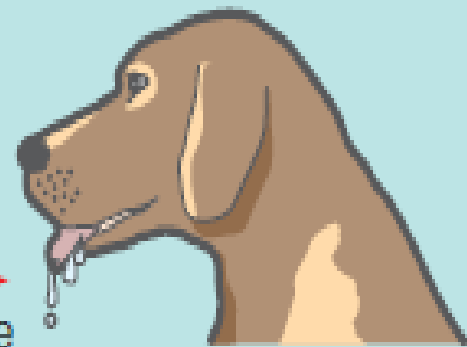


handbell

conditioned
stimulus



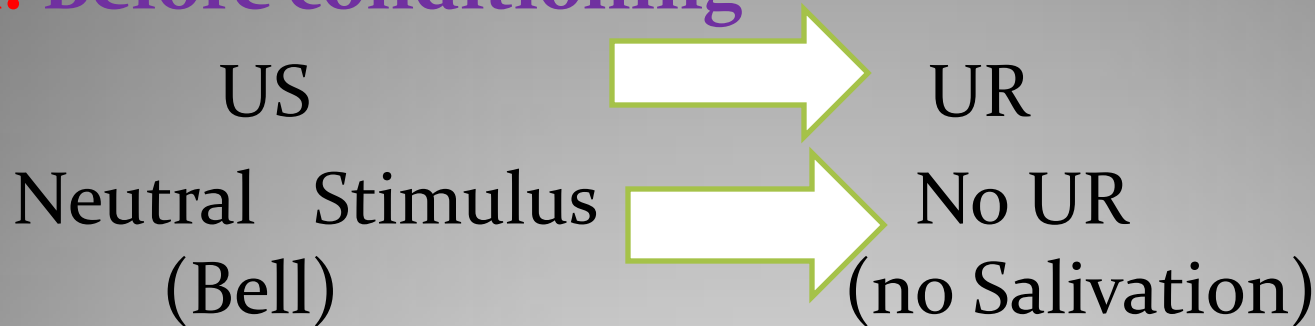
response



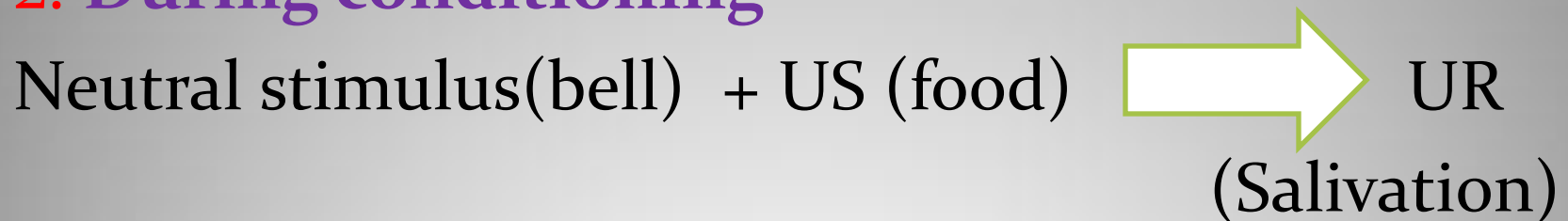
salivation

conditioned
response

1. Before conditioning



2. During conditioning

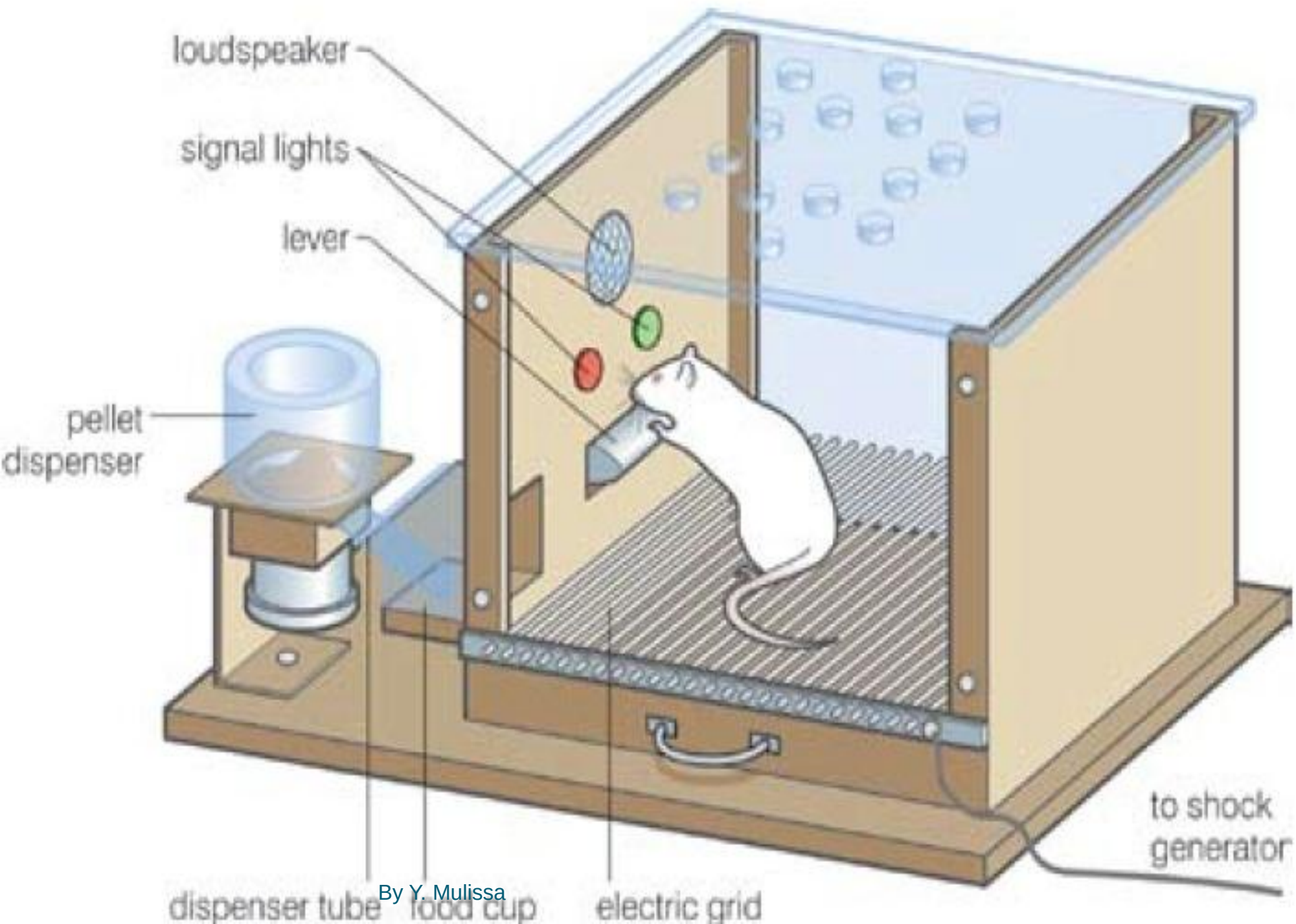


3. After conditioning



B. Operant conditioning

- Operant conditioning can modify more complex, voluntary behaviours by the animal/ person learning to associate the behaviour with certain **specific consequences**.
- The term 'operant conditioning' was first used by a behaviorist psychologist **B.F Skinner**
- Can modify more complex voluntary behaviors by animal or person, learning to associate the behavior with specific consequences.
- Involves modifying an innate response by pairing it with a previously neutral stimulus.
- B.F Skinner identified three types of responses that he called **operants** that can follow behavior.



1. Neutral operants – responses from environment that neither increase nor decrease the probability of a behavior being repeated.

2. Reinforcers - – responses from environment that increase the probability of a behavior being repeated.

☞ Can be positive or negative.

3. Punishers- responses from environment that decrease the probability of a behavior being repeated.

Q . What is shaping?

☞ It is the technique animal trainers use to train animals to perform in a specific ways.

Q. What is the difference & similarity between classical and operant conditioning?

- An animal may be reinforced for **each successive approximation** towards the final goal of the desired trained behavior

Q. What is approximation?

- Examples where shaping is used
 1. Training guide dogs for the blind
 2. Training horses
 3. Training Dolphins and killer whales at marine parks
 4. Training Zoo animals

Latent learning

- Latent – is to mean hidden.
- It is learning that is not apparent as it takes place.
- Happens when the brain acquires knowledge at a certain time without reinforcement.
- Does not use it until later at a time when that knowledge is needed.
- Involves finding solutions to problems that are not based on actual experience.

- Is the ability of an animal to respond correctly to the time ,to a situation different from any other previously encountered experience.
- Is confined to animals with more advanced brain development like primates.
- Based on thought and reasoning.

