

CHAPTER
19**BEHAVIOUR****Key Concepts**

- 19.1 Nature of behaviour
- 19.2 Innate behaviour
- 19.3 Learning behaviour
- 19.4 Social behaviour

EXERCISE**SECTION I: Multiple Choice Questions****Select the correct answer from the following choices.**

1. The responses of an organism to signals from its environment are its:
 - (a) behaviour
 - (b) culture
 - (c) releaser
 - (d) motor programs
2. A form of learning in which a young animal forms a strong attachment to a moving object (usually its parents) within a few hours of birth is:
 - (a) classical conditioning
 - (b) insight learning
 - (c) imprinting
 - (d) habituation
3. In an insect society, such as the honeybee society:
 - (a) the division of labour is based on biologically determined castes
 - (b) all adult members share labour equally
 - (c) all adult members have the opportunity to reproduce
 - (d) reproduction is altered seasonally among adults
4. Working to a mathematics problem is an example of:
 - (a) insight learning
 - (b) an environment act
 - (c) an instinct
 - (d) reflex

- (a) classical conditioning
- (b) imprinting
- (c) insight learning
- (d) habituation

6. The benefits of territoriality include:

- (a) rights to defend a home range
- (b) increased reproductive success
- (c) monogamy
- (d) pair bonding

7. The round dance of bee:

- (a) indicates that the food is close to the hive
- (b) communicates direction
- (c) results in bees flying long distances in all directions
- (d) indicates that food is distant from the hive

8. When *Drosophila* were exposed to a particular odor and electric shock at the same time, they started to avoid the odor. This is an example of

- (a) classical conditioning
- (b) reasoning
- (c) imprinting
- (d) habituation

Answer

1	(a)	2	(c)	3	(a)	4	(a)	5	(d)
6	(a)	7	(a)	8	(a)				

SECTION II: Short Questions

Give short answers of the following questions.

Q1. Give examples of positive responses and negative responses.

Answer

The response to a stimulus can be:

- i) Positive response
- ii) Negative response or ignored as not important

A positive response is that in which one wants more or is attracted to the stimulus.

A negative response is that in which one wants to avoid the stimulus.

For example: A person laughs after hearing a funny joke, is a positive response or you make a face after smelling a sour odour is a negative response. The decision to ignore the stimulus is also kind of response as a dog pays no attention to sounds from television or your child ignores your order to clean up his room.

Q2. Define the following.

Answer

- i) Behaviour

ii) Biological Rhythms

Biological rhythms are cyclic pattern of physiological changes or changes in activity in living organism that are in response to periodic environmental changes. The internal mechanism by which such a rhythmic phenomenon occurs and is maintained even in the absence of an apparent environmental stimulus is termed as biological clocks.

iii) Diurnal Animals

When the rhythm is synchronized with the day night-cycle it is called diurnal (behavioural activities of daytime).

For example animals like bees and pigeons are most active during the day time/light hence called diurnal animals.

iv) Nocturnal Animals

When the activities are mostly done by the animals at night when no light is available at regular basis are called nocturnal animals.

For example: animals like owl, bats and pigs are most active during night.

v) Crepuscular Animals

Some animals like fiddler crab are busiest during the time of dawn or dusk or both are therefore called Crepuscular animals.

vi) Monthly Rhythms

Include menstrual cycle in women. These activities are repeated on regular basis after one month.

vii) Circadian Rhythms

Those activities which are repeated or done in 24 hour cycle shown by physiological processes in all organisms. These include changes in body temperature, blood pressure, urine production, sleep/awakefulness cycle, patterns of hormone secretion and digestive secretion.

viii) Innate Behaviour

Behaviours resulting from genetically determined neural programmes that are part of nervous system at the time of birth or develop at an appropriate point in maturation.

ix) Taxis

A taxis is a directional movement towards or away from a stimulus such as light, chemical or heat e.g. Euglena shows positive taxis by moving towards dim light but negative taxis by moving away from intense light.

Q3. What are biological rhythms? How biological rhythm are important to man?

Answer

Biological Rhythms

Biological rhythms are cyclic pattern of physiological changes or changes in activity in living organisms that are in response to periodic environmental changes. The internal

exact nature of the internal mechanism, or biological clock, that controls such rhythms is not understood.

Biological rhythms may show interval of less than 24 hours or less than a month or less than a year. The circadian rhythms are 24 hour-cycle shown by physiological processes in all organisms. These include changes in body temperature, blood pressure, and urine production, sleep/wakefulness cycle, patterns of hormone secretion, digestive secretions, and levels of alertness. When the rhythm is synchronized with the day/night cycle it is termed as diurnal (behavioural activities of day time) or nocturnal (behavioural activities of night time). For example, animals like honeybees and pigeons, are most active during the day light, hence called diurnal animals while animals like owl, bats, pigs are most active during the night, thus, called nocturnal animals. However, some animals like the fiddler crab, are busiest during the time of dawn or dusk or both are therefore called crepuscular animals.

Monthly rhythms include menstrual cycle in women. Annual cycles or circannual rhythms, include bird migrations, reproductive activity and hibernation of animals.

Q4. What is reflex? Give three examples of reflex in invertebrates.

Answer

Reflex

The most basic unit of innate behaviour is a simple reflex. A simple reflex is an involuntary stereotyped response of part of an organism to a given stimulus. It is determined by the presence of an inherited pattern of neurons forming reflex arcs. The reflex arc is a neural pathway that may involve as few as two neurons: a sensory neuron detects a stimulus and is linked with a motor neuron that sets off a response in an effector cell (such as a muscle or a gland cell). More commonly, reflex arcs also include an association neuron spliced between the sensory and motor neurons. A knee jerk, coughing, yawning, blinking of eyes, sneezing, salivation, movement of diaphragm during breathing are all examples of reflex actions.

Invertebrates also show reflexes. For example:

- i) Snail stop creeping and draw its body inside its shell as feel some sound.
- ii) Movement of jelly fish as feel touch stimulus.
- iii) Hydra has tentacles-which are also sensitive to touch.

Q5. What is instinct? Write examples of instinct?

Answer

Instincts are unlearned, inherited fixed action patterns of responses or reactions to certain kinds of stimuli. The term instinct refers to innate or inborn behaviour. Since they are genetically programmed behaviour so these are also referred as fixed action pattern. Each species display its own characteristics instinctive behaviour through some examples i.e. migration of salmon, dances of bees, construction of hanging nest by birds and mating behaviour of stickleback.

Q6. What is learning behaviour? In what kind of organisms it is found?

Answer

learning involves some choice of responses to a given stimulus.

Learning is also not directly controlled by genes. Learned behaviour can help an animal become better suited to a particular environment or set of conditions. Learning is more common and prominent in those organisms having long life span and have well developed nervous coordination e.g. lion, humans, apes, monkeys etc..

Q7. What is the difference in learning and innate behaviour?

Answer

Innate behaviour	Learning behaviour
It comes natural or by default	It should be developed with experience.
It cannot be modified.	It can easily be modified.
It may or may not have the direct involvement of the brain.	It has the direct involvement of the brain.
These are more common in the animals having short life span.	These are more common in the animals having long life span.
It is economical as animals require no time to adapt them.	It is not economical as animals require more time to adapt them.

