

COORDINATION continuation.....

RESPONSE AND BEHAVIOUR IN ANIMALS

BEHAVIOUR IN ANIMALS.

Behaviour is an outwardly expressed course action of an organism in response to stimuli from a given situation.

TYPES OF BEHAVIOUR

Behaviour is broadly divided into categories.

- (i) Instinctive (innate) behaviour.
- (ii) Learned behaviour.

(i) Instinctive (innate) behaviour

Is an inborn pattern of response or activity to one or more environmental stimuli. It has the following features (X-tics).

- It is inherited and highly specific and inflexible (cannot be altered)
- It is an inborn pattern of behaviour and cannot be altered.
- Some instinct (innate) behaviour can be modified to some degree in response to past experience.
- It is similar among all the members of the same species (species characteristic behaviour) except for slight differences between males and females of the same species.
- It is unintelligent and often accompanied by no appreciation of the purpose for which it performed.
- It is highly complex and consists of a chain of actions; the completion of each stage in a chain acts as the stimulus for the commencement of the next stage.
- Instinctive behaviours have much value in adapting the organism to its environment.

Examples of the instinct (innate) behaviour include:- simple reflexes (reflex action ;), orientation, migration, territorial behaviour, nest building, mating, courtship and parental care.

TYPES OF INSTINCTIVE BEHAVIOUR

This is divided into;

- (i) Simple reflex (simple action)
- (ii) orientation.

(i) Simple reflex actions

A simple reflex is a rapid, involuntary (automatic) and stereotyped response of part of an organism to a stimulus. It is determined by inheritance of a pattern of neurones forming spinal and cranial reflexes, but most simple reflexes are spinal.

A stereotyped response is a response where the same stimulus always produces the same response.

Examples of reflex actions, the knee jerk, withdrawal reflex of the hand from painful stimulus, escape reflex of earthworm, blinking.

The simple nervous pathway that transmits impulse during a reflex action is called a **reflex arc**.

Monosynaptic reflex arcs involve a sensory neuron with a single synaptic connection to a motor neurone such as in the knee jerk.

Other reflex arcs involve a relay neurone between the sensory and motor neurons.

Relay neurons make synaptic connections with nerves that pass upwards into the association areas of the brain, enabling the brain to influence reflex actions, resulting in a form of learned behaviour called a conditioned reflex.

Note:

1. When the stretch receptors within the quadriceps are stimulated during the knee jerk, in addition to bring about the stretch reflex called a knee jerk, they also send information to antagonistic muscles ensuring that they are relaxed, this is called reciprocal / inhibition.
2. Stereotyped behaviour occurs when the same response is given to the same stimulus on different occasions.
3. Stereotyped behaviour shows fixed patterns of coordinated movements called fixed action patterns (FAP's) such as during the courtship dances of sticklebacks , food begging responses of gull chicks, suckling response of babies.
4. Simple spinal reflexes are either flexion responses involving withdrawal of a limb from a painful stimulus; or stretch responses, involving the balance and posture of the organisms.
5. Most reflex actions are protective in nature.

ORIENTATION

It is a simple behaviour pattern of lower organisms in response to specific environmental stimuli. Orientation response is important in the natural environment in that; it enables organisms to move towards desirable stimuli and away from harmful one. I.e. Flagellates are guided towards light; animals towards food parasites towards their hosts and spermatozoa towards the females eggs.

Examples of orientation response include;

- Kinesis.
- Taxis.

(i) KINESIS

A kinesis (kinetic response) is a non-directional / movement of the whole organism or cell whereby by the rate of movement is related to the intensity of the stimulus and not the directions of the stimulus.

There are 2 main types of the kinesis;

(a) Orthokinesis: involves changes in speed of movement

(b) Klinokinesis: involves changes in the rate of turning.

This kind of behaviour is seen in wood lice if wood lice are placed in a "Choice-chamber" half of which has a humid atmosphere and the other half a drier atmosphere; the animals move much

faster in the dry half than the humid half on the humid side. Note in kinesis the animal does not move towards or away from the stimulus but instead it simply moves faster and changes direction when subjected to un-pleasant stimulus.

(ii) TAXIS

Is the movement of a whole organism in response to directional stimulus. In this case the organism orientates itself with respect to the source of the stimulus if an organism moves towards the stimulus it is positively tactic, while moving away is a negative taxis examples of taxis include. Swimming of euglena, and other green flagellates towards light (phototaxis) and movement of spermatozoa towards chemical substances secreted by eggs (chemotaxis).

Stimulus	Taxis	examples
Light	Phototaxis	Positive: the unicellular euglena moves towards light, fruit flies fly towards light Negative: wood like and cockroaches move away from light
Chemical	Chemotaxies	Positive: Sperms of liverworts, mosses and ferns swim towards substances released by the ovum, motile bacteria move towards various food substances. Negative: Mosquitoes avoid more repellent
Air O ₂	Aerotaxis	Positive; motile aerobic bacteria move towards oxygen source
Gravity	Geotaxis	Positive: planktonic larvae of king crab moving downwards. Negative: Ephyra larvae swim away from the sea bed.
Magnetic field	Magnetaxis	Certain motile bacteria respond to magnetic fields.
Resistance	Rheotaxis	Positive; planaria move against water current, moths and butterflies into the wind.

COMPLEX INSTINCTIVE BEHAVIOURS

1. MIGRATION:

Is the movement of the whole population of species of organisms from one region to another and their return to the habitat of origin at some other time. Examples of migratory behaviour are seen in salmon fish which migrates to the fresh water streams to breed, and returns to the sea for normal life. The young ones on attaining maturity also migrate to the sea. Many species of birds migrate between the North Pole in Europe and the south pole in South Africa or South America to escape unfavourable winter seasons.

