Innate or Instinctive Behaviour

Q. 1. Define instinctive behaviour and explain it with the help of suitable examples. *(Allahabad 1991)*

Write an account of innate or instinctive behaviour giving suitable examples. *(Kanpur 1999)*

Definition of Innate Behaviour

Instincts are complex behaviour patterns which are inborn and inflexible. These are of value in adopting the animal to its environment. These differ from simple reflexes in their degree of complexity. The entire body participates in instinctive behaviour and an elaborate series of actions may be involved. Instinctive behaviour is probably the most important type of behaviour in insects. Fishes, reptiles and birds also depend to a large degree on inborn, instinctive patterns of behaviour specially during migration.

1. Hereditary Basis of Instinctive Behaviour

The spider's building of a web is an example of instinctive behaviour. A long series of complex actions are required to spir the web, but these actions and the final shape of the web are entirely dependent upon instinct. A spider spins a web which is characteristic of its species even though never before exposed to that pattern.

Nest building in birds is also an example of instinctive behaviour. Even when it has never been allowed to see another member of its species or any nest, the weaver bird builds a nest characteristic of the species. Instincts, therefore, are inherited just as the structure of tissues and organs is inherited.

2. Inflexibility of Instinctive Behaviour

The relative inflexibility of instinctive behaviour has been seen in many organisms. The tropical army ant gets its name from the foraging marches that the entire colony makes over the jungle floor. The motions of the colony arise from the simple interplay of three factors :

(i) The stimulus to move,

(ii) The tendency of the individual ants to remain close to one another following the pheromone laid down by those in front, and

(iii) The presence of obstacles or food in the line of march.

On occasions, because of these factors, behaviour of these ants is revealed as blind and instinctive rather than the result of consciousness. On a flat surface, the lead ants begin to move away from the swarm but their conflicting tendency to stay with the group results in their walking a circular path. The chemical trail laid down is followed by the others and soon the entire swarm is marching around and around in a circle. Unless some obstacle interrupts the path established, the ants will march themselves to their own destruction.

In most circumstances, instinctive behaviour promotes the survival of the species. It is only when unusual circumstances arise that the true, inflexible, and unthinking nature of instinctive behaviour is revealed.

Carrying Out of Instinct

The carrying out of instinct often depends upon the conditions in the internal environment of the organism. In many vertebrates, courtship and mating behaviour will not occur unless sex hormones are present in the blood stream. The target organ appears to be a small region of the hypothalamus. When stimulated by the presence of sex hormones in its blood supply, the hypothalamus initiates the activities leading to mating. The level of sex hormones in the blood is, in turn, regulated by the activity of the anterior lobe of the pituitary gland.

Releasers of Instinctive Behaviour

Once the body is prepared internally for certain types of instinctive behaviour, an external stimulus is needed to initiate the response. During the breeding season, the female three-spined stickleback follows the red-bellied male to the nest that he had built, and lays eggs in it. She will, however, follow almost any small red object presented to her. Once within the nest, the presence of neither male nor red object is necessary any longer. Any object touching her near the base of the tail will cause her to liberate her eggs. It is as though the sticklebacks were primed internally for each item of behaviour and needed only one specific signal to release the behaviour pattern. Thus, the signals that trigger instinctive acts are called releasers.

Salient Features of Instinctive Behaviour

1. It evolves gradually as do structural features.
2. Natural selection modifies it to fit in the environment.
3. It consists of stereotyped patterns of movement, which are similar in all individuals of a species.
4. Instinctive patterns can often be evoked readily by simple stimuli.
5. An animal may have few inborn inherited responses but as it grows up moulds its behaviour in the light of its experience.
6. Behaviour patterns that develop in isolation are under some genetic control and result from an inherited potentiality of the nervous system.
7. Genes may control behaviour, but for this they must interact with developing animal's environment.

8. Innate behaviour is not a limited response but may involve a sequence of patterns that run a predictable course involving complex set of activities.
9. Some innate behaviours may be complete in seconds, some may show extra ordinary elaboration and may take hours.

Q. 2. What is innate or instinctive behaviour. Describe various forms of instinctive behaviour.

Give an account of conditioned reflex. *(Garhwal 1995)*

Instinctive Behaviour

Hint : Refer Q. 1.

Forms of Instinctive Behaviour

The innate or instinctive behaviour is of three types :

1. Reflexes and reflex actions
2. Fixed action patterns
3. Modifiable action patterns

1. Reflexes and Reflex Actions

These are simplest and invariable responses of a single organ system to a simple stimulus such as a touch or a flash of light. Reflexes are fixed, stereotype responses to stimuli. These depend upon the reflex arc.

Examples : The contracting of pupils of the eyes in response to bright light and the familiar knee-jerk reflex are examples of reflexes in man. The reflex provides a short cut, avoiding the delay that would be involved if impulses first had to travel to the brain, and the brain in response then had to send out impulses to achieve action. Reflexes operate only so long as stimuli are present, and the reflex behaviour affects only a portion of the organism.

Classification of Reflexes

Reflexes are of following types :

1. Unconditioned or Simple Reflexes : These are transmitted through inheritance and are constant. These are evoked by a definite stimulus. Pupillary, swallowing, tendon flexes, etc., are examples of such reflexes.

2. Conditioned Reflexes : These are acquired or learned reflexes during the life time. These are not constant and may disappear or reappear again.

3. Phasic Reflexes : These are rapid, short-lived adjustments, e.g., flexion response.

4. Tonic Reflexes : These are rapid, short-lived adjustments that maintain muscular tone, posture and equilibrium.

Salient Features of Reflexes

1. Threshold : Each type of stimulus has a threshold for eliciting the reflex. For example, if a weak shock is given to the foot pad of the spiral dog whose central nervous system is cut, does not show any response. When the intensity of stimulus

is raised step by step, a point comes when the response follows each stimulus. This is the threshold for that stimulus.

