Behavior

Is the outwardly expressed course of action produced in an organism in response to stimulus from a given situation.

It modifies the relationship between the organism and its environment.

Adaptive significance of behavior

- To perpetuate the organism in terms of survival and reproduction.

Ethology: is the scientific study of animal behavior, particularly when that behaviour occurs in the context of an animal's natural environment.

TYPES OF BEHAVIOR

1. Innate / instinctive behaviour: natural, inborn patterns of behaviour e.g. suckling in newborns.

2. Learned behaviour: behaviour acquired through experience / practice.

INNATE BEHAVIOR

Natural, inborn behaviour that is genetically programmed hence inherited.
It includes; orientation (kinesis and taxism), simple reflexes and instincts
Characteristics of innate behavior.

- It is inherited not acquired
- It is similar among members of a species though slight differences occur between males and females.
- It is sequential, the completion of one activity results in start of another.
- It is unintelligent, the individual does not know the purpose of the behavior

Note:

1. Since innate behavior is encoded in DNA, it is subject to genetic change through mutation, recombination, and natural selection.
2. Just like physical traits, innate behaviors are phylogenetic adaptations that have an evolutionary history.

Advantages of innate behaviour

- Innate responses are generally rapid – organisms can react quickly to their environments (predators etc.) e.g. the earth worm quickly / rapidly withdraws into its burrow, away from the danger.
- Innate behavior suits species that have short lifespans – they don't have time to learn behaviours
- Suits species with no parental care/solitary lifestyles as they can't learn behaviours from other members of the species
- It does not make enormous demands from the higher centers of the nervous system hence it places economy on nerve pathways.

CATEGORIES OF INNATE BEHAVIOUR

1. **Reflex**:

- This is an involuntary stereotyped response of part of an organism to a given stimulus.
- It is a simple, automatic response of a body to a stimulus that involves no conscious control e.g. Pull hand away from hot surface, baby feeding, horse tail swatting at flies.
- They are determined by the inheritance of specific patterns of neurons forming cranial and spinal reflexes.
- Neurons are concerned with flexion or stretch.
- Flexion responses code for withdraw whilst stretch responses code for balance and posture.
- There may be an overlap of innate and learned behavior when the brain modifies reflexes according to circumstances. These are called conditioned reflexes e. g. blinking the eye in response to sudden movement.

2. **Orientation behaviors**

These are coordinated movements (walking, flying, swimming, etc.) that occur in response to an external stimulus. These behaviors have adaptive value for survival by helping the insect locate (or avoid) the source of a stimulus.

a. **Kinesis:**

This is a non-directional orientation behavior where the rate of movement is directly proportional to the intensity of a stimulus.
Example: Woodlice move around rapidly and randomly when exposed to light until they find better conditions then they stop moving or move slowly.

b. **Taxis:**

This is a directional movement of a whole organism in response to an external directional stimulus. If the movement is towards the stimulus, it is positive, if it is away from the stimulus it is negative. Some orientations involve maintain a

dorsal light reaction in which the dorsal side is usually uppermost e.g. in fish such as Plaice.

***Example*:**

Fly maggots move away from light sources (negative **photo taxis**)

Direction of stimulus is detected by moving the head which bears the major sensory organs. This enables symmetrically placed receptors on the head to detect stimulus. It is called klinotaxic response.

Describe an experiment to demonstrate orientation behavior in animals.

INSTINCTIVE BEHAVIOR (Fixed Action Patterns)

This is a collection of complex, inborn, stereotyped behavior patterns of immediate survival value to the animal, produced in response to sudden changes in the environment.

- They are unique to a species and hence are called species characteristic behavior.
- Its more common in insects and in vertebrates
- It's a neuronal economy measure; providing organisms with already made set of behavioral responses.
- The already made responses undergo natural selection and confer survival significance.
- The animal performs such behavior without a period of learning.