Migration in animals is said to be triggered by some stimulus in the environment such as changes in the day length; decreased temperature; food scarcity etc.

ADVANTAGES OF MIGRATION

- ❖ Provide better chances of finding better food supplies.
- ❖ Provides better chances of finding good breeding grounds, such breeding grounds with enough food and without predators.
- ❖ Allows the organism to avoid unfavorable environmental conditions.

The migrating animals find their route by any one of the following means.

- They follow prominent natural features like mountains ranges and water bodies.
- They orientate themselves in relation to the position of the sun.
- They have an in-born ability to sense direction e.g. homing ability of the pigeon.

2. TERRITORIAL BEHAVIOUR (TERRITORIALITY)

A territory is an area of the habitat which is occupied by an individual or group and defended from others of the same species. Most territories are defended for breeding purpose by use of passive means like.

- Urinating around it.
- Defecating around it.
- Use of other forms of signals like posture, odour etc.
- Use of specific sound.

IMPORTANCE OF TERRITORIAL BEHAVIOUR TO SURVIVAL OF ORGANISMS

- Prevents overcrowding and the space and food for organisms is enough preventing intraspecific competition.
- Population growth is controlled.
- They limit mating to only fit individuals and hence increase the overall fitness of the population.
- They prevent epidemics since contact between very many animals is reduced.
- They permit improved defense of habitats and nests for the young ones.
- Actual fighting between organisms which would be detrimental to the species is quite rare and replaced by mere threats.
- The available resources are protected and shared amongst the population this brings about maximum utilization of resources available in the habitat.

- The mating pair of organisms of the same species and their offspring are well spaced to receive the available resources e.g. food, space etc.
- Provides defense of an area in which organisms live against other organisms of the same species.

DISADVANTAGES OF KEEPING TERRITORIES

- They may encourage in-breeding where it is possible among the organisms. This carries along the disadvantages of reduced biological fitness.
- The sounds produced and some postures exhibited by animals in defense of their territory may easily expose them to their predators.
- Animals are over restricted within an area; this may encourage spread of diseases.
- The weak individuals are denied chances of breeding and cannot propagate some of their could be good genes, since only fit individuals are allowed to mate.
- They limit the population density that can be attained in an area.

3. REPRODUCTIVE BEHAVIOUR

These are specific patterns of activities or rituals performed by an individual usually males towards another individual (the females) of the same species to cause mating or copulation to successfully take place. They include the following,

- (i) Courtship.
- (ii) Parental care.

(i) COURTSHIP BEHAVIOUR

Is a form of innate behaviour between male and female organisms which occurs before mating which eventually leads them to mate (copulate).

IMPORTANCE OF COURTSHIP BEHAVIOUR TO ORGANISMS

- (i) It stimulates organism to sexual activity.
- (ii) Enables male and female gametes to mature at the same time, ensuring fertilization to occur when mating takes place (Synchronizes gonad development).
- (iii) It strengthens the bond between male and female individuals mating.
- (iv) It leads to rise in levels of reproductive hormones.
- (v) It synchronizes time to produce offsprings in right seasons.
- (vi) It induces mating between individuals who accept each other and copulation readily occurs.
- (vii) It ensures that mating occurs between sexually mature individuals.
- (viii) It permits both parents to show same parental care to the young.
- (ix) It suppresses other tendencies like the avoidance of body contacts, escape behaviour and even mate cannibalism e.g. in spiders.

(ii) PARENTAL CARE

Are the activities a parent animal does to ensure the survival and proper development of its young ones. Parental care is mostly developed in the higher animals; the birds and mammals. In birds it involves activities like feeding; warming; watering; nesting, protection against predators etc. of the young.

In humans, the highest form of parental care is exhibited, it may involve learning language and traditional cultures by young ones

In mammals it involves training the young on how to recognize predators find food and escape from danger.

The activities associated with the parental care are of evolutionary significance for they ensure the survival of the species.

ADVANTAGES OF PARENTAL CARE TO ORGANISMS

- (i) It strengthens the love bond between the parents and their offspring's.
- (ii) It protects the young offspring's from predators.
- (iii) It promotes the survival of the young offspring's until they reach maturity. This ensures continuity of the species.
- (iv) During parental care, the young animals learn from their parents some behavioural patterns of the species such as search for food. Feeding and recognition and escape from predators.

FACTORS THAT INFLUENCE INSTINCTIVE BEHAVIOURS.

The instinctive (innate) behaviours (species characteristics behaviour) depend on certain factors and these are,

- stimuli
- motivation.

TYPES OF STIMULI

There are three kinds of stimuli;

- Motivational stimuli.
- Releasing stimuli (releasers)
- Terminating stimuli.

- (i) **MOTIVATIONAL STIMULI**; are those changes in environmental conditions which prepares an animal in readiness to respond. e.g. temperature, light, smell.
- (ii) **RELEASING STIMULI (RELEASERS)** Are features of the environment. (Specific stimuli) which cause/elicit particular responses when the animals encounters them.
- (iii) **TERMINATING STIMULI**; are those features of the environment (stimuli) which brings to an end response to stimuli.

In feeding behaviour, the smell of the food act as a motivational stimulus since they raise the animals' state of responsiveness while the sight of the food may act as a releasing stimulus, unleashing feeding behaviour and a full stomach may act as a terminating stimulus bringing feeding behaviour to an end.