Q8. Write difference between latent learning and trial and error learning.

Answer

- i) When an animal learns a response for a particular stimulus in its routine life without having any punishment or reward. When the animal is particularly exposed to that stimulus, the animal suddenly responded it by quickly recalling the previous experience. This is called latent learning.
- ii) When an animal learns a response to a particular stimulus after many unsuccessful tries it is called trial and error learning or operant conditioning. The trial and error learning occur through experience.

Q9. Why are the following scientists famous?

- i) Konrad Lorenz
- ii) Ivan Pavlov
- iii) B.F. Skinner
- iv) K.L. Lashley
- v) Wolfgang Kohler

Answer

i) Konrad Lorenz

In 1930 Konrad Lorenz showed that principle imprinting stimulus in graylag geese (Anseranser) is a nearby moving object from the young. When incubator hatched goslings they spent their first few hours with Lorenz rather than goose, they imprinted with him from then on.

ii) Ivan Pavlov

Performed an experiment on dog to show conditioned reflex type I. He altered the natural stimulus (right of food) with ringing bell and got same response (secretion of

iii) B.F. Skinner

The American psychologist B.F. Skinner studied conditioning in rats by placing them in a specially designed box.

iv) K.L. Lashley

The American psychologist K.L. Lashley used a maze (a network of paths). A rat was put into a maze. The rat explores the maze in order to find the exit.

v) Wolfgang Kohler

The German psychologist Wolfgang was the first to describe learning by insight, performing extensive experiments on chimpanzees in the 1920's.

Q10. How are reflexes important to man? List some human reflexes.**Answer**

The most basic unit of innate behavior is a simple reflex. A simple reflex is an involuntary stereotyped response of part of an organism to a given stimulus. It is determined by the presence of an inherited pattern of neurons forming reflex arcs. The reflex arc is a neural pathway that may involve as few as two neurons: a sensory neuron detects a stimulus and is linked with a motor neuron that sets off a response in an effector cell (such as a muscle or a gland cell). More commonly, reflex arcs also include an association neuron spliced between the sensory and motor neurons. A knee jerk, coughing, yawning, blinking of eyes, sneezing, salivation, movement of diaphragm during breathing are all examples of reflex actions.

In Patellar Reflex (knee jerk) when the patellar tendon is tapped just below the knee, the patellar reflex is initiated and the lower leg kicks forward (via contraction of the quadriceps). The tap initiates an action potential in a specialised structure known as a muscle spindle located within the quadriceps. This action potential travels to the spinal cord, via a sensory axon which chemically communicates by releasing glutamate (see synapse) onto a motor nerve. The result of this motor nerve activity is contraction of the quadriceps muscle, leading to extension of the lower leg at the knee.

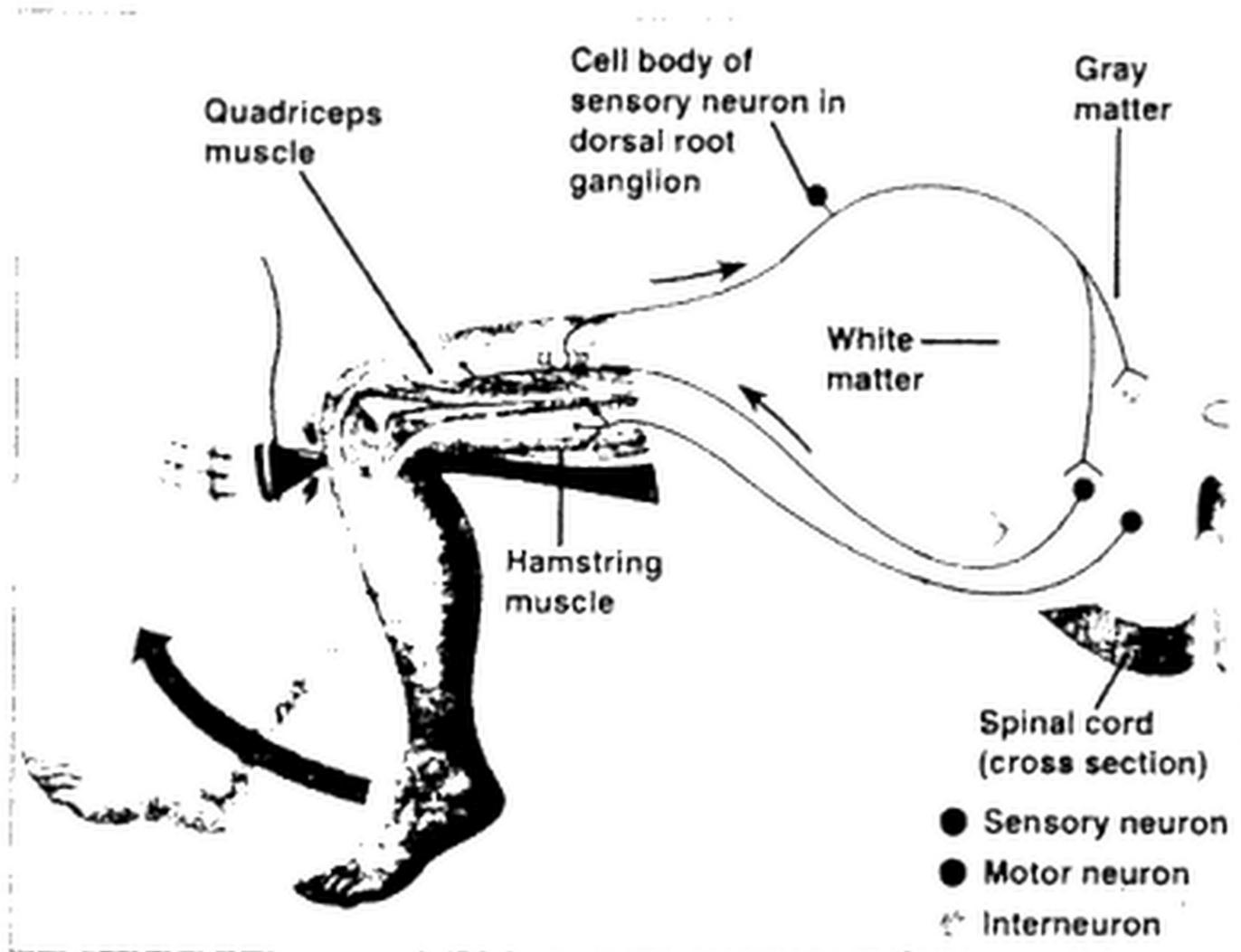


Fig. Patellar Reflex (Knee jerk).

Q11. How do bees communicate about food sources?

Answer

When food is within 50-75 meters of the hive, the bee will do the round dance on the combs surface. When food is more than 75 meters from the hive, the bee will do the waggle dance. This dance tells the direction of the food through a straight run, and also reveals how far away the food is through the speed of the dance. The length of buzzing while dancing increases as the distance to the food source is increased. Bees seem to be able to communicate about food up to 2 kilometres away. This mode of communication is innate and bees are born with the ability to understand it.