Types of stimuli

- **Releasers/ sign stimulus**

These are simple stimuli or sequence of stimuli produced by a member of a species which evokes a behavioral response in another member of the same species. These stimuli elicit particular responses when the animal encounters them e.g. sight of food

- **Motivational stimulus**

Provide the goal or drive to prepare the organism for activity. For example, a depleted food reserve in the body during hibernation prepares the body for awakening. These stimuli determine the animal's state of responsiveness. e.g. being hungry

- **Terminating stimulus**

Is an internal or external stimulus that terminates a behavioral response. For example; a visual stimulus of a completed nest will terminate nest building. The internal satiety of a full stomach will terminate feeding. Also internal satiety accompanying ejaculation terminates mating.

Continuity of behavior is upon the presence of such stimulus.

Classification of responses in case of interruption of the fixed action pattern

- **DISPLACEMENT ACTIVITY**

An irrelevant activity produced by an excess of one or more conflicting drives in an organism.

Displacement activities occur when an animal experiences high motivation for two or more conflicting behaviors, the resulting displacement activity is usually unrelated/ irrelevant/ out of context to the competing motivations

Examples

- ✓ Birds may peck at grass when uncertain whether to attack or flee from an opponent.
- ✓ A human may scratch his or her head when they do not know which of two options to choose.
- ✓ A bird may pick up nesting material from the ground and throw it away on being disturbed from the nest.
- ✓ Sticklebacks suddenly dig in the vertical position during a boundary clash.
- ✓ Walking up and down when stressed.

VACUUM ACTIVITY

This is a type of displacement activity in which an animal with motivation to perform a behavior but deprived of its appropriate releaser performs in the wrong situation performed without apparent need or stimuli.

Examples

- ✓ Even if there are no insects, a bird snaps at imaginary insects in the air, no reason to do so but just exercising instinctive action pattern.
- ✓ Domestic squirrel raised in a metal cage will go through the entire sequence of nut-burying activities as if it were in the bush.
- ✓ Birds deprived of a mate will display to an inanimate object such as a bucket

TIMING OF BEHAVIOUR

Circaannual - occurs on a seasonal / annual basis

Examples: hibernation in bears, frogs, toads, salamanders bury themselves in mud during the winter.

Circadian - This is a 24-hour, light-regulated, sleep/wake cycle of behaviour. Circadian rhythms are controlled by genes, yet are also influenced by factors such as jet lag and shift work.

TERRITORIAL BEHAVIOUR / TERRITORRIALITY

A **territory:** a physical space an animal defends against other members of its species.

The main reasons for territoriality

- Control food supply
- Retreat; shelter; nest,
- Access to mates;
- space for sexual display; courtship

Animals that have territories mark and defend their space by **singing** e.g. birds, **urinating** e.g. mammals, **constantly standing guard** e.g. carpenter bees, **releasing pheromones** e.g. some insects

Advantages of territoriality	**Disadvantages of territoriality**
✓ Males able to hold on to resources show their evolutionary fitness and are attractive to females. ✓ Exclusive access to food, particularly at times of shortage. ✓ Exclusive area for breeding and raising young. ✓ Space for sexual display and courtship. ✓ Spacing of animals avoids competition. ✓ Reduces aggression / conflicts. ✓ Improves local knowledge of predators and resources. ✓ 8. Exclusive place to retreat and shelter. ✓ 9. Dispersion of nests reduces predation. ✓ 10. Higher survival rates.	✓ Cost of defending territory including risk of physical contact, and displays of strength. ✓ Need to be vigilant for intruders. ✓ Defending territory is time that could be feeding or mating. ✓ Vocal or visual communication of territory ownership makes the individual vulnerable to predation. ✓ Difficult for smaller animals to hold territory; i.e. more likely to be attacked than larger animals ✓ Difficult to move if resources exhausted. ✓ Importance of territory size. If too large, then hard to maintain control. If too small, not enough resources for effort of defending. ✓ 8.Higher risk of predation if territory within predator's territory. ✓ Easy for predators to find. ✓ Ever present threat of take-over as surplus of animals without territory. ✓ Extra vigilance required at certain times of the year (e.g. breeding season).

MIGRATION

Migration

Animal migration is the relatively long-distance movement of individual animals, usually on a seasonal basis. It is the most common form of migration in ecology. It is found in all major animal groups, including birds, mammals, fish, reptiles, amphibians, insects, and crustaceans.

