UNIT 14 DEVELOPMENT OF BEHAVIOUR

Structure

14.1 INTRODUCTION

In the previous unit you were introduced to the study of animal behaviour. You learnt the definition of behaviour and the importance of its study and how anatomical and physiological attributes of an animal determine its capacity for behaviour.

Research in animal behaviour branched off in several directions. You learnt in the previous unit that some biologists considered behaviour to be genetically determined. Others argued that all behaviour can only be studied in the natural environment while still others strongly advocated that only controlled laboratory conditions can yield authentic results about behaviour. But what causes a particular pattern of behaviour to develop?

You would have heard the repetitive call of the koel as summer approaches and may have wondered why does the koel sing? Do all koels 'know' what they are supposed to sing or does each one learn something from the environment that influences the way it sings? Such questions lead us to study the development of animal behaviour through various approaches.

In this unit we will discuss the role of genes and the environment on the development of behaviour further. You will study that different species of animals have different capacities for behaviour. You will learn about inherited or innate behaviour and how learning and experience shape an animal's behaviour during its lifetime. In recent years biologists have come to regard behaviour as a part of the total adaptational package of an animal, necessary for its survival, therefore, you will read briefly about the evolution and adaptiveness of behaviour. In the next unit you will learn how behaviour is organised at different levels.You will also learn about social behaviour and the need for communications in animals.

Objectives

After studying this unit you should be able to:

- reason why all animals of a species behave, under similar circumstances, in more or less the same way,
- explain how animals learn to behave from their parents and others of their kind,
- discuss and distinguish between innate and learned behaviours,
- describe the adaptive value of behaviour.

14.2 CAUSES OF BEHAVIOUR

Animal behaviour shows a range of variety as great and bewildering as there are sizes, shapes and colours of animals which took generations to describe and classify. No two species behave in a similar manner. For instance, a bird can be recognised by its call or its song, the way it feeds and the way it builds its nest and such behaviour patterns are fixed for each species. No sparrow can build its nest the way a tailor bird does, nor can the

sparrow sing like a "koel". Therefore, we can appreciate that anatomical and physiological difference between different species can elicit the very different patterns of behaviour and this difference gets more pronounced as the species get phylogenetically far removed. Apart from this, members of a species also differ from each other in their behaviour.

The enormous variety of behaviour repertoires found in animals that we encounter even in our day to day life makes us wonder why does an animal behave the way it does? Most of you at some time or the other would have seen a house lizard catch an insect on a hot summer night. The lizard approaches the insect slowly and suddenly snaps at the insect and holds it in its mouth. How and why does the lizard do this?

The question **how** may be answered as-the lizard saw the insect, it was hungry, a nerve signal went to the central nervous system which in turn activated the muscles of the leg to move the lizard closer to the insect and the muscles of mouth to catch the insect. The **how** questions are related to the immediate factors and processes that triggered the observed behaviour. These are the **proximate** causes. Proximate causes of a behaviour are observable, immediate and structural (anatomical and physiological), that is, how the structures within the animal operate enabling the animal to behave in certain way.

The answer to the why question is that the behaviour took place as it was advantageous or selected during the course of evolution. This is the **ultimate** cause, which is long term, genetic, ecological and evolutionary and leads to better survival and reproduction. The distinction between proximate and ultimate factors can be applied to virtually all behaviour.

The study of the causes of behaviour is therefore, a three fold task. How does the machinery for behaviour work? How does it develop during the individuals life time and how the animals have evolved their machinery for behaviour.

Earlier all animal behaviour traits were classified into either instinctive or learned. These categories were created to acknowledge the differences in the proximate causes of various behaviours. Instincts were claimed to be genetically controlled and learned behaviour was believed to be entirely dependent on experiences or the environment. However, as behavioural science has developed we find that it is difficult to separate the two categories and influence of heredity and environment interact to produce a set of behaviour.