Q12. What is territoriality? How is territoriality related to social hierarchy?

Answer

Territoriality is the defence of an area by an organism or group of organisms against organisms of same or different species. There are threat displays between owners of adjacent territories.

After establishing any territory a social or dominance hierarchy is composed of Authority and each member of society pay respect and follow the order.

Q13. Why are most aggressive encounters among members of same species relatively harmless?

Answer

Despite the apparent conflict and aggression associated with territory formation, actual fighting which would be detrimental to the species, is rare and is replaced by threats,

Q14. Behaviour capacity is inherited and is modified by learning. Give an example.

Answer

Every organism is born with some instinctive behaviours/response, which are important for survival of any organism.

Learning is a change in behaviour resulting from experience. Unlike innate behaviour, learning involves some choice of responses to given stimulus.

Predation skill is there in lion but when it is a cub, it learns how to kill the other animals from its mother and father.

Q15. What is a relationship between heredity and behaviour?

Answer

Relationship between Heredity and Behaviour

All behaviours depend on nerve impulses, hormones and other physiological mechanisms such as sensory receptors. Therefore genes play a role in the development of behaviours because they direct the development of the nervous system. In addition, autonomic responses depend on specific nerve pathways within central nervous system of an organism. These pathways are neural programs and are genetically determined. Even the capacity to learn is inherited.

Members of a species vary in the expression of certain behaviours because of variations in their genes and these behaviours have survival value in some environments. One example of such behaviour is curiosity, some organisms are more curious than others and in some settings curiosity is advantageous for survival. Heredity has important role in intelligence, moodiness, impulsiveness, shyness and all other psychological characteristics.

Q16. Differentiate between animal aggregation and animal societies.

Answer

Society

A society or social group is a group of individuals of same species that interact with each other and influence each other's behaviour in different ways, different sexes, age, group or castes such as some members are specialized for finding food, reproduction and defence. This behavioural interaction is a key characteristic of society. A hive of bees, a pack of wolves, and school of fishes are example of societies. Characteristics of well organized society include cooperation and division of labour among animals.

Aggregation

A simple aggregation is group of animals that may be together but do not interact behaviourally. For example huge flocks of birds of many species roosting together in trees are aggregations or a group of Zebras, buffaloes are not societies.

SECTION III: Extensive Questions

Q1. Describe innate behaviour in term of taxis shown by unicellular organisms.

Answer

Innate Behaviour (Inborn or Instinctive behaviour)

Innate behaviour may be defined as behaviours resulting from genetically determined neural programmes that are part of the nervous system at the time of birth or develop at an appropriate point in maturation. Interestingly- these instinctive or inborn behaviours are performed in a reasonably complete form, the first time they are exhibited. A human new born, for example, will turn to suckle when touched on the cheek near the mouth. Innate behaviours are important in the survival of specially those animals that have short life span and poorly developed nervous coordination. All plant behaviours are innate in nature. Innate behaviours are primarily divided into two types i.e., orientation and non-orientation behaviours.

Orientation Behaviours

When an animal moves or changes its position or alignment relative to points of the specific directions in response to some stimuli, this behaviour is known as orientation behaviour. There are two types of animal orientation behaviours i.e., taxis and tropism.

Taxis

A taxis (plural, taxes) is a directional movement toward or away from a stimulus, such as light, chemicals or heat. e.g., Euglena shows positive taxis by moving toward dim light but negative taxis by moving away from intense light.

Q2. Describe innate behaviour in terms of tropism shown by plants.

Answer

Tropism

Tropisms are growth movement related to directional stimuli. Phototropism is the responses to the light in which shoots will grow towards a source of light but away from the direction of gravity. Geotropism is the responses to gravity. If a plant is placed horizontally, its stem will change its direction and grow upwards and away from gravity. The roots will change their direction of growth to grow vertically downwards towards the pull of gravity. Plant roots also show hydrotropism (responses to water).



Fig Geotropism

Answer**Reflex**

The most basic unit of innate behavior is a simple reflex. A simple reflex is an involuntary stereotyped response of part of an organism to a given stimulus. It is determined by the presence of an inherited pattern of neurons forming reflex arcs. The reflex arc is a neural pathway that may involve as few as two neurons: a sensory neuron detects a stimulus and is linked with a motor neuron that sets off a response in an effector cell (such as a muscle or a gland cell). More commonly, reflex arcs also include an association neuron spliced between the sensory and motor neurons. A knee jerk, coughing, yawning, blinking of eyes, sneezing, salivation, movement of diaphragm during breathing are all examples of reflex actions.

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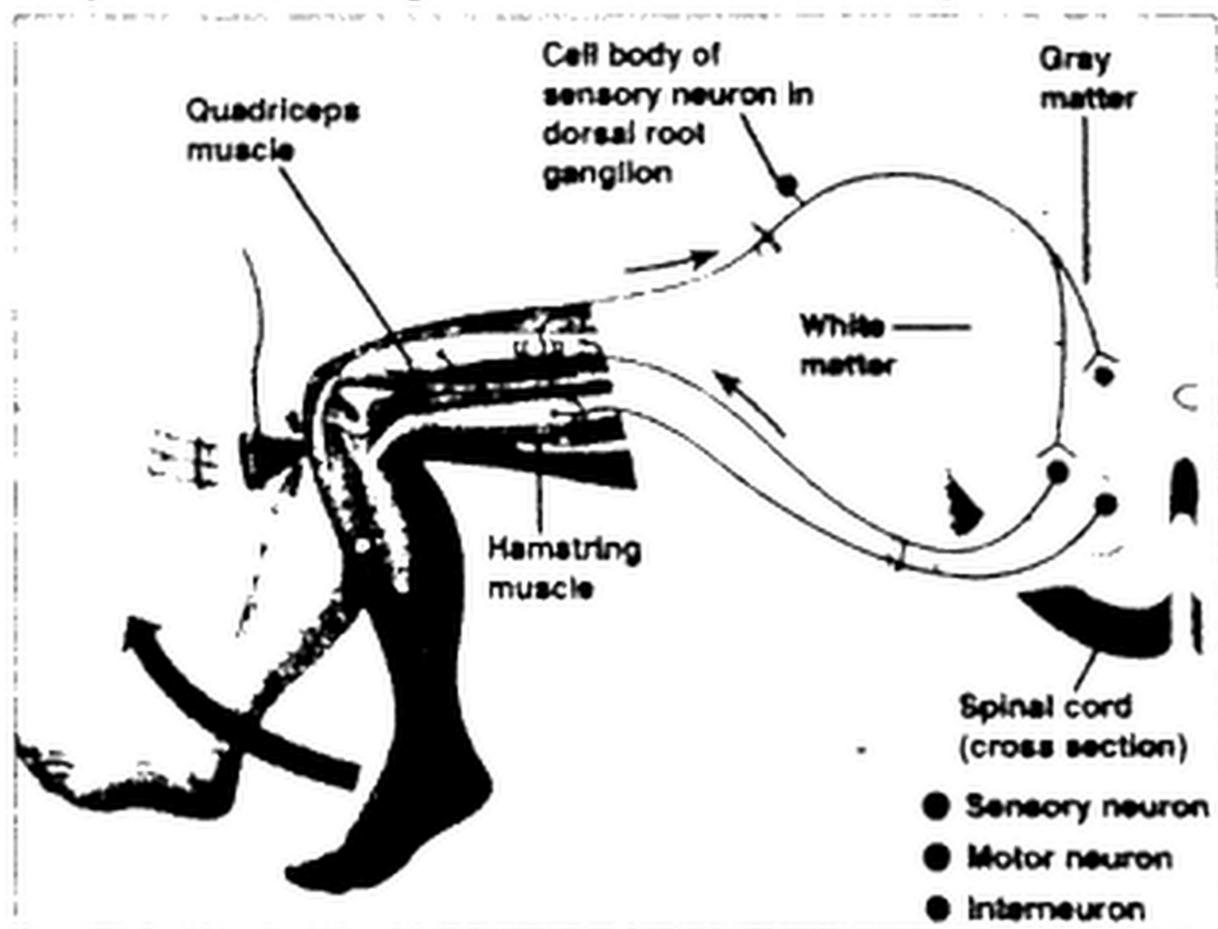