Causes of migration

- ✓ Resource availability changes depending on seasonal fluctuations, which influence migration patterns.
- ✓ Different species also might migrate for reproductive purposes. Pacific salmon is an example of a species migrating to reproduce. Every year pacific salmon travel upstream to mate and then return to the ocean.
- ✓ Temperature is also a driving factor of migration that is dependent on the time of year. Many species, especially birds, migrate to warmer locations during the winter to escape poor environmental conditions.
- ✓ In circadian migration clocks of both circadian (daily) and circannual (annual) patterns are utilized to determine the birds' orientation in both time and space as they migrate from one destination to the next. This type of migration serves as being advantageous in birds that during the winter remain close to the equator and also to monitor the auditory and spatial

Examples of migration:

- ✓ Some species of Gallinaceous and raptorial birds migrate from valley to mountain peaks.
- ✓ Salmon return to native streams to breed after several years at sea.
- ✓ Deer and Caribou, African ungulates - mammals engaged in overland migrations.
- ✓ Some sharks, whales (northern oceans for calving, southern areas for breeding) and other marine mammals - engaged in long distance oceanic migrations

CUES THAT ANIMALS USE TO NAVIGATE

(i) ***Endogenous*** - hormonal

(ii) ***Exogenous*** - external cues from the environment

Examples:

- ✓ Sun compass - movement of sun; angle of sun; polarized light (pattern of light based on sun's position and reflection on water)
- ✓ Geomagnetic compass - sensitivity to magnetic North and the earth's magnetic field
- ✓ Star compass or position of moon
- ✓ Other visual cues - patterns of waves; cloud patterns; landmarks
- ✓ Smell
- ✓ Sound
- ✓ Electric
- ✓ Young animals may learn when and where to migrate by following their parents

Advantages of migration	**Disadvantages of migration**
✓ Return to specialist site for breeding that does not need all year round food supply, and often no (or few) predators. ✓ Move to where food/prey available when not breeding, particularly with young (i.e. maximize feeding opportunity). ✓ Stationary can mean increased predator risk. ✓ Constant temperature conditions: escape bad weather and lower temperatures (and greater risk of death), especially to give birth. ✓ Able to have specialist breeding site (e.g. no predators) and another site for feeding. ✓ Flexible strategy - some members of the species can migrate and others not depending on where live. ✓ Stationary animals risk exhausting food supply using it all year round, particularly if competition from other species. ✓ Opportunity for different members of the species to meet, and greater breeding variety ✓ Ideal when specialist food required because the earth's resources are not evenly distributed. ✓ Birds migrating at night usually safe from predators as few day-time birds of prey adapt to night-time hunting.	✓ Large amount of energy required to travel long distances. ✓ Problems and risks of navigation. ✓ Risk of forgetting sites or not being able to find again. ✓ Leave home territory empty allowing for invaders, and then fights on returning. ✓ Risk at temporary stopovers from lack of local knowledge about predators. ✓ Vulnerable to weather changes or poor conditions in one year. ✓ Many decisions required including optimal fuel load and optimal time of departure. ✓ Other risks like the change from salt to freshwater or vice versa for some fish. ✓ Evolutionary maladaptive behavior in some cases; e.g. green turtles feed on eastern coast of South America but breed on Ascension Island (south Atlantic). ✓ Risks of night-time migration if animals normally active in day-time (e.g. bat predation of birds).

AGONISTIC BEHAVIOURS

Ritualized behaviors that substitute for physical contact and fighting e.g. yawn of baboons, dogs and baring their teeth, cats and raising their fur, birds raising their feathers, fighting and physical contact in wolves, coyotes, seals, etc.

- Aggressive behavior is used to intimidate another animal of the same species.
- Animals fight or threaten one another in order to defend their young, their territory, or a resource such as food.
- Animals of the same species rarely fight to the death; fights are symbolic / highly ritualized.
- The fight is over when the defeated individual shows submission to the victor.
- In animals, usually the oldest or strongest wins the argument.

DOMINANCE/ SOCIAL HIERACHY

A ***dominance hierarchy:*** a form of social ranking within a group in which some individuals are more subordinate than others.