Q. **What is Anthropomorphism?**

- Is the tendency of humans to interpret animal actions in the light of human responses.

Insight learning

- This is very different from the trial-and-error learning that is often an important part of learning through operant conditioning.
- Insight learning involves finding solutions to problems that are not based on actual experience as with trial and error but on 'trials' occurring mentally.
- Often the solution is learned suddenly, such as when a person has been trying to solve a problem for a period of time and suddenly the solution appears almost 'out of nowhere'.
- Much of the pioneering research on insight learning was carried out by Wolfgang Kohler, working with chimpanzees



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By Y. Mulissa



Courtship behavior?

- Courtship behaviour is an activity that precedes and results in mating and reproduction.
- It allows members of a species to recognize each other and prevents or reduces attempts/challenges at interbreeding between different species.
- Courtship may simply involve a few chemical, visual or auditory stimuli, or it may be a complex series of acts by two or more individuals using several methods of communication

- Elaborate courtship rituals can also help to strengthen already established pair bonds. These may then last through the time it takes to rear the young and, in some cases, even longer.
- There are many different methods of communication that are used to attract a mate. These include:
 - a. the use of pheromones by some female insects to attract males from a distance
 - b. the use of touch by painted turtles
 - c. the courtship songs of frogs heard on spring nights in many different countries
 - d. the song of a humpback whale under the sea, which can be heard hundreds of miles away

1. **alarm pheromones** that are secreted by animals when attacked and produce the response of flight or aggression by others of the same species
2. **releaser pheromones** that are highly volatile and can attract a mate from a distance of two miles or more
3. **territorial pheromones** that are used to mark the boundaries of a territory by the owner; dog urine contains a powerful territorial pheromone
4. **sex pheromones** that signal the availability of a female for mating

Territorial behaviour

- Territory is any space that an animal defends **against intruders** of the same species.
- Territorial behaviour is found in nearly every species of animal, even humans.
- Possessing territory gives the holder areas to forage for food and so increases the chances of attracting a mate.
- It also reduces vulnerability to predators.
- Animals that do not have a territory of their own may contest with the owner for a territory that is already occupied.

- Such contests are called conspecific (same species) conflicts.
- Territorial animals usually defend areas that contain one or more of:
 - a. a nest
 - b. a den, or mating site
 - c. sufficient food for themselves and their young
- Males are usually the territorial sex, but in some species (such as fiddler crabs) females maintain a territory also.
- When conspecific conflicts occur, they usually involve ritualistic displays and rarely involve the animals actually fighting.

- Residents of a territory are difficult to dislodge as they are often older and more experienced
- Defence threat displays may be visual as in the colour of feathers or fur, auditory as in birdsong or the howls of gibbons or olfactory through the deposition of scent marks.
- Many territorial mammals use scent marking (containing pheromones) to signal the boundaries of their territories.

- The resident animal usually holds on to his (or her) territory only by expending considerable time and effort in its defense.
- Sunbirds, for example, can use up to 13 000 kilojoules per hour patrolling and defending their territory.
- This is more than the recommended daily energy intake for the average adult human male
- So, to expend that amount of energy, the territory must contain, at the very least, an abundance of food to support it.

- The Ethiopian wolf (*Canis simensis*) is a social animal; the wolves live and hunt in packs. As a result, they maintain a group territory by marking with urine (containing pheromones).
- All adult animals (male and female) contribute to this marking behaviour, particularly during patrols of the territory.
- Some of the subadult (younger) males occasionally mark but subadult females nevermark.
- Direct encounters between neighbouring wolves at the borders were aggressive and involved repeated chases, with the larger group more likely to win



By Y. Mulissa



- Some animals defend their territory by fighting with those who try to invade it.
- But this is the exception, rather than the rule.
- Marking a territory usually 'warns off' intruders.
- Animals that do not mark territories use threats from one, or more, of *vocalisations*, *smells* and *visual displays*.
- The songs of birds and the loud calls of monkeys are warnings that carry for considerable distances, and warn intruders that they are approaching someone else's territory.