Fig. Patellar Reflex (Knee jerk).

Q4. Define instinct and justify these as a type of innate behaviour.

Answer**Instincts**

Instincts are unlearned, inherited fixed action patterns of responses or reactions to certain kinds of stimuli. The term instinct refers to innate or inborn behaviour. Since these are genetically programmed behaviour so these are also referred to as fixed action

participates in instinctive behaviour and elaborate series of actions may be involved.

We will discuss here the fact that each species displays its own characteristics instinctive behaviour through some examples i.e., migration of salmon, dances of bees, construction of hanging nest by birds, construction of intricate web by spider and mating behaviour of stickleback.

Q5 Describe migration of salmon as instinct behaviour.

Answer

1) Migration of Salmon

The upriver Salmon migration is one of nature's most exciting dramas.

The female builds her nest and deposits her eggs. The male then moves alongside and deposits his sperm, over the eggs. This process is known as spawning. The male salmon dies within a few days of spawning. The newly hatched fish live the first part of their lives in freshwater and then migrate to the ocean to spend their adult lives which may be as short as 6 months or as long as 7 years. Migration between fresh and salt water occurs during every breeding season. When they reach sexual maturity, Pacific salmon can swim hundreds, even thousands, of miles to get back to the stream where they hatched. Only a small percentage of salmon reach their spawning grounds due to many reasons. Since salmon do not feed once they leave the ocean, some will die on the way. Thus migration of salmon is an instinct or inborn behaviour as the young ones do it to perfection without having seen it done.



Fig. Migration of salmon

Q6. Describe the dances of bees for communication as instinct behaviour.

Answer

Dances of Bees

The most sophisticated known mode of communication among bees is a stereotyped series of body movements known as a dance. When worker bees return having found food, their intricate dance not only tells what direction the food is in, but also how far away it is and what type of food and its quality.

When food is within 50-75 meters of the



Fig. Honey Bees dance (a) round dance
(b) waggle dance

waggle dance. This dance tells the direction of the food through a straight run, and also reveals how far away the food is through the speed of the dance. The length of buzzing while dancing increases as the distance to the food source is increased. Bees seem to be able to communicate about food up to 2 kilometer away. This mode of communication is innate and bees are born with the ability to understand it.

Q7. Describe construction of hanging nests by birds as instinct behaviour.

Answer

Construction of Hanging Nest by Birds

There are nearly 100 species of Baya weaver (*Ploceus philippinus* Fig. 19.4 a) birds renowned for their carefully woven hanging nests. These nests tend to be either hung from the tip of a branch or leaf or suspended between two twigs. The construction of nest shows breeding behaviour of Baya. They nest in colonies of up to 20-30, close to the source of food, nesting material and water. The



Fig. (a) Baya weaver



(b) Nest

nests are woven with long strips of paddy leaves, rough grasses and long strips torn from palm fronds. The females inspect and choose a nest before signalling their approval to a male. Once a male and a female are paired, the male goes on to complete the nest including the entrance tunnel, males are solely incharge of building the nests, though their female partners may join in giving the finishing touches. Every generation show the same behaviour without any learning.

Q8. Describe construction of intricate web by spider as instinct behaviour.

Answer

One of the truly wonderful performances by any animal is the intricate web constructed with geometric precision by the big black and yellow garden spider (one of the orb-weavers) that can complete it in one hour. Each individual of spiders inherits this innate ability to construct such intricate web. They are able to show this behaviour generation after generation without having any learning. Although the garden spider has eight eyes, she builds a web almost entirely by touch. Underneath abdomen are six spinnerets that can be



tubes to several types of glands. Each type manufactures in liquid form, a different kind of silk. Filaments of the several kinds are used singly or in combinations for specific purposes in certain locations e.g., as traps to catch insects. Most strands are composed of more than one filament. They solidify and become stronger than steel when drawn out and exposed to the air (Fig: 19.5).

Q9. Describe courtship behaviour of the stickleback fish as instinctive behaviour.

Answer

Mating Behaviour of Stickleback Fish

The three-spined stickleback is a small fish that shows conspicuous sexual behaviour and paternal care during the breeding season; males develop bright orange-red body colouration and blue-green eyes. During the breeding season- the female three-spined stickleback normally follows the red-bellied male (a in the figure) to the nest that he has prepared. He guides her into the nest (b) and then prods the base of her tail (c). She then lays eggs in the nest. After doing so, the male drives her from the nest, enters it himself, and fertilizes the eggs (d). Although this is the normal pattern, the female will follow almost any small red object to the nest, and once within the nest, neither the male nor any other red object need be present. Any object touching her near the base of her tail will cause her to release her eggs. It is as though she were primed internally for each item of behaviour and needed only one specific signal to release the behaviour pattern. For this reason, signals that trigger instinctive acts are called **releasers**.



Fig. Courtship behaviour in three spined stickleback

Q10. Describe imprinting in young ducks. How is this imprinting adaptive?

Answer

Imprinting

Imprinting is a type of learning in which a very young animal fixes its attention on the first object with which it has visual, auditory, or tactile experience and thereafter follows that object. In experiments, animals and inanimate objects have been used. Imprinting has been intensively studied only in birds, especially chickens, ducks, and geese, but a comparable form of learning apparently



Konrad Lorenz with greylag goose

the critical period. One result of imprinting is the formation of a strong bond between two animals, often a hatching or other newborn animal and its parent.

We can describe the curious process of imprinting by giving an example. In normal life, geese hatch from eggs in the presence of the mother goose. Soon after hatching, the goslings begin to follow their mother about, as she leads them to suitable areas to feed or protects them. In 1930s, Konard Lorenz showed that the principal imprinting stimulus in graylag geese (*Anseranser*) is a nearby object that is moving away from the young. When incubator hatched goslings spent their first few hours with Lorenz rather than with a goose, they imprinted with him and followed him from then on. Furthermore, they showed no recognition of their biological mother or adults of their own species.

Q11. Describe classical conditioning by narrating the work of Pavlov on salivary reflex in dogs.