The ability to form a dominance hierarchy is innate, but the position each animal assumes may be learned.
The term ***pecking order*** comes from a dominance hierarchy that is formed by chickens. The top-ranking chicken can peck any other chicken. The chicken lowest in the hierarchy is pecked at by all the other chickens in the group.

Features of dominance hierarchies

- ✓ individuals carry out specific roles in the society
- ✓ there are pecking orders; there is a chain of command in the colony
- ✓ Position in the hierarchy is determined by the level of agonistic behavior, size, strength and aggressiveness.
- ✓ Highly determined by ability of an individual to learn and recognize those in higher ranks of the hierarchy
- ✓ Levels of testosterone or estrogens determines order in the hierarchy

SOCIAL ORGANISATION IN BEES

- **R**oles are unchangeable among members of a group due to genetic differences conferring differences in body structure- **polymorphism** giving rise to queens, drones and workers.
- Organization is based on a caste system.
- Perform **dances** as visual orientations for communication.
- Grooming and licking activities are in form **trophallaxes** transmitting chemical odors and pheromones.

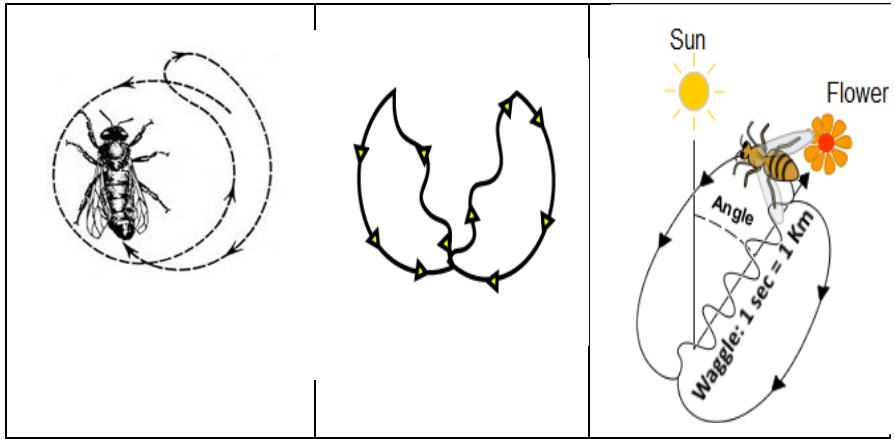
Honey bee dancing is performed by a worker bee that has returned to the honey comb with pollen or nectar, informing other workers about both the distance and direction where the food is.

1. Round dance: Communicates only distance from the food source (less than 50 meters from the hive). It involves running around in narrow circles, suddenly reversing direction to her original course.

2. Sickle dance: Communicates only distance from the food source (between 50 and 150 meters from the hive). This dance is crescent-shaped and represents a transitional dance between the round dance and a waggle dance.

3. Waggle dance (wag-tail dance): Communicates both distance and direction. Is performed by bees foraging at food sources that are more than 150 meters from the hive.

Round dance	Sickle dance	Waggle dance



How waggle dance is performed

- A bee that performs a waggle dance runs straight ahead for a short distance, returns in a semicircle to the starting point, runs again through the straight course, then makes a semicircle in the opposite direction to complete a full figure-eight circuit.
- *W*hile running the straight-line course of the dance, the bee's body, especially the abdomen, wags vigorously from side to side.
- The duration of the waggle phase is proportional to the distance from the food source (1 second = 1 Km).
- The orientation of the dancing bee during the straight portion of her waggle dance indicates the location of the food source relative to the sun.
- The angle that the bee adopts, relative to vertical, represents the angle to the flowers relative to the direction of the sun outside the hive.

Importance of dominance hierarchy

- ✓ Reduces aggression associated with feeding, mate selection and breeding site selection.
- ✓ established order and stability
- ✓ Influences resources among population (
- ✓ Avoiding injury of animals due to fighting in order to establish a hierarchy.
- ✓ Subordinate remains to obtain food, avoid predators, chance to mate
- ✓ Increasing genetic vigor by ensuring that the strongest and genetically fittest have a reproductive advantage.