- If these warnings are ignored, and the intruder enters the territory, or two animals meet near the border of their adjacent territories, they usually threaten each other with visual displays.
- These displays often either:
 - a. exaggerate an animal's size by the fluffing up of feathers or fur, or
 - b. show off the animal's weapons
- The animals may go through all the motions of fighting without ever actually touching each other, a behaviour known as *ritual fighting*

Social behaviour/ playing

- Social behaviour is the set of interactions that occur between two or more individuals of the same species that modify the behaviour of individuals of the same species in a way that is usually beneficial to the group as a whole.
- It is thought to have been selected for because it has survival value to the species as a whole.
- Social behaviour serves many purposes and is found in a wide variety of animals, including some invertebrates, fish, birds and mammals.
- Some of the benefits of social behaviour are that it allows animals to:

- form stable groups in which intra-specific aggression is reduced, sometimes as a result of hierarchies being established
- improve the effectiveness of reproduction and/or parenting through courtship behaviour (a kind of social behaviour) and pair-bond formation
- forage more efficiently - especially if sources of food are localized. Examples of this include:
 - i. dolphins often surround shoals of fish and take turns to swim quickly in and eat the fish trapped in the centre of the shoal
 - ii. lions hunt in small groups when hunting large prey (such as wild beast) but may hunt smaller prey singly



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➤ protect themselves against attack more effectively.
Examples of this include:

- i. baboons co-operate to fight off a leopard, which would be extremely difficult for a single baboon
- ii. fish and birds moving in groups in which the movement of the whole group is co-ordinated; rapid movements one way and then another make it more difficult for a predator to attack; individuals who cannot maintain position in the group are most vulnerable.

- increase the chance of surviving migration - some birds travel in large groups, for example, many geese fly in a 'V' formation, which reduces the total wind resistance on the birds; the lead position is rotated as this is the position that receives most wind resistance
- increase the chance of surviving extreme conditions - some birds huddle together in very cold weather, this effectively reduces the overall surface-area-to-volume ratio and can reduce heat loss by up to 50%; the birds constantly change position as the ones at the outside of the group lose heat most rapidly
- communicate across long distances.



Social behaviour in bees

- Honeybees and bumblebees and other species of insects exhibit what is called eusociality.
- Eusociality has three main features:
 - a. there is co-operation in caring for the offspring; as a consequence, many individuals are caring for offspring that are not their own
 - b. there are usually several generations in the colony so that it will sustain for longer and allow offspring to assist parents, and

- C. there is division of labour - not every individual in the group is reproductively active; in the case of bees, the queen is the only reproductively active female with the male drones also being active; the female worker bees are more or less sterile
- Honeybees nest in large cavities such as hollowed-out trees or other enclosed spaces.



- Honey bees build vertical sheets of hexagonal honeycomb from wax secreted by glands in their abdomens, in which they store honey and pollen.
- An individual hexagon (a cell) can also be used as a home for a single developing bee larva.
- There are three different types or castes of bees in a nest. They are:
 1. **the queen** - the only truly reproductively active female (1st caste)
 2. **workers** - non-reproductively active females (2nd caste)
 3. **drones** - reproductively active males (3rd caste)

Type of adult bee	What they do	How many in a honey-bee colony	How many in a bumble-bee colony	What they look like in a honeybee colony	What they look like in a bumblebee colony
Queen	Lay eggs	1	1		
Worker	Take care of larvae, build and clean nest, forage	10 000–50 000	Less than 50 to over 400, depending on species		
Male	Leave nest to mate, then die	100–500	0–50, depending on species and season		

- The queen secretes powerful pheromones within the nest that control the behaviour of the workers at different stages of their development and so help to maintain the social structure of the nest.
- She may also make aggressive attacks on maturing worker bees.
- If the queen does not produce these pheromones, or if she produces too few eggs, then the structure of the nest breaks down.
- She may be attacked by mature workers, one of whom will replace her