Answer

Classical Conditioning

When an animal learns the same response for two different stimuli which are given to the animal simultaneously it is called classical conditioning. The response is actually for one stimulus but the same response has become developed for the other stimulus. Pavlov paired the meat powder with various stimuli such as the ringing of a bell. After the meat powder and bell (auditory stimulus) were presented (together several times, the bell was used alone. Pavlovs dogs, as predicted, responded by salivating to the sound of the bell (without the food). The bell began as a neutral stimulus (i.e., the bell itself did not produce the dogs salivation). However, by pairing the bell with the stimulus that did produce the salivation response, the bell was able to acquire the ability to trigger the salivation response. In technical terms, the meat powder is considered an unconditioned stimulus (UCS) and the dogs salivation is the unconditioned response (UCR). The bell is a neutral stimulus until the dog learns to associate the bell with food. Then the bell becomes a conditioned stimulus salivation after repeated pairings between the bell and food.



Fig. Experiment of Pavlov

Q12. Describe trial and error learning by narrating the work of Skinner on rats learning.

Answer

Instrumental Conditioning . (Trial and Error Learning Operant Learning)

When an animal learn a response to a particular stimulus after many unsuccessful tries it is called trial and error learning or operant conditioning. The trial and error learning

The American psychologist B.F. skinner studied conditioning in rats by placing them in a specially designed box (today called a Skinner box fitted with levers and other experiment devices.

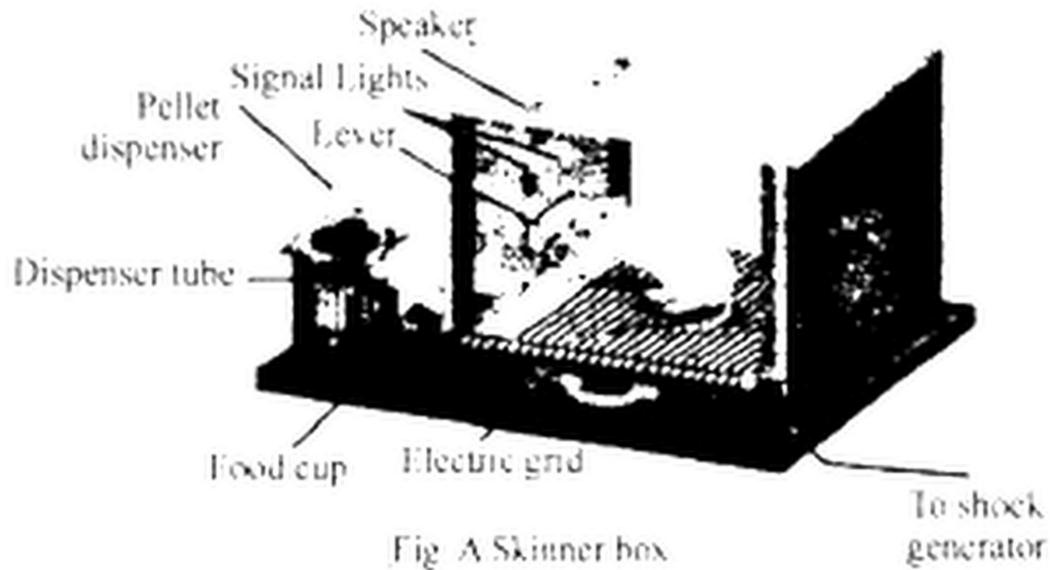


Fig A Skinner box

Once inside, the rat would explore the box feverishly, running this way and that. Occasionally, it would accidentally press a lever, and a pellet of food would appear. At first, a rat would ignore the lever and continue to move about, but soon it learned to press the lever to obtain food. As the animal learns by chance i.e., trail so this type of learning has been named trial and error learning.

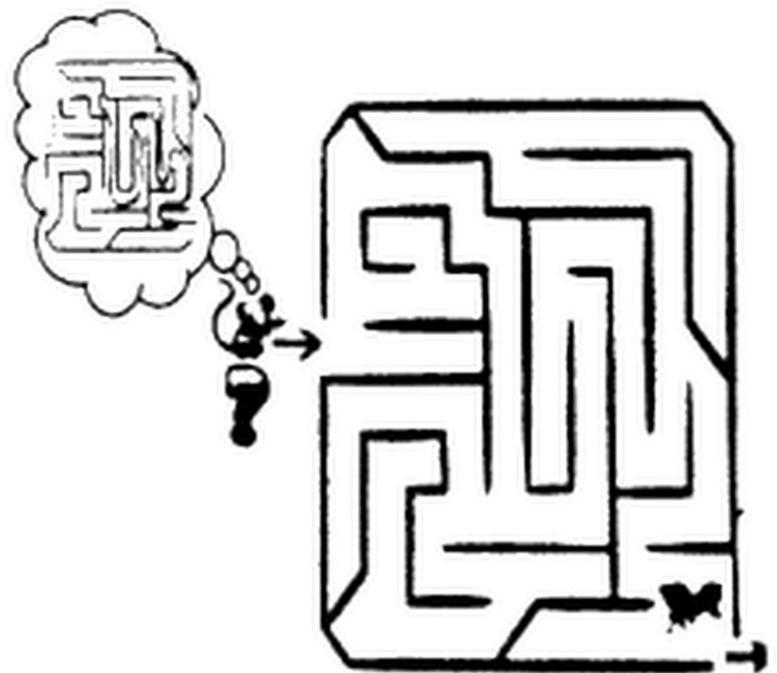


Fig. Maze

Q13. Interpret Kohler's work on chimpanzees insight learning.

Answer

Insight Learning

Insight learning is a much complex type of learning because it requires that an animal must respond correctly in first attempt to a particular situation it has never met before. Animals capable of insight learning seems to practice a sort of mental trial and error process, analyzing the possibilities for the solution of a problem before setting out to tackle it.

German psychologist Wolfgang Kohler was the first to describe learning by insight, performing extensive experiments on chimpanzees in 1920s. Kohlar showed that animals must perceive relationship and



problem on the first try. A chimpanzee was placed by Kohler in a cage containing several boxes and out of reach hung bananas. The chimpanzee solved this problem by stacking the boxes so that it could climb on them to reach the bananas. No past experience provided the chimpanzee with his plan of attack.

Somehow the chimpanzee was able to think out the fact putting the boxes on top of each other would provide a means for reaching the bananas. He used insight to solve the problem. The keeper had placed some boxes of different sizes in the cage. After a short period of head scratching, the chimpanzee moved the largest box and piled other smaller boxes over to, and climbed up to reach the fruits/bananas

Infact this learning is common only among primates (humans, apes, monkeys) and in some other mammals and a few birds.

Q14. Describe agnostic behaviour and relate it with the maintenance of social order in term of territories and dominance hierarchies.