SAQ 1

a) Fill in the blanks:

i) Behaviour has structural and functional basis, and it is important to distinguish between immediate or ..... and the longer-ranging ..... causes of a particular behaviour.

ii) Proximate factors in behaviour are brought about by ..... and ..... systems.

iii) Ultimate factors in behaviour are genetic and .....

b) Explain the two terms instinctive and learned behaviours.

14.3 INNATE BEHAVIOUR

One of the many misconceptions about animal behaviour is that some mysterious source of wisdom directs the animals to behave. There are indeed many instances when animals behave as if they were born with the appropriate responses. Such cases of behaviour are designated as instinctive or innate behaviour. The word 'innate' is of wide and varied connotation and includes several types of behaviour which have one feature in common i.e., **it is not learnt**. Innate behaviour is produced without any mistakes the first time it is performed. It is a programmed, fixed motor pattern and not modified by the environment. This is rather important because the cost of mistakes is high. An example of innate behaviour makes this point clear, kittiwakes are sea birds that nest on narrow ledges near the sea. As soon as the chicks hatch they stand still, for moving about on a narrow ledge could prove fatal. Whereas, the chicks of herring gulls that are born on flat ground move

about after hatching. Innate behaviours appear independent of experiences and are often said to be selected during the course of evolution for their adaptive value and since these behaviours appear automatically without variation, they are also energy saving devices. Let us now discuss different categories of 'innate behaviour'.

i) **Taxes**: You have learnt in LSE-09, Unit-15 about taxes; lower organisms, display a variety of automatic and stereotyped reactions to external stimuli (for instance light, temperature, weak electrical current) which certainly can not be learnt by such simple creatures with a very short life span. These responses called taxes, are in the form of orientation of the organism either away from or towards the stimulus and thus resemble the tropic responses of plants. Taxes are regarded as the properties of the organism's inherited receptors and neural connections. Taxes help the lower organisms adjust to their environment.

ii) **Reflexes**: Another category of innate behaviour similar to taxes, are reflexes which are also the function of inherited neural mechanisms. In fact, in many respects it is difficult to make a clear-cut distinction between taxes and reflexes. However, taxes involve orientation of the whole body of the organism while reflexes are responses of only a part of the body like the flexion of a limb in response to a painful blow or the blinking of the eyelids in response to a flash of light. Reflexes in lower organisms are adaptive in function and are relatively invariable but are progressively variable in higher organisms. For instance people living in urban environment have subdued reflexes to various types of sights and noises.

iii) **Instinct**: This is perhaps the most complex of all categories of innate behaviour and also the most difficult to explain. We can define an instinct as a behaviour that appears fully functional from the first time it is performed even though the organism may have had no experience with the cues to which it reacts.

Fig. 14.1: Begging behaviour in chick of herring gull. Pecking by the chick instinctively at the red spot on the herring gull's beak induces it to regurgitate food.

Typically such behaviours are mechanically triggered by a simple cue or a stimulus. A well-cited example is of the garter snake. Experiments showed that a new born garter snake from coastal areas if presented with a slug, darts out its tongue to get the chemical scent. If presented with a cotton swab dipped in slug extract, a similar response is elicited. The snake detects and captures food in this way in nature and the newborn knows what to do without having ever seen another snake capturing food. Chicks of herring gulls instinctively peck at any stick with a red spot on it, as the red patch on the beak is the sign that induces it to peck which elicits a feeding response in the parent bird.

Instinctive behaviour seems to be triggered by rather limited environmental cues. Male stickleback fish in reproductive condition have red bellies and they guard their eggs in the nest. Therefore, if any thing red is placed near their nest, males will attack it aggressively because in breeding condition they recognise and attack other males that also have red bellies (Fig. 14.2).