2. Reflex Latency : There is always a delay between giving a stimulus and its effect. According to **Sherrington,** in the dog flexion reflex in which it withdraws its legs in response to the stimuli, the minimum latency is about 22 milliseconds.

The reflex latencies are shortest when strong stimuli are applied. The latencies are longer in the case of less intense stimulus.

3. Irradiation : It is increase in the extent of the response with an increase in stimulus strength. For example, a man on touching a hot stove, withdraws the hand. If the stove is very hot, the entire arm is pulled back. If the stove is red hot, the person springs backward, usually crying and pulling the entire body away from the danger.

4. Affter-discharge : The continuation of response after the end of stimulus is called after-discharge. As in the case of dog, when the stimulus is stopped, the leg gradually returns to its normal position. The effect of a stimulus persists for some time even after the application of stimulus is over.

5. Rhythmic Response : This can be understood by the **scratch reflex** example of dog. The scratch reflex can be elicited by an electrical shock given on the dog's back. Even if the shock is given 500 times/second, the response is rhythmic scratching motion by the hind leg. The leg moves back and forth 4 times/second. It is also seen that the scratching movements are directed towards the point being stimulated. This is called local sign.

6. Summation : The scratch reflex discussed above also illustrates another aspect of reflex, i.e., **summation.** It is seen that 5-10 weak stimuli given in rapid succession may not evoke any response. The scratch reflex is evoked only after 44 stimuli since the stimuli are added up in the animal until a threshold is reached. This is called **temporal summation.**

7. Warm up : Warm up in some reflexes is due to the summation of stimuli which evoke a response from more and more motor nerve fibres, producing a stronger contraction. This phenomenon is regarded as motor recruitment.

8. Fatigue : It was found that the dog scratch reflex gradually becomes weaker after about 20 seconds to continuous mechanical or electrical stimulation at a single point of skin. The long movements become weaker and lose their rhythm. It was caused due to increased resistance to transmission across the synapses which convey impulses down the spinal cord and the motor neurons. This shows that fatigue lies between the receptors in the skin and the origin of motor nerve.

9. Inhibition : Some times transmission of impulses inhibits. Delay and fatigue also cause the inhibition. It is noted that when the flexors of one limb are contracting, the flexors of the opposite limb get inhibited (reciprocal inhibition).

Active inhibition can easily be distinguished from fatigue. In the case of fatigue, scratch reflex shows gradual weakening. When the same reflex is inhibited by stimulating the antagonistic flexion reflex, it stops abruptly. On the removal of flexion stimulus, it starts again. Therefore, inhibition serves in a smooth and rapid transition from one reflex action to the other.

2. Fixed Action Patterns (FAP) *(Allahabad 1994)*

Fixed action patterns are specific stereotyped patterns of behaviour that are independent stimuli and are exhibited automatically by an animal without having learnt from conspecific individuals. These are endogenous and are exhibited even when an animal is raised in isolation. The fixed action patterns are also called **instinctive, inborn, inherent** or **innate behaviour.** FAPs are triggered by external stimuli.

Fixed action patterns are species specific and are shared by all members of the species. However, some FAPs are based on idividual experience and are called acquired or learned behaviour. These are highly conservative. Some patterns are exhibited by young ones, some by nuptial males and some only by lactating mothers.

Examples : Common examples of FAPs are :

1. Visible and audible courtship plays of insects, birds and fishes to attract the mate.
2. Nest building, food gathering and food hoarding behaviours.
3. Thermoregulatory behaviours in animals
4. Attack and defence behaviours.
5. Construction of web by spider and beehive by bees.
6. Migration of fishes and birds along a fixed route.

The most common example is dancing of peacock after seeing a peahen during breeding season. In human infants crawling, crying and smiling are also fixed action patterns.

Lorenz and **Tinbergen** (1939) studied egg-rolling behaviour of **gray lag goose.** When an egg rolls out from the nest the gray lag goose attempts to take it back into the nest. This is done by placing the beak ahead of the egg and drawing it back towards the chest. The movement of beek towards chest is in fixed fashion.

Genetic basis of FAPs : The information for most of the fixed action patterns are governed by genes and are stored in the genome. These are passed on to the next generation and are called **species memory.** FAPs are mostly innate or inherent but some are acquried by individual experience and may be called acquired or learned fixed action patterns.

Instincts are also innate FAPs. These involve complex and highly rigid patterns of behaviour. These are the results of interaction of numerous sets of muscles, organs and systems along with brain and nerves. All of them function in an extremely coordinated fashion.

3. Modifiable Action Patterns (MAPs) *(Garhwal 1999)*

These behaviour patterns show a basic core of fixed action pattern but are still modifiable by different types of learning processes. Examples are nest building behaviours of birds and rats, singing and calling behaviours of birds, etc.

In peach-faced lovebird, cutting of nest material in strips is partly instinctive and partly a result of experience. The propensity for punching holes in the material

from which nest material is taken is instinctive but the technique and pattern of punching holes to get proper with, length and shape of strips is learned through experience.

In isolated young of a species deprived of all auditory stimulations, sound is produced instinctively but its pattern is found to be only basic and very limited. The elaborate singing behaviour is fully realized only thorugh listening and singing with other members of its species i.e. experience.

These behaviours are often species specific and quite useful in taxonomic and evolutionary studies. These behaviour patterns are determined along with the developing structure of the animal and shared by all members of a species. Not only this, but the developing nervous system lays down circuits which predispose the animal to perform particular sequence of muscular contractions that go to make up FAP.