In general, a releaser is any feature of the environment which causes or evokes a behavioural response for example in courtship; the releasers may be features of an individual such as colour, shape or particular markings.

To respond to a specific stimulus, there must be a mechanism in the receptors or brain which filters out the relevant features of the stimuli from the irrelevant ones. This is referred to as **stimulus filtering mechanisms**.

THE FUNCTIONS OF RELEASERS

- (i) Signals that initiate and ends appropriate behaviours and interactions among individuals for example initiation of feeding, escape from predators etc.
- (ii) Important in courtship as it causes copulation to take place among malea and females of the same species, ensuring reproduction among species of organisms.
- (iii)It is used for defence of territories without open conflicts. This prevents physical injuries.
- (iv)Used by predators to identify their preys which enable them to obtain food for survival.
- (v) It is important for the young ones to correctly distinguish between their parents and the predators. This avoids predation of the young ones.
- (vi)It guides population of animals to migrate successfully from one place to another and return to the original habitat.
- (vii) In sexual reproduction, releasers are important in changing an Animals aggressive behavior to sexual behaviours for example in Spiders.

MOTIVATION

Is the term used to describe the internal or physiological state which stimulates an act of behaviour. The animal's internal physiological state is determined by,

- Pheromones.
- Levels of hormones.

These are in turn determined by motivational stimuli such as temperature and light. E.g. in certain birds sexual behaviour in spring is brought about by increasing day-length (Photoperiodism) i.e. the eyes receive the light stimulus, which is transmitted to the brain; reaches the pituitary gland which secretes gonadotrophic hormones, the gonads are also activated to produce sex hormones, including reproductive behaviour. Courtship and mating in the stickle back only takes place in the spring when the female's sex urge reaches its height as a result of various environmental and physiological conditions.

PHEROMONES

A pheromone is a chemical substance produced by one animal which influences the behaviour of another animal. The best known pheromones are the secretions of mammals. The importance of pheromones to different animals include;

- In mammals they are important in marking out territories.
- Used in attraction of mates e.g. unmated female cockroaches secrete a chemical substance from the surface of their body which stimulates males to court them.
- They are also responsible for bringing the different sexes together in insects, marine worms etc.

In social animals like bees, they play an important part in directing the development and behaviour of different castes in the colony. E.g. Pheromones produced by the queen bees called queen substance prevent workers from building queen cells in which a new queen would be received.

Pheromones also serve as releasers or build up motivation towards a particular type of behaviour.

THE ROLE OF HORMONES ON BEHAVIOUR

Hormones are involved in the building up of motivation and therefore it influences behaviour in the following ways.

- (i) Motivate animals to respond appropriately to changes in environmental conditions (Stimuli) i.e. are motivational stimuli for example during hibernation and in breeding activities. Increase sensitivity of the effectors to stimulations, causing appropriate responses.
- (ii) Prevent responses or an act of behaviour to in-appropriate or non-useful stimuli in the Environment by causing degeneration of muscles.
- (iii) Initiate an act of behavior and brings it to an end.
- (iv) Increase awareness or level of alertness of animals to danger for example the hormone adrenalin.

Note: The specific region of brain which is influenced by hormone, leading to a particular behavioural pattern in organisms is the hypothalamus.

When motivational stimuli are present but no releasing stimuli, an animal become frustrated or stressed and exhibit certain acts of behaviours and they include,

- Displacement.
- Vacuum activity.

(i) DISPLACEMENT ACTIVITY

Displacement activity is where an animal which is in state of stress or frustration will perform behaviour which is out of context or irrelevant or performs a behaviour in a wrong situation to try and ease the anxiety developed.

For example two birds that are fighting may suddenly begin to peck at the ground. In humans when in tense situation we perform displacement activities such as stroking the forehead, scratching an ear, or walking up and down; after quarreling with a wife a man can resort to smoking cigarettes or drink alcohol.

Displacement activity serves a useful purpose of preventing open conflict. It is also revealed that much of the courtship behaviour evolved from the displacement activities arising from frustration. This occurs when the male's sexual motivation builds up but can not be released until the appropriate signal is given by the female so some of his sexual motivation is channeled into forms of behaviour which constitute courtship.

(ii) VACUUM ACTIVITY

This is when an animal is frustrated its motivation builds up but no sign stimulus is provided to release the appropriate behaviour as a result it performs in the wrong situation.

For example a cock deprived of a mate will display courtship behaviour to another object such as a bucket. A bird goes through motions of building a nest even if there is no nest materials available.

LEARNED BEHAVIOUR

Learned behaviour is behaviour which is acquired and modified in response to the past experience whereas learning is defined as an adaptive change in behaviour resulting from past experience.

FEATURES CHARACTERISTICS OF LEARNED BEHAVIOUR

- (i) They are not inherited but acquired during life time of an individual
- (ii) Learned behaviour tend to vary from one individual to another. Therefore, not common among all members of the same species.
- (iii) They are adaptable i.e. The learned behaviour can be modified if the environment changes.
- (iv) Some learned behaviour are species specific and cannot be altered once established, while others are very flexible.

TYPES OF LEARNING/LEARNED BEHAVIOUR.

Learning may be classified into five categories.

- (i) Habituation.
- (ii) Associative learning.
- (iii) Imprinting.
- (iv) Exploratory learning.
- (v) Insight learning.

(i) HABITUATION.

This is where an animal gradually stops or ceases to respond to repeated stimulation. It is the simplest form of learning behaviour it is believed that habituation is caused by synaptic accommodation. An example of habituation is when a fan worm jerks back into their tubes when touched but when the tentacle is repeatedly stimulated the worm quickly stops reacting. This implies that habituation enables organism to ignore stimulus in the environment which is neither harmful nor beneficial e.g. wind.