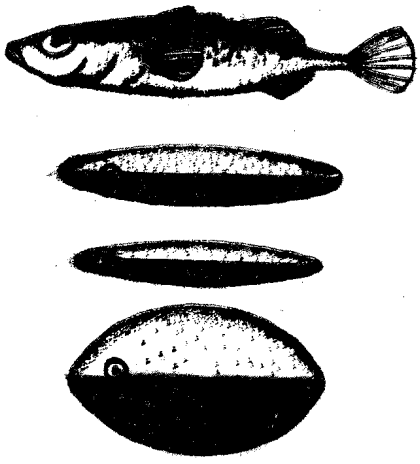

Fig. 14.2: In an experiment the carefully made model of the stickleback (a) does not triggers an attack by the breedin males, while the crudely made models having red bellies are

A very interesting experiment that popularised the concept of instinct was performed by the two pioneers of ethology, Conrad Lorenz and Niko Tinbergen. They observed that while incubating the eggs a female greylag goose will pull back any egg that has rolled out of the nest, under her neck by extending her bill over it and bending her neck (Fig. 14.3). If the egg is removed away from the goose during her act of retrieval she still completes the act. In an experiment if the egg was replaced by a rounded stone or a larger egg than her own it was still retrieved.

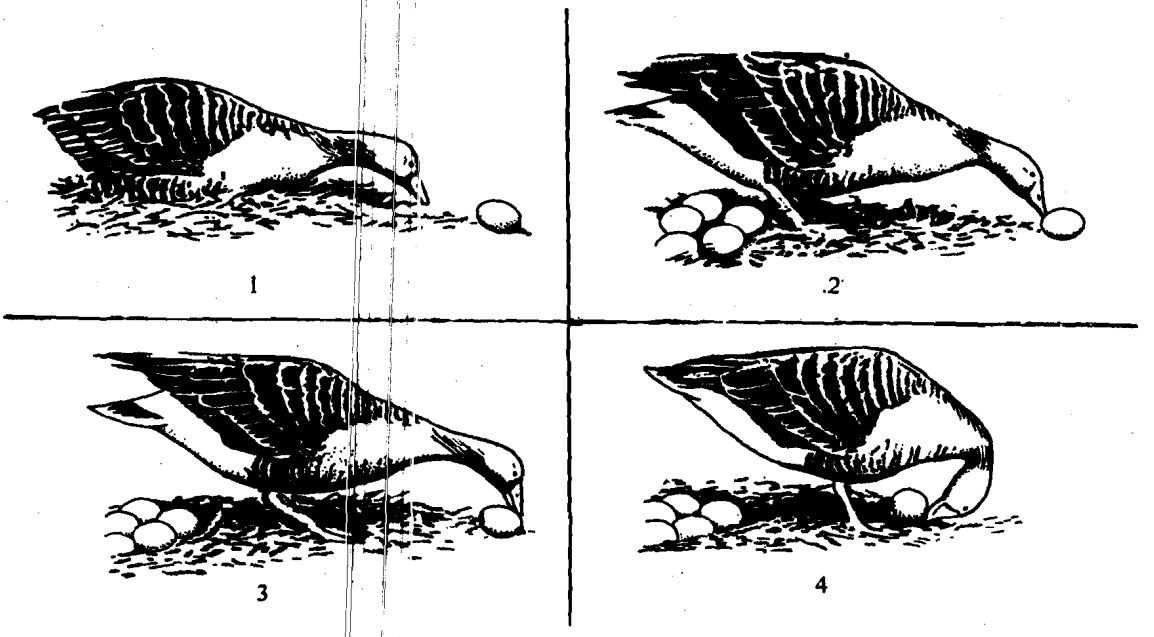

Fig. 14.3: A greylag goose will roll her egg back to her nest and will continue with the FAP even if the egg is removed midway through the process. (after Lorenz, and Tinbergen 1938. Zeit Tierpsychol 2:1-29)

Interestingly if the egg is removed during the retrieval act the goose still continued the chin tucking movements. Ethologists call this kind of innate stereotyped behaviour as a **fixed action pattern** (FAP) which is played out to completion, once activated by a simple sensory cue. The presence of the egg outside the nest was the cue or the trigger that released the egg retrieval behaviour.