HIBERNATION

Hibernation: a state in which the body temperature drops substantially, oxygen consumption decreases, and breathing rates decline to a few breaths per minute to avoid cold temperatures. Its conserves energy

AESTIVATION

Estivation: is a state of reduced metabolism that occurs in animals living in conditions of intense heat. Could be due also to lack of food or periods of drought.

REPRODUCTIVE BEHAVIOUR

Courtship Behavior: is a set of display behavior in which an animal attempts to attract a mate and exhibit their desire to copulate. It is a complex behavior designed to stimulate organisms into sexual activity.

Examples:

- ✓ Singing in male birds
- ✓ Peacocks display flamboyant plumage colors and prominent tail feathers
- ✓ Preening (sit with their bodies touching one another to show that they are not intending to harm their partner)
- ✓ Dancing in birds
- ✓ Building nests in birds

Significance **of courtship behavior**

- ✓ It involves formation of a pair bond – relationship between male and female of same species which means they recognize each other as individuals and avoid aggression.
- ✓ It advertises sexually receptive individuals
- ✓ Brings both mating partners to reproductive readiness simultaneously
- ✓ It ensures that members of the same species find each other and mate e.g. at dusk, different species of fireflies flash distinct light patterns. However, female fireflies of one species respond only to those males exhibiting the species-correct flashing pattern.
- ✓ Maintain distinct species
- ✓ Reduction of escape tendencies of the female.
- ✓ Synchronization of gonad development so that gametes mature at the same time.
- ✓ Reinforcing altruistic, territorial and agonistic behavior

GUIDING QUESTION

Describe releasers as they relate to animal behavior

Answer plan

RELEASERS = sign stimuli > behavioral response {innate/stereotyped}

(environmental) (fixed action pattern)

RELATIONSHIP TO ANIMAL BEHAVIOR (OTHERS MAY BE GIVEN):

(i) 3-spined stickle-back red belly > aggressive behavior
(ii) pheromones (chemical) > mate attraction
(iii) male *Aedes* - tuning fork > attract female
(iv) urine in dogs > avoidance of territory
(v) female digger wasp behavior must run course once triggered
(vi) European red robin breast > aggressive behavior
(vii) black gulls > white egg shell pieces. egg shell removal
(viii) bowerbirds - red pebbles, berries > attract female to nest
(ix) Herring gull - red spot on beak > infant feeding response
(x) ants > chemicals > trails

ALTRUISM

Altruistic behavior is one in which an individual (the donor) performs an action that helps another animal (the recipient) with no apparent advantage to itself but sometimes putting itself to self-risk.

Examples:

- ✓ alarm calling in squirrels,
- ✓ helpers at the nest in scrub jays,
- ✓ sterile worker castes in honey bees etc.)

Kin Selected altruism is one directed to those with whom one shares alleles e.g. offspring, siblings e.tc.

It is an evolutionary mechanism that selects for those behaviors that increase the inclusive fitness of the donor.

Significance of altruism

- ✓ reinforcing of reproductive behavior
- ✓ strengthening intraspecific relationships for success of a species by promoting survival and reproduction
- ✓ strengthening interspecific association for stability of communities.
- ✓ Increasing the frequency of alleles of both donors and recipients of altruism.

GUIDING QUESTIONS

1. *Alarm calls put the caller at increased risk of predation by drawing attention to its location. Why might this behavior be favored by evolution?*

Animals that use alarm calls put themselves at risk but increase the chances of their relatives' survival. Animals that live in colonies with alarm calls usually live in large family groups, so their genes benefit by allowing others in the group to survive. Alarm calls may be favored by kin selection.

2. *What are some benefits to living in a group? What are some negative consequences of group living?*

- ✓ Group members can cooperate in finding food.

- ✓ Group hunters can catch larger prey than individual animals can, and animals foraging might find spots where food is plentiful and all members of the group benefit rather than wasting time fighting over it.
- ✓ Groups can defend territories more efficiently than individuals can, and living in a group also provides better access to mates.
- ✓ There are also drawbacks to living in a group.
- ✓ Groups may attract predators or attacks by other animals because of scents or noises.
- ✓ Animals living in groups also spread disease more easily than animals living on their own.