This type of learning is significant in a way that,

- (i) It avoids wastage of energy that would be used to respond to stimuli which are neither harmful nor beneficial.
- (ii) A lot of energy is saved and used for other important processes such as searching for food, feeding, reproduction, growth and development, escape from predators, etc.
- (iii) It enables an individual to quickly escape from danger or take precautions against danger if the first stimulus signifies danger.
- (iv) It can adapt to repeated stimuli or simply ignore it if such stimuli carries no further consequences or not harmful.
- (v) Repeated responses to high frequency stimulation are eventually ignored. This prevents fatigue that would arise from repeated responses.

(ii) IMPRINTING

This is where young animals tend to follow their parents. Unlike other forms of learning imprinting behaviour is fixed and not adapted. For example the young geese follow that first thing they see after they are born generally, this first objects they see is their mother but they can follow any other objects.

Imprinting is important in many ways which include;

- (i) It permits the newly born young ones to be under full parental protection for their survival.
- (ii) It establishes a strong instant bond between the offsprings and the parent.
- (iii) It enables the young ones to learn certain essential skills for survival such as identifying their potential predators and how to escape from the predators.
- (iv) The young ones are always with their parents so, it becomes easy for them to be cleaned, kept warm and be provided with food.
- (v) It ensures protection of the young one from predators.
- (vi) It is used in training of animals for circus.
- (vii) It is applicable in psychiatry.

(iii) ASSOCIATIVE LEARNING.

Is a type of behaviour where an animal learns to associate a particular response with reward or punishment (A response to two stimuli presented together). In associative learning the animal

remembers its past experiences and modifies its behaviour accordingly. It is carried in the nervous system, below the level of the conscious part of the brain.

Associative learning is important in the following ways,

- (i) Animals learn quickly actions or behaviors and do not forget easily experiences that are rewarded and avoid those that are punished.
- (ii) Important in mimicry, where predators avoid to feed on particular prey because they are associated with unpleasant taste. So it is means by which prey can escape predation.
- (iii) The predators can recognize organisms or preys which are poisonous and avoid them.
- (iv) For fast learning by conditioning.
- (v) It enables problems to be solved through trial and error.

There are two basic forms of associative learning

- (i) **Classical conditioning / conditioning reflex/ parlovian condition**
- (ii) Operant conditioning (trial and error learning).

1. Conditioned reflex

Classical conditioning is when a behaviour that is normally triggered by a certain stimulus comes to be triggered by. A substitute stimulus which previously had no effect on the behaviour.

Classical conditioning occurs when an organism learns to associate the natural unconditioned stimulus with a newly acquired conditional stimulus to produce a conditioned reflex. This is a response to two stimuli which are associated together due to reward or punishment.

A conditioned reflex is shown by a classical experiment performed on dogs by **Ivan pavlov**.

Illustration of classical condition in dogs by Ivan Parlov

In his experiment, Pavlov allowed dogs to hear the sound of a bell and observed that the dogs did not salivate at all.

He then presented the dogs with the taste of powdered meat and measured quantity of saliva produced. In another instance, he presented the powdered meat and immediately rang the bell. This was repeated many times.

He later, rang the bell alone without presenting meat and he observed that the dogs salivated in response to it, implying that the dogs had learned to associate the bell with food. He called the new stimulus (the bell) as conditioned stimulus and the response a conditioned reflex if however the bell is rang a lone without presenting of the food several times. It leads to reduction in quantity of the saliva produced until the conditioned stimulus failed to produce any conditioned response.

Note:

1. The behaviour that associates a neutral stimulus (the bell) with a significant stimulus (the food) is called a conditioned reflex, and the animals is said to have become conditioned to the bell.
2. If the unconditional stimulus is pleasant/ advantageous and act as a reward this is called positive reinforcement for example food given to a dog on hearing the sound of a bell.
3. If the unconditioned stimulus is unpleasant/ disadvantageous and acts as a punishment, this is called negative reinforcement, for example a cow that touches an electric fence and receives a milk shock soon learned to associate the fence with the shock, and is less likely to approach the fence in future.

How conditioning occurs

Conditioned learning requires the development of a new nervous pathway in which the association area in the cortex of the brain makes a link between two different types of stimuli and gives the same response to them.

Significance of classical conditioning.

Conditioned reflex is also important in the wild in that predators learn to associate unpalatable animals with certain markings or coloration and will thus avoid eating them. In this way maximum rewards are obtained and punishment is avoided.

FEATURE OF A CONDITONED REFLEX

- (i) It is the association of two stimuli presented together.
- (ii) It is a temporary condition.
- (iii) The response is involuntary.
- (iv) It declines without repetition.
- (v) Removal of the cerebral cortex causes loss of the response.

2. Operant conditioning/ instrumental/ trial and error learning

Operant conditioning is when the organism learns to associate its own behaviour with a reinforce, which may be a reward or punishment. In this type of associative learning an animal learns by trying out several options, some right while others are wrong until it solves the problems.

Operant conditioning is also demonstrated in Trial and error learning in a maze and is confined to animals with well-developed brains. In trial and error experiments, it is common that the animal is provided with a “ choice” it is punished if it makes the wrong choice and it is rewarded if it makes a right choice.

For example a hungry dog is allowed to roam about the room. But as soon as it jumps onto certain chair, we reward it with food. The dog is observed to immediately go to the chair as soon as it

enters the room. In this case the dog has learned to associate a reward with its own behaviour but not with other stimuli.