This stimulus is termed as the **releaser** and since the animal usually responds to some aspect of the releaser (colour, shape, sound etc.) the stimulus is called **sign stimulus**. The hypothetical neural mechanism that receives sensory input from sign stimulus detectors to make the decision to activate the FAP is called **innate releasing mechanism**. FAPs start and stop under the influence of the sign stimulus but unless it is stimulated to stop, the FAP completes its course automatically as the egg retrieval behaviour of the goose shows. There are hundreds of sign stimuli and the response is usually the same for each case for a species. Though a sign stimulus does not invariably provoke its FAP, a lot depends on the animals physiological condition and nervous system. Thus only during the breeding season will the male sticklebacks attack other fish with red bellies. A stimulus may be filtered out by the nervous system. For instance if the animal is hungry food will stimulate feeding behaviour but if the animal sees a predator the food stimulus will become ineffective. Generally stimuli that elicit escape behaviour take precedence over stimuli for food.

Ethologists explain instinctive behaviour as the outcome of complex interactions of internal conditions and external influences. Many aspects of reproductive behaviour in animals, attraction towards an individual of the opposite sex, courtship displays and movements of body parts associated with the act of copulation, are regarded as instinctive behaviour. Reproductive behaviour depends to a great extent on the presence of sex hormones. There will be no response if the level of sex-hormones in the blood is very low. But with the increase in sex-hormones level (this can also be done experimentally) courtship displays and actions associated with copulation start even with minimum of stimulation (environmental factor) such as a passive mate.

Sometimes when the sex-hormone level rises beyond certain limits, the animal gets aroused even at the sight of an individual of the same sex or of a different species or even

an inanimate dummy of the mate. This indicates the relative roles of internal and external factors in the origin and development of instinctive behaviour. It also shows that relative ineffectiveness of one set of factors may be compensated for by the other set of factors. Note that in the above example, increasing level of sex hormone (internal factor) eliminates to a great extent the need of stimulation (external factor).

The term 'instinct' had been coined to designate a class or catagory of behaviour which was thought to develop without learning. But with the passage of time and a much better understanding of various dimensions of behaviour development, the meaning of instinct has undergone considerable change. Present day ethologists generally agree that clear distinction between 'instinctive' and 'learnt' behaviour is neither feasible nor necessary. A conclusive test to see if instinctive behaviour can develop without any influence of learning or other external factors seems impossible. Instinctive behaviour is conceived as the outcome of complex interactions between internal (inherited) and external (learning, experience) factors.

SAQ 2

a) Indicate whether the given statements are true or false.

i) Taxes involve the orientation of only a part of the body towards a stimulus.
ii) A behaviour can be considered instinctive if it appears fully functional the first time it is elicited.
iii) Some instinctive behaviours can be modified or become more efficient with practice.
iv) Reflexes are not part of innate behaviour but genetically influenced.

b) Shoving of the eggs of the host out of the nest by the hatchling cuckoo is an example of learned or innate behaviour?

14.4 LEARNING AND EXPERIENCES

In the earlier section we concluded that the instinct concept can help explain certain kinds of behaviour in animals that appears fully formed even if they are denied all opportunities to learn. Behaviour is different from the functioning of machines which work in a fixed and predetermined patterns. A machine is regarded as defective if its functioning varies even slightly from what it has been designed for. It needs repair if its functioning becomes inconsistent. Animal behaviour by contrast is not a passive mechanical activity. Animals respond innately to certain stimuli but also store information about the various connections between experience and consequences of their action.

This information storage results in learning, which is the adaptive modification in behaviour in response to specific experiences during the individuals lifetime. For instance the initial begging for food in a chick is an innate response but later it learns where and when and what kind of food it can get most easily.