Answer

Agonistic Behaviour

Agonistic behaviour includes a variety of threats or actual combat that settle disputes between individuals in a population. Agonistic interaction uses a great deal of energy, may cause injury. Agonistic behaviour is displayed to maintain social order such as territoriality and dominance hierarchy.

a) Territorial Behaviour

Territoriality is the defence of an area by an organism or group of organisms against organisms of the same or different species. There are threat displays between owners of adjacent territories. Despite the apparent conflict and aggression associated with territory formation, actual fighting, which would be detrimental to the species, is rare and is replaced by threats, gestures and postures. Once a territory is established through aggressive interactions, relative peace prevails as boundaries are recognized and respected. Territorial behaviour is seen in animals as diverse as worms, arthropods fish, birds and mammals.

Territorial Behaviour in Mountain Gorillas

Gorillas are highly social, relatively non-territorial and live in groups (called troops). The oldest and strongest adult male (called the silverback) is usually the dominant one of the troop and has exclusive breeding rights with the females. Adolescent females transfer to a different troop once they reach about eight years of age. Adolescent males, on the other hand, usually remain in the troop until they can leave and establish a new troop on their own as the silverback. Although gorillas typically aren't aggressive, they do exhibit territorial behaviour. In a troop, the silverback is the dominant male and has exclusive breeding rights with the females. Adolescent females transfer to a different troop once they reach about eight years of age. Adolescent males, on the other hand, usually remain in the troop until they can leave and establish a new troop on their own as the silverback. Although gorillas typically aren't aggressive, they do exhibit territorial behaviour.



Fig. Mountain Gorilla

have been given. These gestures, however, are more for show and aren't usually violent (Fig. 19.12).

Territorial behaviour in monkeys: Gibbon monkeys are social animals. They are strongly territorial, and defend their boundaries with vigorous visual and vocal displays. The vocal element, which can often be heard for distances of up to 1 km, consists of a duet between a mated pair, their young sometimes joins in. In most species males, and in some also females, sing solos that attract mates as well as advertise their territory. The song can be used to identify not only which species of gibbon is singing but the area it is from (Fig. 19.13).



Fig. Gibbon monkey

b) Dominance Hierarchy

In each animal establishes a rank that determines its access to resource. The dominant individuals obtain most access to the resources needed for reproduction, including food, space and mates. In some animals, dominance is a simple function of aggressiveness, which is itself often influenced by sex hormones. Many animals live in social groups maintained by agonistic behaviour. An example is pecking order or social hierarchy. Much of men life is composed of this aspect of behaviour. A social or dominance hierarchy is composed of levels of authority from top to bottom. This is true in most organizations such as the army, a school and the business world. The



Fig. Chicken exhibiting peck order

significance of such a chain of command at the human level is obvious. It provides order and organization within a group of people. It eliminates confusion. Therefore it promotes efficiency of organization. Pecking order of chicken: The origin of the term pecking order was the result, of early studies of animal dominance. Warder C. Alle demonstrated that a society of chicken evolves a hierarchy as the result of pecking each other. If several hens unfamiliar to one another are put together, they respond by chasing and pecking one another. Eventually, they establish a clear peck order. The alpha or fast ranked hen in the peck order is dominant. She is not pecked by any other hens and can usually drive off all others by threats rather than actual pecking. The alpha hen also has first access to resources such as food, eater and rooting sites. The beta or second ranked hen similarly subdues all others except the alpha and so on down the line to the omega or lowest animal.

Q15 Describe characteristics that qualify that the society is organized

Altruism

Altruism means the principle of living for the interest of others. Altruism refers to any behaviour that endangers an individual organism or reduces its reproductive success that benefits other members of its species. Altruistic behaviour is common in animal kingdom e.g., female worker bees forgo reproduction and devote their lives to raising the offspring of the hive queen. Here we will illustrate altruism through the organization of a honey bee society.

Organization of honeybee society: A honeybee colony is made up of three types of castes: the queen, the workers and the drones. The queen lays eggs from which all other bees develop. The drones are the male bees that fertilize the eggs of the queen. The drones develop from the unfertilized eggs and are haploid. The workers are females that develop from fertilized eggs. Any fertilized egg can develop into either a queen or a worker depending upon how the egg is housed and fed. The workers perform all the tasks of the hive except for mating and laying eggs. They take flights away from the hive to forage food. At the time of mating, many drones follow the queen out of the hive, following her pheromone trail, and mate in flight. After mating, the drones die. Drones that do not mate have no better fate, because the workers pinch them, sting them and then throw them out of the hive as the winter approaches.



Fig. Honeybees society

The queen controls the bees with a chemical called pheromone. The bees ingest this chemical by licking the queen and then pass the substances around from one another as they pass food. Pheromone renders the worker bees sterile. Workers make half a dozen or more new queen cells in which replacement queens begin to develop. The old queen and a swarm of females and male drones leave to establish a new hive. The first queen to emerge may kill the other candidate queen and assume rule or may create another swarm and leave to establish another hive. Sterile female workers are prevented from producing offspring, yet they spend their lives looking after their brothers and sisters.

Q16. Give examples to interpret that hormones and brain control instincts.

Answer

- 1) A mother knows innately how to feed, nurture and protect her young; these instincts are ingrained deep in the brain.
- 2) High oxytocin causes a mother to become familiar with the unique odour of her

- 3) In response to nearness and touch, the vasopressin is released which promotes bonding between the father and the mother and also helps the father recognize and bond to his baby.
- 4) Oxytocin also causes the formation of maternal behaviour. Successful reproduction and survival for many species relies upon a mother's attachment to and caring for her offspring. There is a drastic increase in the levels of oxytocin in the body and brain of a woman who is in labour. This upsurge is the main cause of the establishment of the strong bond of love a mother initially feels for her child.

Q17.State the role of research in neurobiology in understanding of behaviour.

Answer

Neuroethology, the integration of animal behavior and the neurosciences, provides important frameworks for hypothesizing neural mechanisms. Careful behavioral data allow neurobiologists to narrow the scope of their studies and to focus on relevant input stimuli and attend to relevant responses. In many cases the use of species, specific natural stimuli has led to new insights about neural structure and function that contrast with results obtained using non-relevant stimuli response.

Q18.Rationalize why marine snail, *Aplysia*, has proved very helpful in studies of neurobiology and of behaviour pattern.

Answer

Aplysia californica is a marine snail. Its simple nervous system, consist of just a few thousand of large neurons. Despite its simple nervous system, however, it is capable of a variety of non-associative and associative learning tasks, including sensitization, habituation, classical and operating conditioning. The nice feature that makes *Aplysia* so attractive for neurobiologists is its large brain cells (neuron). The cell body of one neuron can measure up to 1mm in diameter, which makes it relatively easy to study the physiology of these cells to find out how they accomplish learning.



- Buccal ganglia (BG)
- Cerebral ganglia (CG)
- Pleural ganglia (PG)
- Pedal ganglia (PeG)
- Abdominal ganglion (AG)

ADDITIONAL QUESTIONS

Q19. Define social behaviour.

- a) What is hostile and helpful interspecific interaction?
- b) Differentiate Animal society and Aggregation.