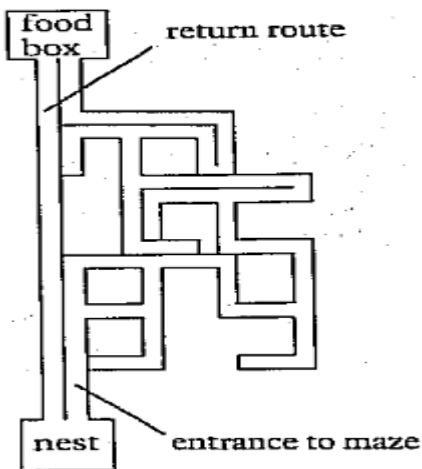
In another experiment, a rat is placed at the entrance to a complicated maze which has an empty food box at the other end. In the first trial the rat makes numerous blind routes as it traverses the maze. The rat is rewarded with food when eventually it reaches the end. In subsequent trials it makes fewer and fewer mistakes and gets through the maze and reaches its end much quicker until eventually it makes no mistakes at all.

The ability of an animal to learn by trial and error is reflected in three things;

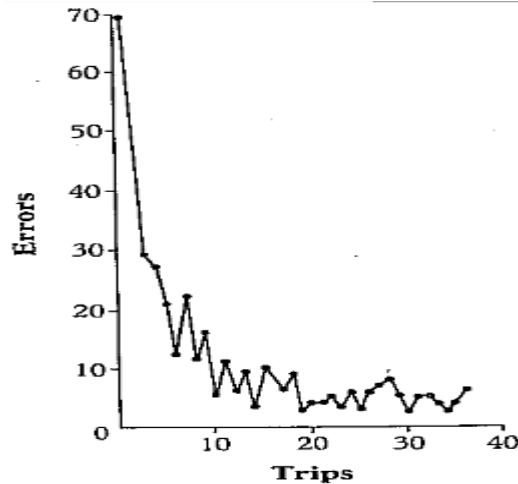
- The speed with which it ceases to make errors.
- The length of time it can remember without repeated trials.
- The complexity of the situation to which it responds.

AGRAPH SHOWING THE RESULT OF MAZE LEARNING BY A RAT

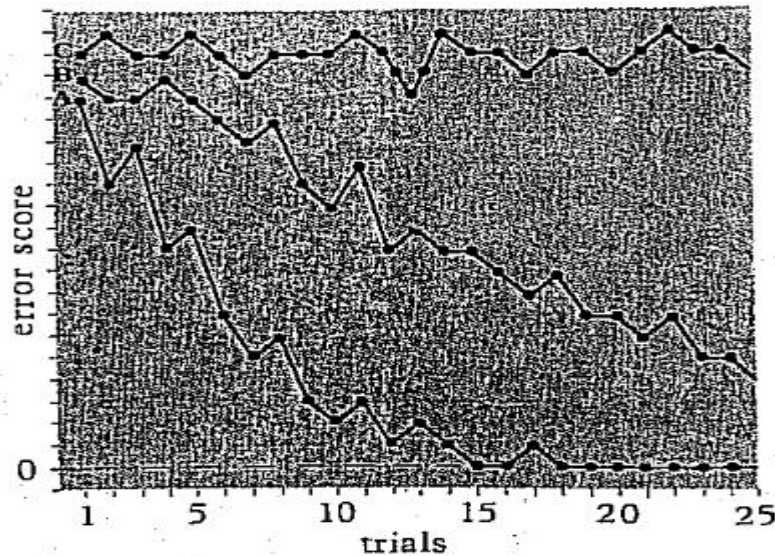
Plan of a maze



results obtained in a graph



GRAPHS SHOWING THE RESULTS OBTAINED IN DIFFERENT LEARNING EXPERIMENTS.



Animal A learns quickly B moderately quickly and C fails to learn at all.

FEATURES OF TRIAL AND ERROR LEARNING

- (i) The associative stimulus follows the action and the two are not necessarily simultaneous.
- (ii) Repetition improves the response.
- (iii) The action is involuntary.
- (iv) It is temporary, but the association is less easily removed than in conditioned reflex.
- (v) Removal of the cerebral cortex does not cause loss of the response.

The factors that affect learning of a new situation include the following,

- Complexity of the situation e.g. The maze.
- The type of motivation or reward, this is the readiness to learn.
- The level of development of the brain or spinal cord (Central Nervous System).

Comparison of classical conditioning and operant conditioning

Similarities

- Both classical and operant conditioning is reinforced by several repetitions.
- Both forms of learning are influenced by rewards and punishments.

Differences

Classical conditioning	Operant conditioning
○ Involves association of 2 stimuli presented together	○ Associative stimulus follows the action
○ Temporary conditioning	○ Temporary but the association less easily removed
○ The response is involuntary	○ Action is involuntary
○ Removal of the cerebral cortex causes loss of the response	○ Removal of the cerebral cortex does not cause loss of the response
○ Animal learns to associate a particular stimulus with a reinforces	○ Animals learns to associate with a particular behavioural act with a reinforces.
○ Delivery of a reward or punishment is controlled by another animal, such as the parent, experimenter trainer	○ The animal’s own behaviour determines whether or not a reward appears.

Modification / reinforcement of learned behaviour can be done in 3 ways

- (i) Through repetition or making several attempts to improve the behavioural / pattern.
- (ii) Through punishments to reduce and extinguish the behavioural pattern.
- (iii) Through rewards to improve and positively reinforce the behavioural / pattern.