All animals can alter their behaviour to the extent their inherited capacities (anatomy and physiology) permit. But why do animals have to modify their behaviour? Recall reading in Unit 13 that the basic objective of behaviour is survival and well-being of the concerned animal. The importance of learning varies from one species to another. For instance a tapeworm is seldom considered clever for it has no need to be so. It lives in an environment that is conducive to its well being. Its food is easily available and as for leaving offspring it has simply to produce thousands of eggs. In contrast monkeys live in a constantly changing and often dangerous environment. They must learn to cope with a variety of complex situations. Unlike tape-worms their life span is long and that gives them enough time to mature and accumulate information.

Going deeper into the mechanisms of learning and behaviour modifications we can categorise the various types of learning.

14.4.1 Associative Learning

It involves the capacity to make connections between a new stimulus and a familiar stimulus. One kind of associative learning is **classical conditioning of reflexes**.

Conditioned reflexes are behaviour patterns shown when an animal has learnt to associate a new stimulus with a stimulus that normally elicits a reflex. This was shown by the Russian Physiologist Ivan Pavlov in his classical experiments on conditioning (Fig. 14.4) Pavlov showed that if a hungry dog is shown food, as a reflex reaction it salivates. He then demonstrated that if a bell is rung or a light is shown to the dog just before it was given food, soon the dog would begin to salivate at the sound of the bell or the sight of the light without the stimulus of food. The dog learns to respond to the new stimulus of the bell or light and associates it with food.

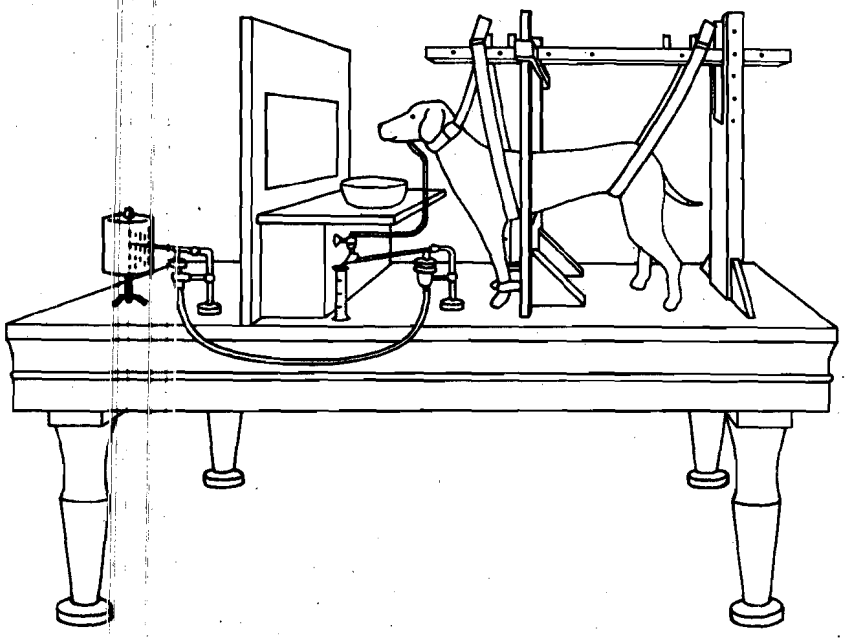

Fig. 14.4: Arrangements for Pavlov's classical experiment on conditioning of reflexes. The dog is restrained on a stand facing a panel, under experimental conditions, well insulated from external disturbances. A tube running from a fistula in its cheek collects the saliva as it is secreted. This drips on a hinged plate which records the intensity and duration of the secretion

B.F. Skinner an American Psychologis devoted his life to the study of instrumental or operant conditioning. The famous Skinner box called after him is basically a problem box in which an animal (in Skinner's experiments a rat) learns by trial and error that pressing a bar in the box releases a food pellet. After a few trials the rat pressed the bar repeatedly and quickly. Skinner believed that on could condition virtually any response and these techniques have been used t regulate internal activities, such as heart rate or brain electrical activity which were earlier thought to be entirely unconsciously regulated.