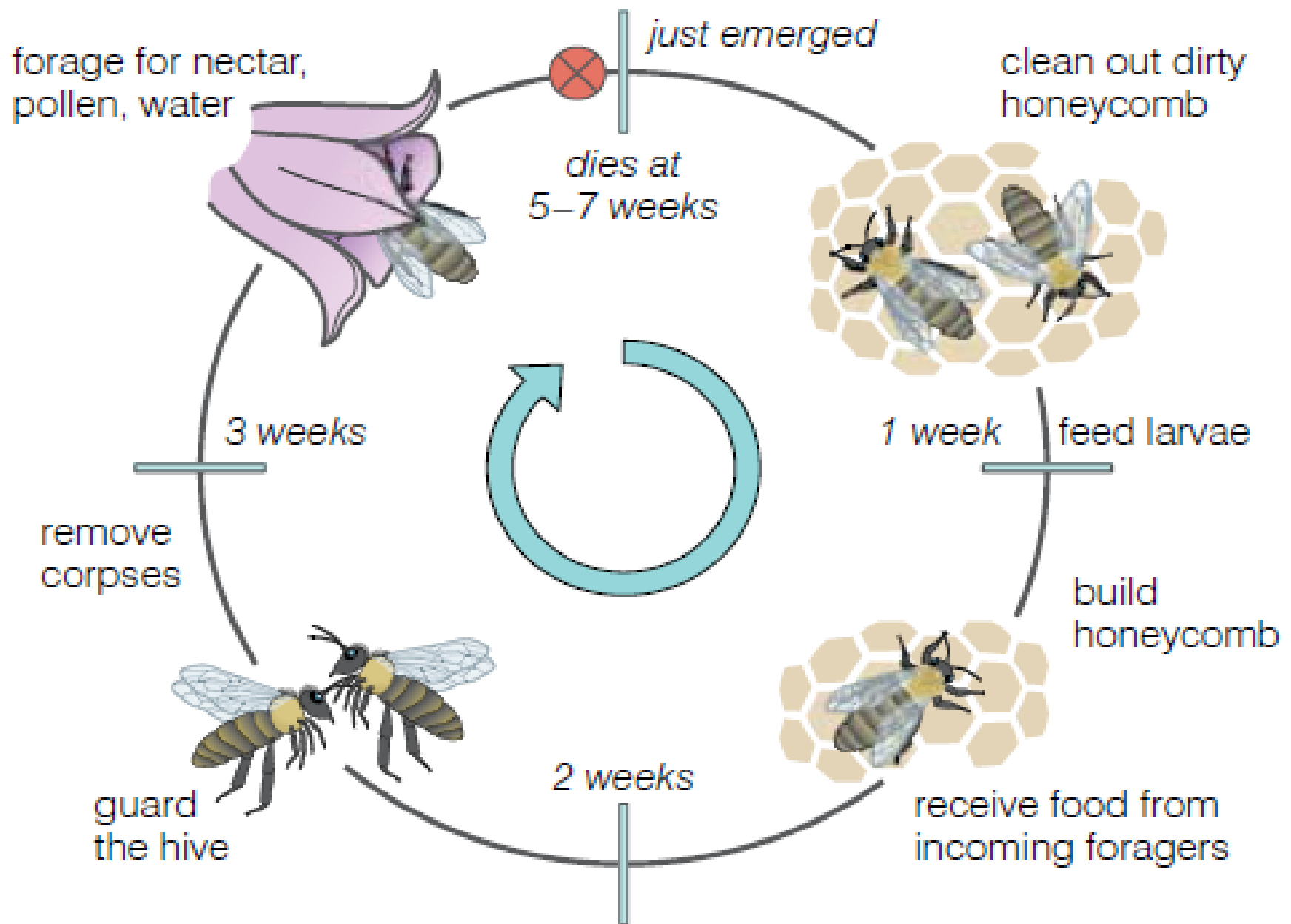
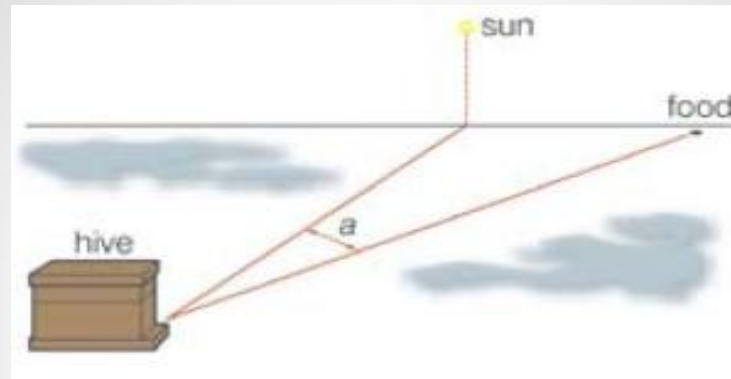
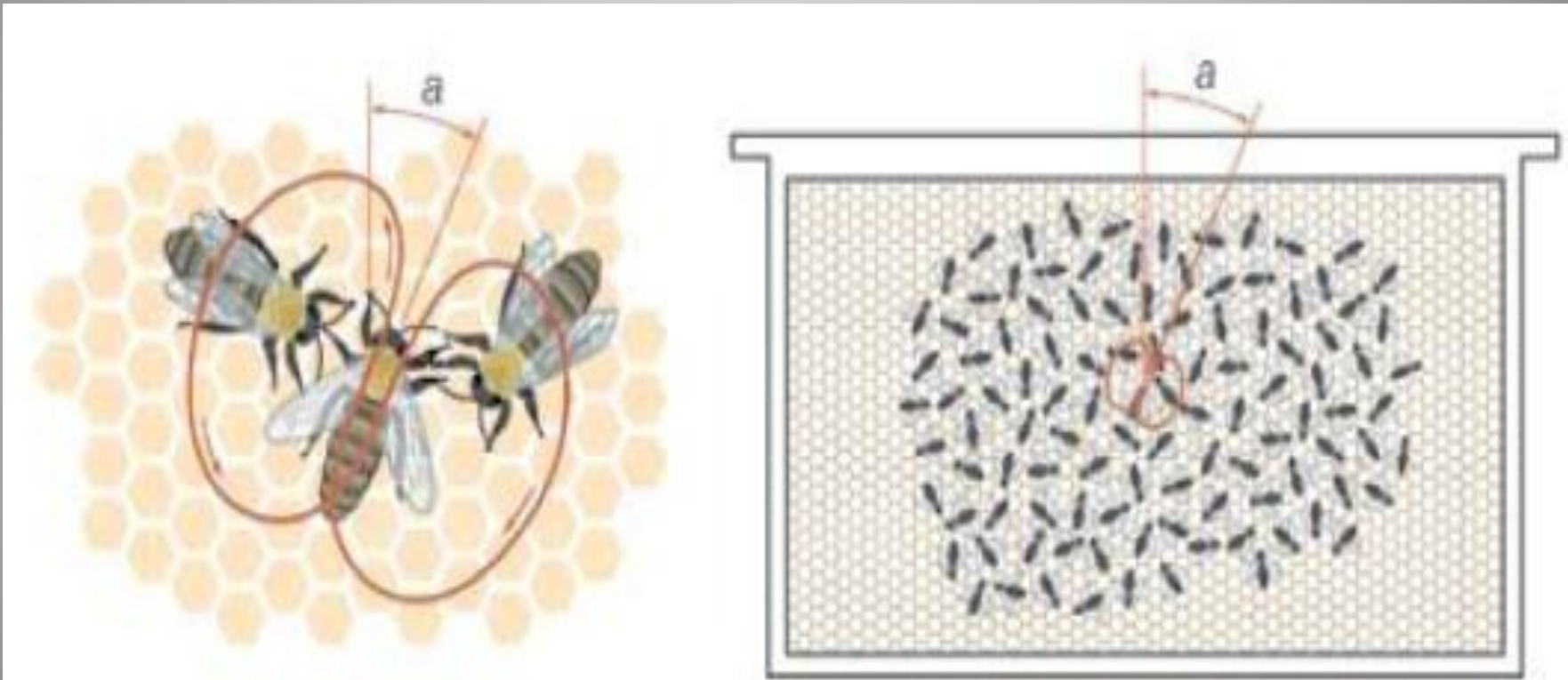


Figure 5.34 The roles of a worker bee at different stages of development

- Worker bees communicate with each other in a very special way to convey information about a source of nectar.
- Foragers perform a 'wag-dance' on the honeycomb to inform other workers of the direction of the nectar source and its distance.
- The dance takes the form of a 'figure of eight' on the vertical face of the honeycomb.
- Information about the nectar is conveyed in two ways:



1. the angle of the dance away from the vertical corresponds with the angle of the nectar from the Sun
2. the length of the 'straight-run' part of the dance is proportional to the distance from the nest



The orientation of the wag-dance on the honeycomb.

- Recent research shows that the foraging bees also use sound to inform other bees about the distance of the source, and, perhaps, to help to 'recruit' these other workers.
- The time for which they produce their sounds is directly correlated with the distance to the nectar source,

A vibrant, fantastical image of a floating island. The island is lush with greenery, has a small castle with a red roof and a tall tower, and is surrounded by a bright rainbow. The background is a deep blue sky with soft, white clouds. The entire scene is framed by a dark, textured border.

**Learning is
change in
behaviour.
So have you
brought this?**

በጣም
አመሰግናለሁ!

Galatoomaa!!

THE END