LEARNED (INDIVIDUAL SPECIFIC) BEHAVIOR

Learning: adaptive change in behaviour that occurs as a result of experience / practice.

Learned behavior: behavior acquired through previous experience / practice.

COMPARISON OF INNATE BEHAVIOUR AND LEARNED BEHAVIOUR

INNATE BEHAVIOUR	LEARNED BEHAVIOUR
1. Heritable - encoded in DNA and passed from generation to generation ***2. Intrinsic*** - present in animals raised in isolation from others ***3. Stereotyped*** - performed in the same way each time by each individual of a species ***4. Inflexible*** - not modified by development or experience **5. *Consummate*** - fully developed or expressed at first performance ***6. Unintelligent*** and automatic; the animal does not appreciate the importance of the behavior	***1. Non-heritable*** - acquired only through observation or experience ***2. Extrinsic*** - absent in animals raised in isolation from others ***3. Permutable*** - pattern or sequence may change among individuals of a species ***4. flexible*** - capable of modification to suit changing conditions ***5. Progressive*** - subject to improvement or refinement through practice ***6. Intelligent***; the animal appreciates the importance of the behavior.

Advantages of learned behaviour

- ✓ Flexible
- ✓ Benefits animals with longer life spans and so there is time to learn
- ✓ Benefits animals with an element of parental care of the young; which involves learning from the parent
- ✓ Benefits animals that live with other members of the species for at least a time e.g. in herds & packs

Note: The responses of learnt behaviour are adapted to the environment.

TYPES OF LEARNED BEHAVIOUR

1. Habituation: is learning to "ignore" stimuli that are not important, irrelevant, or repetitive **e.g.** after sometime, birds learn to ignore a scare crow that is positioned in one position of the garden.

Significance of habituation

- ✓ Helping young animals to understand neutral elements of their environment.
- ✓ Economy of neuronal pathways and energy to other beneficial elements of the environment.

2. Associative learning: any learning process in which a new response becomes associated with a particular stimulus.

Two types of associative learning

(a) Classical Conditioning: A process in which an animal learns to associate a previously neutral stimulus with a behavior once triggered by a different stimulus

- ✓ Honey bees learn to associate floral colors and fragrances with the presence of nectar.
- ✓ Pavlov's Dogs salivated on hearing the sound of a bell in expectation of food, yet initially it was the food smell that stimulated salivation.

Pavlov on the control of salivation in dogs

- ✓ He noted that when presented with the sight and smell of food, the dogs began to salivate in preparation of eating.
- ✓ Pavlov began to ring a bell each time the dog was shown their food.
- ✓ After a while he found dogs salivated when the bell was rung, regardless of whether food was present.

(b) Operant conditioning (Instrumental learning / 'Trial-and-Error' learning):

A form of adaptive learning in which an animal learns to carry out a particular action in order to receive a reward or avoid an unpleasant experience. Reinforcement is in related to behavior not reward or punishment.

- ✓ In Skinners box, rats learnt to press a lever in order to obtain food.
- ✓ Cockroaches learning to run through a simple maze to find food.

Skinner's work on pigeons / rats

- ✓ Trained rats and pigeons to press a leaver in order to obtain food.
- ✓ Certain motor-output responses generated e.g. running around, resting, pressing leaver.
- ✓ After training the subject will show the conditioned response (e.g. pressing the leaver) if the response-unconditioned stimulus (a food reward) association has been memorized.

Significance of conditioning

- ✓ Emphasizes the importance of learning from the environment
- ✓ Extinguishes or promotes behavior by reward or punishment
- ✓ Makes animal behavior predictable and flexible

3. Latent Learning (Exploratory learning): Animals explore new surrounding and learn information that has no apparent value at the time, but may be remembered and used later when necessity arises because it may mean the difference between life and death.

- ✓ Rabbits / rats / mice explore their burrows, which may save them in case of an emergency.
- ✓ A sand wasp remembers the pattern of surrounding landmarks to help her find the nest when she returns.
- ✓ Worker ants can remember a series of landmarks along a trail and follow them (in reverse order) back home to the nest site.
- ✓ A hen uses previous experience to regroup eggs in the nest using wings.