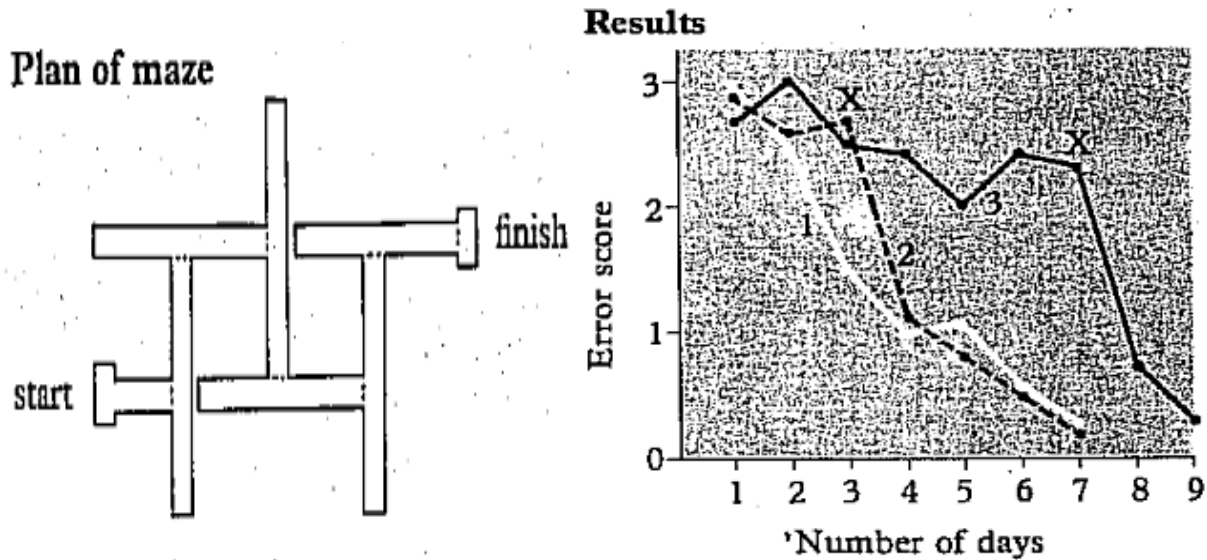
Note: (Read and make notes on the neutral and a biochemical theory of learning Functional App. P9 361

(iv)EXPLORATORY LEARNING (LATENT LEARNING)

This arises when an animal stores information while exploring its environment and uses it at some later time.

Latent learning arises when an animal stores information while exploring its environment and uses this information at some later time when its useful for its survival value.

Example: A rat placed in a maze with no reward as a stimulus will later complete the maze, when a reward is present more rapidly than a rat which has never been in the maze.



- **Groups 1 were given a reward (food) at the end of each run;**
Gradually learn the maze / the number of errors gradually reduces with time, the type of learning is trial and error learning driven by the reward of food.
- **Groups 2 were given no reward until the third day after which they were rewarded each time:**
Very gradually learn the maze/ the number of errors only reduces very slightly with time one remains high. The type of behaviour is exploratory behaviour as no reward is given, leading to latent learning as no reward is involved.
- **Group 3 were given no reward until the seventh day after which they were rewarded each time:**
Very gradually learn the maze in the 7 days/ the number of errors only reduces slightly in the first 7 days. The type of behavior in the first 7 days is exploratory behaviour as no reward is given leading to latent learning as no reward is involved

Significance of exploratory behaviour

It is important in the lives of many animals for it enables them to find their way out of their environment. They learn all its characteristics and remember its landmarks.

(v) INSIGHT LEARNING

It is the immediate comprehension (understanding) and the response of an organism to a new situation without trial and error. It involves mental reasoning and intelligence to solve a new problem situation using knowledge acquired in previous different situations. Insight learning is the highest form of learning.

For example, chimpanzees will acquire bananas fixed to the roof of their cage by piling up boxes upon which they can climb to reach them. In the same way sticks may be joined together to form along pole which is used to obtain bananas which is out of reach outside the cage.

Note:

During problem solving, a trial and error solution may be attempted first, but the animal sizes up the situation using intelligence and comes up with a solution by insight.

Significance of insight learning

- It enables organisms to sense danger easily and escape from it.
- They develop abilities to use tools.
- They improve the ability to solve problems not encountered before.
- Ability to change environment to its favour.
- Organisms become highly adaptable to change in environmental conditions.
- It leads to development of ability to get solutions to problems instantly (very fast).

Differences between innate and learned behaviour

Innate behaviour	Learned behaviour
○ In born and not acquired during an organisms lifetime	○ Not inborn but acquired during an organisms life time
○ Genetically determined	○ Not genetically determined
○ Similar among all members of a species, (species specific) the only individual	○ Varies considerably among different members of the same species (hence its is individualistic/ individual specific
○ Unintelligent and the animal shows no appreciation of the purpose of the behavior	○ Intelligent and the animal often appreciates the purpose of the behaviour

○ Often comprises a chain of reflexes in which completion of one action acts as a trigger for commencement of the next	○ No fixed sequence of actions and the completion of an action need not necessarily affect which action should follow
○ Behaviour is permanent part from minor modifications	○ Behaviour is usually temporary and short-lived and can only become more or less permanent by reinforcement.
○ Can not modified to meet changing circumstances	○ Can be modified to meet changing circumstance
○ Developed over many generations by natural selection based on survival value to the species	○ Developed over the life time of the individual based on experience.
○ Predominant in the lives of animals with short life spans e.g invertebrates where short life cycles prevent modification	○ Predominant in the lives of animals with long life spans e.g vertebrates where long life cycles allow modification by trial and error learning.
○ Least controlled by high centres of the brain	○ Controlled by high centres of the brain
○ Response is usually very rapid	○ Response is relatively slow.