Answer

Social Behaviour

Many species of insects and most vertebrates show a variety of (hostile or friendly) group behavioural activities associated with numbers of individuals living together. This is known as social behaviour. The cooperation achieved as a result of social behaviour has adaptive significance. It increases the efficiency and effectiveness of the species over that of the other species.

a) Hostile and Helpful Intraspecific Interaction

In bees hive, hostile interaction is seen among the worker bees. Old worker bee which is unable to perform its duties in hive is killed by other worker bees. On the other hand helpful interaction is found among these bees as different bees have specific duties to perform over all functions of the hive. Worker bees collect nectar and transform it into honey, drones are specific to perform the duty to fertilize the eggs and queen lays eggs.

b) Animal Society and Aggregation

Organisms living together in organized groups are said to live in societies. A society, or social group, is a group of individuals of the same species that interact with each other and influence each others behaviour in different ways. This behavioural interaction is a key characteristic of society. A hive of bees, a pack of wolves and a school of fishes are examples of societies. Characteristics of a well organized society include cooperation and division of labour among animals of different sexes, age groups or castes. Such as some members are specialized for finding food, reproduction, rearing and defence.

A simple aggregations is a group of animals that may be together but do not interact behaviourally. For example huge flocks of birds of many species roosting together in trees are aggregations or a group of zebras, buffaloes are not societies.

Q20. Relate different examples of learning behaviours of humans with habituation, conditioning. Intent learning and insight learning.

Answer

Habituation: In a short time after human dresses in clothing, the stimulus clothing creates disappears from our nervous systems and we become unaware of it. In this way, habituation is used to ignore any continual stimulus.

Conditioning: You almost certainty have many conditioned responses yourself. One that common in man and particularly easy to demonstrate, is the increased rate of flow of saliva in response to the sound or even the thought of words like lemon, vinegar, tamarind and sweets etc.

quicker than a person who does not know the route and reach that place.

Insight learning: You know how reasoning plays a part in modifying human behaviour. For instance you feel hungry and want to go to college cafeteria. You look at the watch and decide not to go yet. Your capacity to reason and the time shown by your watch make you aware of the fact that (probably) that cafeteria will not be opened for half an hour. Another example of human insight learning is the ability to solve mathematical problems.

Q21. Define learning. What are the divisions of learning? Explain each one with examples.

Answer

Learning

Learning is a change in behaviour resulting from experience. Unlike innate behaviour, learning involves some choice of responses to a given stimulus. Also, learning is not directly controlled by genes as innate behaviour is. Innate behaviour can become a liability if environment conditions change and an animal's condition cannot change to adapt to new conditions.

Learned behaviour can help an animal become better suited to a particular environment or set of conditions. Unlike innate behaviour, learning is more prominent in those organisms that have comparatively long life span and have well developed nervous coordination. Learning behaviours can be grouped into six categories: (a) habituation (b) imprinting (c) classical conditioning (d) trial and error learning (e) latent learning (f) insight learning.

Habituation

In habituation, an animal learns to ignore a repeated, irrelevant stimulus. We see the buffalos or cows in street city or squirrels in the city parks. These animals have learned by repeated harmless encounters that humans are no more dangerous to them and behave accordingly. This is to their advantage. An example of learning by habituation is the one observed in squirrels: when one of them feels threatened, the others hear its signal and go to the nearest refuge. However, if the signal comes from an individual who has caused many false alarms, its signal will be ignored. Habituation is highly adaptive.

Imprinting

Imprinting is a type of learning in which a very young animal fixes its attention on the first object with which it has visual, auditory, or tactile experience and thereafter follows that object. In experiments, animals and inanimate objects have been used. Imprinting has been intensively studied only in birds, especially chickens, ducks, and geese, but a comparable form of learning apparently occurs in the



Konrad Lorenz with grey lag goose

period. One result of imprinting is the formation of a strong bond between two animals, often a hatching or other newborn animal and its parent.

We can describe the curious process of imprinting by giving an example. In normal life, geese hatch from eggs in the presence of the mother goose. Soon after hatching, the goslings begin to follow their mother about, as she leads them to suitable areas to feed or protects them. In 1930s, Konard Lorenz showed that the principal imprinting stimulus in graylag geese (*Anseranser*) is a nearby object that is moving away from the young. When incubator hatched goslings spent their first few hours with Lorenz rather than with a goose, they imprinted with him and followed him from then on. Furthermore, they showed no recognition of their biological mother or other adults of their own species.

Difference between habituation and imprinting as reversible and irreversible learned behaviour

Habituation is the loss of a response to a stimulus after repeated exposures. It is reversible. For example a snail crawling on a sheet of glass retracts into its shell when glass is tapped. After a pause, it emerges and continues moving. A second tap causes retraction again but it emerges more quickly. Ultimately, tapping has no effect and snail ceases to respond. It is reversible learning behaviour because after some time this habituation will vanish and snail again will show same response. Imprinting is learning that is limited to a specific time period in animals life and that is irreversible i.e., it remains throughout the life.

Classical Conditioning

When an animal learns the same response for two different stimuli which are given to the animal simultaneously is called classical conditioning. The response is actually for one stimulus but the same response has become developed for the other stimulus. Pavlov paired the meat powder with various stimuli such as the ringing of a bell. After the meat powder and bell (auditory stimulus) were presented (together several times, the bell was used alone. Pavlov's dogs, as predicted, responded by salivating to the sound of the bell (without the food). The bell began as a neutral stimulus (i.e., the bell itself did not produce the dogs salivation). However, by pairing the bell with the stimulus that did produce the salivation response, the bell was able to acquire the ability to trigger the salivation response. In technical terms, the meat powder is considered an unconditioned stimulus (UCS) and the dogs salivation is the unconditioned response (UCR). The bell is a neutral stimulus until the dog learns to associate the bell with food. Then the bell becomes a conditioned stimulus (CS) which produces the conditioned response (CR) of salivation after repeated pairings between the bell and food.



Fig. Experiment of Pavlov

When an animal learns a response to a particular stimulus after many unsuccessful tries it is called trial and error learning or operant conditioning. The trial and error learning occurs through experience. In the natural environment, animals are faced with naturally occurring awards and punishment and they learn by experience.

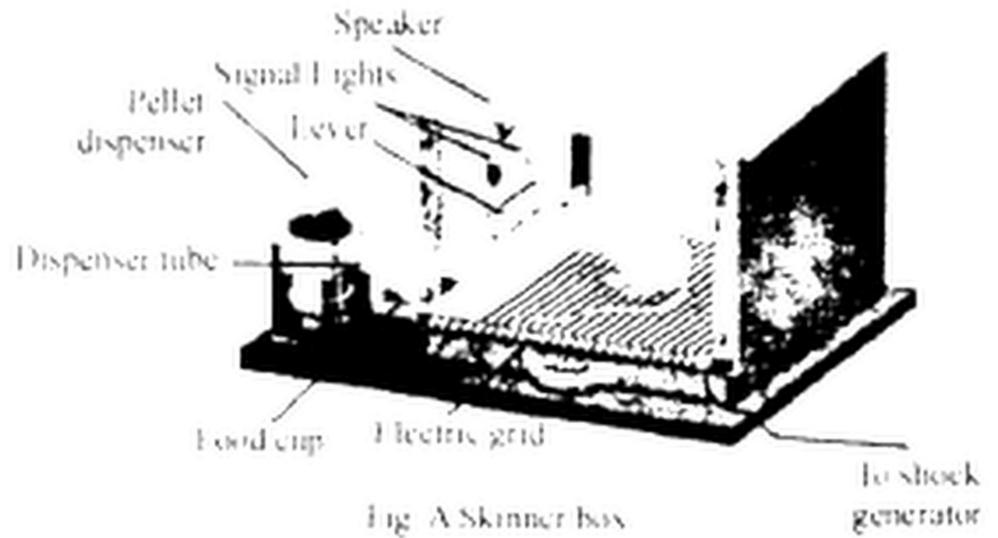


Fig. A Skinner box

The American psychologist B. F. Skinner studied conditioning in rats by placing them in a specially designed box (today called a Skinner box fitted with levers and other experimental devices).