Pavlov called the food as unconditjoned stimulus and salivation is its ui.conditioned response. The bell is the conditioned stimulus and the salivation in response to the bell or light becomes the conditioned response. A similar conditioned response can be formed to a negative stimulus or punishment in a similar manner. Pavlovian or classical conditioning is very widely observed in animals and it pervades every aspect of normal life in higher animals including humans.

Another form of associative learning is **instrumental conditioning** or learning by **trial and error** where a **reinforcing stimulus** can be either a reward or a punishment and appears after a particular behaviour is performed by chance. If an animal gets a reward for performing a particular behaviour it soon learns that behaviour (Fig. 14.5). Similarly a punishment would deter it from performing that act. Therefore, the correct response is instrumental in providing access to reward. This type of learning has been known to circus trainers for centuries.

Fig. 14.5: The rat examines a metallic lever in a Skinner box and learns to press it after being rewarded with food which acts as a reinforcer.

14.4.2 Extinction and Habituation

In conditioning the behaviour persists for as long as there is persistent reinforcement. If the reinforcing stimulus is removed the learning behaviour is extinguished. This is called **extinction**. However, if the conditioned stimulus is again paired with a reinforcer there is rapid recovery of the original conditioning. At the same time repeated application of a stimulus often results in a decreased responsiveness. This phenomenon is called **habituation**, a form of non-associative learning. Evidence of habituation has been obtained throughout the animal kingdom from coelenterates to humans. The function of habituation is to discriminate between novel and familiar events and to ensure that the animals behaviour is more or less appropriate to each.

All of us see a crude bamboo cross wearing a worn-out shirt with an inverted earthen pot resembling a human head, standing in the crop fields. This is popularly called a scare-crow and has been used to frighten the pest-birds. When first installed in a season, it is quite effective in keeping the birds away, but gradually loses its effectiveness and the birds are sometimes seen sitting on the device itself! Domestic cattle in the villages get panicky at the sight of a moving motor vehicle but those living in towns do not bother about so many vehicles on the roads.

There can be many such examples to prove that repeated exposure to the same situation or repeated stimulation of a particular type leads to a change in the behaviour of the concerned animal.

Extinction differs from habituation as it occurs in relation to previously learned responses whereas, habituation occurs with innate response that have not occurred through any processes of conditioning.

SAQ 3

i) Define 'learning' in simple terms as briefly as you can

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ii) A bird learns to avoid the black and orange caterpillar of the cinnabar moth after one or two times because of its evil taste. What kind of learning is this?

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14.4.3 Latent and Insight Learning

Latent learning refers to an ability to store information about features of the environment which can be used later in guiding the animal through its habitat. This occurs without any

reward or punishment. Experiments have shown that if a mouse is allowed to roam in a complicated maze (without any reward) prior to the actual experiment it will be able to find its way through it with fewer food reinforced learning trials.

Wolfgang Kohler was interned on the Island of Tenerife between 1913 and 1917 throughout World War I. He studied chimpanzees at the Anthropoid station there and reported his results in a book. The Mentality of Apes published in 1925.

Insight learning is a form of reasoning that draws on the results of past experiences to arrive at a solution to a problem. Insight learning has been adequately determined only in some primates and birds. A classic example of insight learning was demonstrated by Wolfgang Kohler experiments with chimpanzees. A bunch of bananas was placed in the cage along with boxes and sticks which if used appropriately, would enable the chimpanzee to reach the bananas.

After appearing to study the situation the animal piled up the boxes to make a stand and reached the bananas (Fig. 14.6).