SOCIAL BEHAVIOUR

Is where groups of organisms of the same species live together and are completely dependent on one another for their survival.

When animals come together to form a cohesive social group, individuals usually assume specialized roles to increase the efficiency of the group. Members are specialized for

- ✓ food-finding
- ✓ reproduction
- ✓ rearing
- ✓ defence.

In social behaviour, there is the establishment of a social hierarchy (pecking order). This is where each individual has its own fixed status and role within the group.

Social organization is cooperation between members of a society and sharing division of labour depending upon stereotyped behaviour patterns and effective means of communication.

Note:

1. Private societies are flexible, in that roles are interchangeable between members of a social group.
2. Insect societies are not flexible in that differences in body structure and reproductive potential designate then fixed roles within the society. This is a case of polymorphism.

Social organization in insect societies.

True societies are found in to insect orders isoptera (termites) and hymenoptora (bees and wasps).

Characteristics features of social organization in insect societies

- Cooperative care of their young
- Overlapping of generations
- Division of labour by a cast system
- Communication among members of the society.

Members are divided into different groups called castes, each with a specific task. This is after caste system.

Factors determining an individual's caste;

- sex of the individual
- chromosome number of the individual whether, the individual is haploid or diploid.
- Type of food the individual feeds on
- temperature of the nest or hive
- pheromones produced by the queen
- age of the individual.
- needs of the colony or queen.

Example in boney bee colony, there is a caste system which consists of a queen which is the single fertile female; the remaining females are the workers which are all sterile. All the males are called drones and are fertile.

Communication in honey bees.

Activities of workers are controlled by communication between each other and the queen.

The queen communicates with workers by means of **pheromones**.

Workers communicate

- tactically (by touch)
- chemically by means of orobus and pheromones transmitted during the many licking and grooming activities called trophallaxes
- by particular forms of visual orientation displays called dances.

Communication about food source by worker bees.

Worker bees forage for sources of nectar and communicate information about food sources by orientation displays performed on vertical surface inside the hive or on the floor at the hive entrance. These include: -

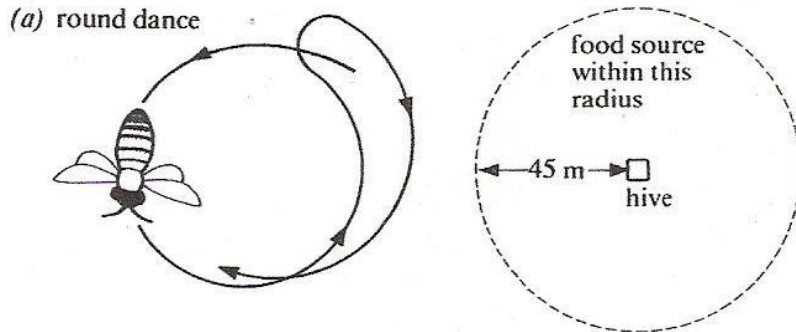
a) The round dance

if the new food source is less than about 70m from the hive, a foraging bee performs around dance which involves the worker moving around and around in a tight circle.

The round dance indicates a food source close to the hive (less than 70m away) but gives no information about distance and direction of food.

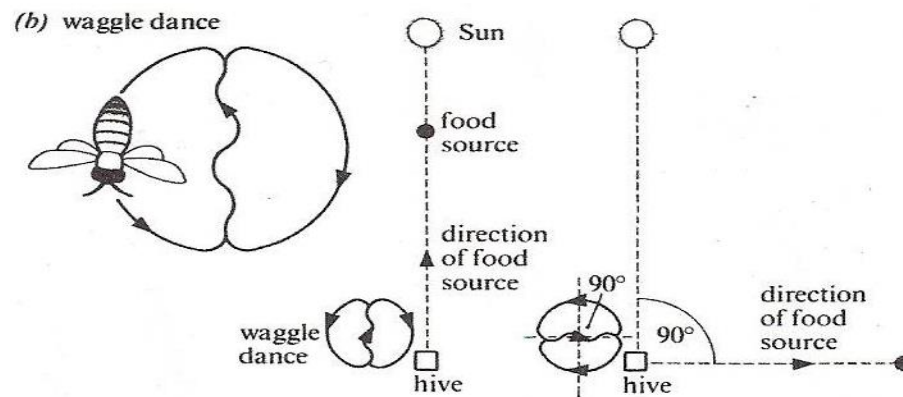
The rest of the workers interpret the dance and respond by flying away to different directions in search of food close to the live.

During the round dance, the bee dances in a roughly circular patch alternatively to the left and to the right.



(b) A waggle dance; is performed if the food source is greater than 100m.

it involves the worker walking in a figure- of eight while wagging her abdomen vibrating her abdomen from side to side.



During the waggle dance, the bee initially regurgitates its nectar, emits a buzzing noise, as it waggles its abdomen from side to side and completes the figure of 8 with a straight run in the middle of the figure of –eight called waggle run.

Information given by the waggle dance

- The interval between the dances (duration of the dance) the number of waggles, the sounds produced and the length of the waggle run, all communicate the distance of the food source.
- The angle made between the waggle run (straight run between the 2 loops of the figure – of-eight) and the vertical equals the angle subtended at the hive by the sun and food source. This indicates the direction of the food source.
- If the run is up the hive, the food is towards the sun, if the run is down the hive, the food is located away from the sun.