Once inside, the rat would explore the box feverishly, running this way and that. Occasionally, it would accidentally press a lever, and a pellet of food would appear. At first, a rat would ignore the lever and continue to move about, but soon it learned to press the lever to obtain food. As the animal learns by chance i.e., trial so this type of learning has been named trial and error learning.

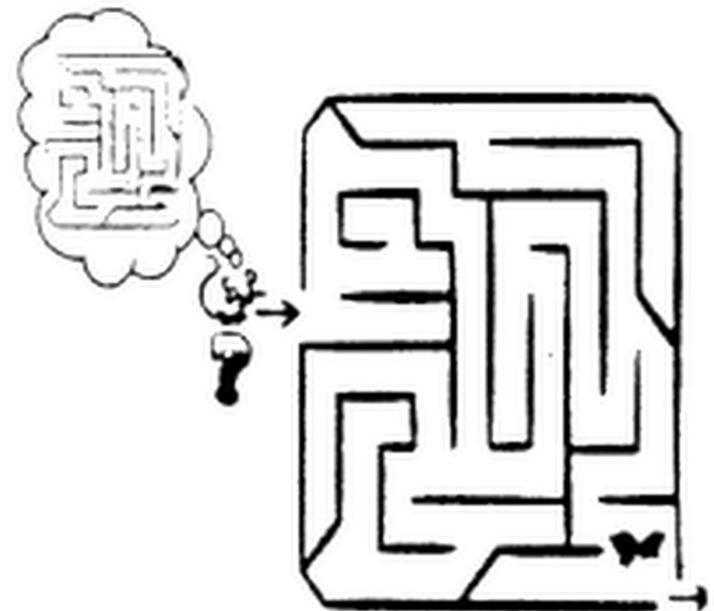


Fig. Maze

Latent Learning

When an animal learns a response for a particular stimulus in its routine life without having any punishment or reward, but sometimes, when the animal is particularly exposed to that stimulus, the animal suddenly response to by quickly recalling the previous experience. This is called latent learnins.

Insight Learning

Insight learning is a much complex type of learning because it requires that an animal must respond correctly in first attempt to a particular situation it has never met before. Animals capable of insight learning seems to practice a sort of mental trial and error process, analyzing the possibilities for the



German psychologist Wolfgang Kohler was the first to describe learning by insight, performing extensive experiments on chimpanzees in 1920s. Kohler showed that animals must perceive relationship and manipulate concepts in its mind to solve a problem on the first try. A chimpanzee was placed by Kohler in a cage containing several boxes and out of reach hung bananas. The chimpanzee solved this problem by stacking the boxes so that it could climb on them to reach the bananas. No past experience provided the chimpanzee with his plan of attack.

Somehow the chimpanzee was able to think out of the fact putting the boxes on top of each other would provide a means for reaching the bananas. He used insight to solve the problem. The keeper had placed some boxes of different sizes in the cage. After a short period of head scratching, the chimpanzee moved the largest box and piles other smaller boxes over to, and climbed up to reach the fruits/bananas.

In fact this learning is common only among primates (humans, apes, monkeys) and in some other mammals and a few birds.

Q22. Differentiate instinctive behaviour from learning behaviour.

Answer

Instinctive behaviour	Learning behaviour
This is the type of behaviour that depends on the hereditary material which the animal inherits. The animal may be born with the right responses built in the nervous system as part of its inherited structure.	This type of behaviour also depends on the environmental influence, but the ability to modify the behaviour depends on the hereditary material.
Experience has no obvious influence on this type of behaviour.	Experience has an obvious influence on this type of behaviour.
This type of behaviour depends on the selection operating during the history of species, so that it helps in, the adaptability of the organism in the environment.	This type of behaviour depends on the selection operating during the history of the individual (during one's life-time) so as to help the organism in its adaptability in the given environment.
Instinct can equip an animal with a series of responses. This is advantageous for animals with short life spans, and with little or no parental care.	Learning can equip an animal with a set of adaptive responses to its environment. This is advantageous for those animals which have long life spans and have parental care, so that they can modify the behaviour by previous experiences.
This type of behaviour evolves slowly in the species.	This type of behaviour evolves during the life cycle of the individual but the ability of learning depends on the genetic basis of the individual.
For example: i) Honey bees inherit the ability to form wing muscles and wings for	For example: i) Conditioned reflex type 1, in case of dogs where dogs learn to salivate on

fly towards flowers to seek nectar and pollen.	ii) Trial and error learning in case of cat, when it learns to press the lever to open the door of the cage.
ii) Behaviour of digger wasp is instinctive; but it does learn certain things during its brief life, such as locality of each of its nests, where it has to return after hunting.	iii) Crawling snail on a sheet of glass, learns that tapping has no harmful effect and ceases to respond after few early responses.

KEY POINTS

- Behaviour is the response of an organism to stimulus or stimuli which may originate outside the organism or within the organism. Behaviour is what animal does and how it does it.
- Members of a species vary in the expression of certain behaviors because of variations in their genes, and these behaviors have survival value in some environments.
- Biological rhythms are cyclic phenomena in biology, which recurs each year, each lunar month, each day or with the tides.
- Some animals are diurnal, having their greatest degree of activity during the day. Others are crepuscular and have their greatest activity during the twilight hours.
- Innate behaviour is inherited or in-born and it does not involve parental sign, training or experience or even of contact with member of the same species.
- Innate behavior is genetically programmed. Individuals inherit a suite (ethogram) of behaviors.
- Reflex is an involuntary stereotyped response of part of an organism to a given stimulus which is determined by the presence of an inherited pattern of neurons forming reflex arcs.
- Orientation behaviors are coordinated movements that occur in response to an external stimulus.
- Taxis is a movement of whole organism directly toward (positive) or away from (negative) a stimulus.
- Learning can be defined as a persistent change in behavior that occurs as a result of experience.
- Habituation is learning not to respond to some unimportant stimulus.
- Imprinting behavior includes both innate and learned components. Genetic and environmental factors influences animal behavior.
- Insight learning that uses reason, especially to form conclusions, inferences, or judgments, to solve a problem.
- Social behaviour consists of a set of interactions among individuals of the same species.
- In dominance hierarchies (pecking orders), animals within a group are arranged according to the status. Position in the hierarchy is usually decided by some agonistic form of behavior other than fighting.
- Altruistic behavior is the behavior in which certain organisms expend time and energy