3. **Insight learning:** The highest form of learning in which an animal applies thinking and reasoning in order to solve problems or deal with complex situations without immediate trial and error.
    - It is based on information learned from other behavioral activities.
    - It requires advanced perceptual abilities such as though and reasoning.

- ✓ A chimpanzee piles boxes to increase height for reaching hanging sweet bananas which are out of its reach. Experience from playing with the boxes (apparent learning) increased the likelihood of the response.
- ✓ A child uses stones to hit at mango fruits which are high on the tree.

5. Imprinting: Within a specific period of time after birth an animal learns to recognize and bond to its parent. Imprinting occurs in the receptive and hypersensitive period of an animal's life called "**critical period**". It is around 36 hours after hatching in goslings and helps survival during infancy

Example:

Goslings, ducklings and chicks become attached to the organism they interact with during the sensitive period.

ROLE OF HORMONES IN BEHAVIOR

- Hormones may affect growth of nervous connections in the brain
- They can alter sensitivity of peripheral receptors e.g. male hormones in rats; increase sensitivity of the penis.
- They may suppress or increase the performance of effectors for example; hormones causing degeneration of muscles.
- They directly affect nerve cells and synapses in the central nervous system by blocking inhibitory pathways or opening up excitatory pathways

PLANT BEHAVIOR

Instinctive/innate behaviors of a plant depend mainly on growth or movement in a given direction due to changes in their environment e.g. light, gravity, water, air, touch, etc.

Examples of instinctive / innate behavior in plants

Tropisms: Growth movement towards (positive) or away (negative) from the stimulus e.g. phototropism, geotropism, hydrotropism, etc.

Nastism: Non-directional response to stimulus e.g. when touched, folding of *Mimosa pudica* leaves (Thigmonasty).

Examples

(i) Photonasty: response to light (ii) Nyctinasty: movements at night or in the dark (iii) Chemonasty: response to chemicals or nutrients (iv) Hydronasty: response to water (v) Thermonasty: response to temperature (vi) Geonasty/gravinasty: response to gravity (vii) Thigmonasty/seismonasty/haptonasty: response to contact

BEHAVIOUR DISSCUSSION QUESTIONS

1.
    a. describe each of the following forms of behavior.
        i. Habituation
        ii. Imprinting
        iii. Instinctive behavior
    b. State the benefits of each of the above forms of behavior to animals.
        i. Habituation.

ii. Imprinting.
iii. Instinctive behavior

2.

a. Explain the significance of the following forms of behavior
   i. Territorial behavior
   ii. Courtship behavior
b. Distinguish between **learned** and **instinctive** behavior.

3.

a. Explain the adaptive significance of altruistic behavior.
b. State **two** factors that influence instinctive behavior

4.

a. Using examples, distinguish between **displacement activity** and **vacuum activity**.
b. What is the importance of the following forms of behavior to the survival of organisms in community?
   i. Territorial behavior
   ii. Courtship behavior
   iii. Imprinting
   iv. Habituation
   v. Associative learning/conditioning
c. Give **five** ways in which animals avoid predation

5.

a. Differentiate between **learned** and **instinctive** behavior.
b. Outline the characteristics of the following forms of innate behavior
   i. Social hierarchies
   ii. Agonistic behavior.
c.
   i. How may agonistic behavior be detrimental to the species?
   ii. How can the disadvantages of agonistic behavior be overcome?
d. Distinguish between **operant conditioning** and **classical conditioning.**

6.

a. Distinguish between **territoriality** and a **territory** as used in behavior.
b. Give **two** examples of animals that commonly display territorial behavior.
c. Outline any **four** advantages of territorial behavior to such animals.
d. How can territorial behavior be detrimental to a species?

7. What do you understand by the term **fixed action pattern**?
   a. Explain the following types of stimulus
      i. Releasers
      ii. Motivating stimulus
      iii. Terminating stimulus
   b. What is the role of the following in controlling behavior?
      i. Then hypothalamus
      ii. Hormones

8.

a. Distinguish between
   i. kinesis and taxis
   ii. conditioned and simple reflex.
   iii. Trophallaxes and dances in eusocial animals
b. Describe an experiment you can carry out to demonstrate orientation behavior in a named invertebrate.