- The bees compensate for movement of the sun by means of an innate biological clock, and the bees orientate on cloudy days by substituting polarized light from the sun for the position of the sun.
- The intensity of the waggles is related to the amount of food at the source.
- The scent of flowers on the body and of the forages, and the smell of the nectar regurgitated by the forages, all indicate the nature of the food source.

Fellow workers learn the dance by touching and following the dancer. using all the tactile, sound and chemical signals associated with the dance, they discover the precise location and type of food

The advantages of asocial group include;

- Increases chances for locating food.
- Provides better protection against predators.

Assignment: state the advantages and disadvantages of social behaviour

ALTRUISTIC BEHAVIOUR (ALTRUISM).

Is the behaviour or activities carried out by one organism so as to promote the survival of other organisms of the same species, sometimes at the expense of its own life. Examples include, parental care to their young ones, defence of the bee hive and the queen by the worker bees. This behaviour ensures the continuity of the species in the population and the continuous transmission of their genes to the next generations.

RHYTHMICAL BEHAVIOURS

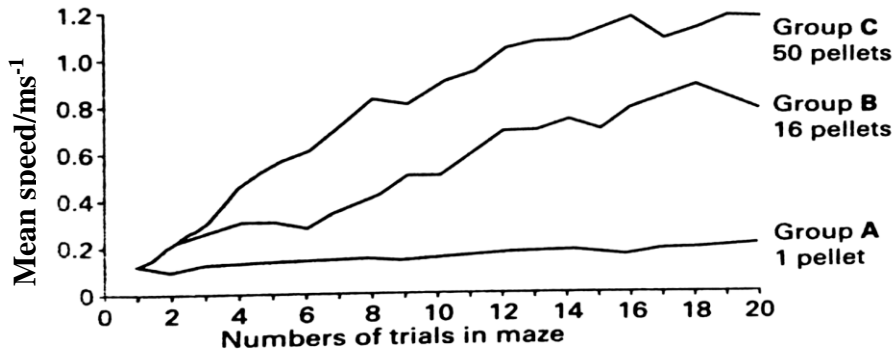
This is where animals carry out activities at regular intervals irrespective of the season or day length. They are described as time biology since they tend to indicate existence of biological clocks within the animals or organisms. Rhythms that are controlled by biochemical and physiological changes within the organisms are called endogenous rhythms. This involves nervous and endocrine system in animals. Rhythms that are controlled by external changes such as day lengths (Photoperiodism) are called exogenous rhythms. Annual rhythmical behaviours include,

- Breeding seasons.
- Biannual migrations.
- Annual hibernation.
- Daily (circadian) rhythms.

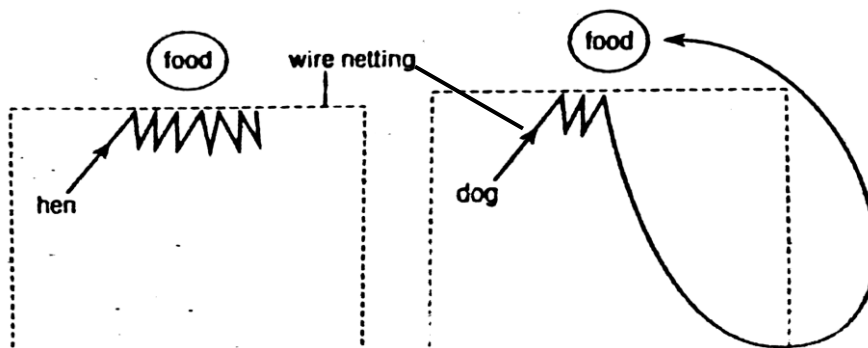
Exercise 3

1. a) i) *What is meant by the term pheromone?* (1 mark)
 ii) *State three importances of pheromones to different animals.* (3 marks)
- b) i) *Distinguish between territorial behaviour and social behaviour?* (2 marks)
 (ii) *State two advantages of living in social group* (2 marks)
 (iii) *Outline two disadvantages of territorial behaviour* (2 marks)
2. *In an experiment the ability of rats to learn the route out of a maze was investigated. Three groups of rats were used. Each rat in group A was put in the maze and when it found its way out it was given one pellet of food, the time taken for each rat to get through the maze was measured*

and the mean speed for each group of rats calculated. Each rat in group A was put through the maze 20 times. The rats in the other two groups were treated in exactly the same way except that each rat in group B was rewarded with 16 pellets of food and each rat in group C with 50 pellets



- Giving evidences from the graph; state the type of learning behavior shown by the rats in the experiments (04 marks)
- Explain how each of the following affected the behavior of the rats
 - Number of trials made (06 marks)
 - Quantity of food (05 marks)
- Apart from the factors investigated, suggest **two (2)** other factors that can increase the ability of the rats to learn by the form of learning under investigation (02 marks)
- How does the behavior shown by the rats in the experiments differ from instinctive behavior (05 marks)
- The figures below show the response shown by a hen and a dog towards a visible food source when each was first starved and then placed separately in transparent wire netting left open at one end with food placed outside the netting on the opposite end which is closed



- State the form of behavior shown by the dog (01 mark)
 - Mention **three (3)** characteristics of the type of behavior identified in e (i) above (03 marks)
 - Explain the behavioural response shown by each animal (14 marks)
3. (a) State two main characteristics of learned behavior (02 marks)

- (b) Using an example in each case distinguish between conditioning and trial and error learning (04 marks)*
- (c) State the importance of each type of learning above to animals within a natural environment. (02 marks)*
- (d) Explain why unlike innate behavior learned behavior varies among individuals of the same species. (02 marks)*

End.