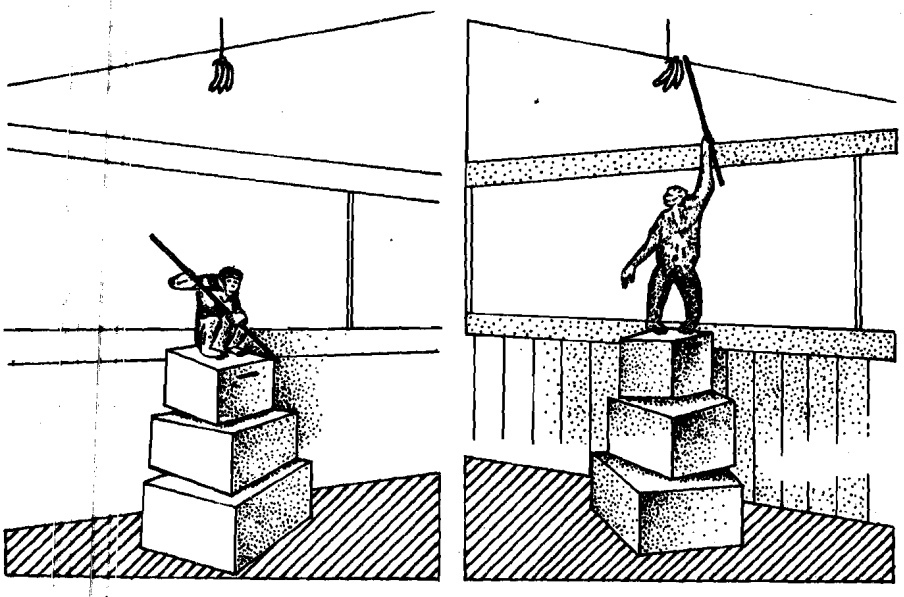

Fig. 14.6: Insight learning shown in captive chimpanzee. The animal could perceive that by climbing up on boxes after piling them one over the other, he could reach the bananas.

14.4.4 Imprinting

We said in Unit 13 that an animal's behaviour like its anatomy and physiology forms during its development through the interactions of its genetic makeup and the environment. In some animals the capacity to learn specific kind of behaviour is pronounced during certain early stages of development. This form of learning is called **imprinting.**

Konrad Lorenz in his famous studies on imprinting showed that goslings (young geese) and ducklings learn to follow their parents and to respond to their signals during a critical period after they hatch. Lorenz found that goslings would follow him as if he was their mother if they saw him rather than their mother during this critical period.

Imprinting has significant long-term consequences. When male goslings or ducklings have matured, they direct their sexual behaviour towards members of whatever species they follow as hatchings. In nature it would obviously be the female of their own species. However, sexually mature birds that had been imprinted on Lorenz directed their courtship behaviour at him.

Imprinting is especially important in many kinds of song birds. If male white crowned sparrows are deafened while very young they will sing disconnected notes but no real song. The birds must be able to hear themselves sing in order to learn the songs of their species. Normally they must be exposed to the song of their species at age 3 months though they will not be able to sing till a few months later. A bird that has been isolated after hearing the song at three months age will still sing the song correctly not only the basic song of the species, but also the dilect of the local population whose song it heard (Fig. 14.7). However, this imprinting is specific, for the young birds can learn the song and dilect of their own species not the dilect of other species to which they might be exposed.

Imprinting is thus a kind of learning that takes place during a critical period of time during development and is very closely under genetic constraints.

Fig. 14.7: Diagrammatic representation of some results of the work on song development of white-crowned sparrow.

Under natural conditions two important consequenses of imprinting are formation of social attachment to a specific individual – the mother and the eventual recognition of a suitable mate. Imprinting behaviour is also seen in some mammals. Young shrews of a European species hold on to the fur of their mother or sibling forming a line of babies (Fig. 14.8). They become imprinted on the odor of the mother between 5 and 14 days after birth. Before that period baby shrews will form a caravan by even grasping a cloth. However, after day 5 if they are given a substitute mother of another species they will become imprinted on her and even if they are returned to their natural mother after day 15 they will not follow her!

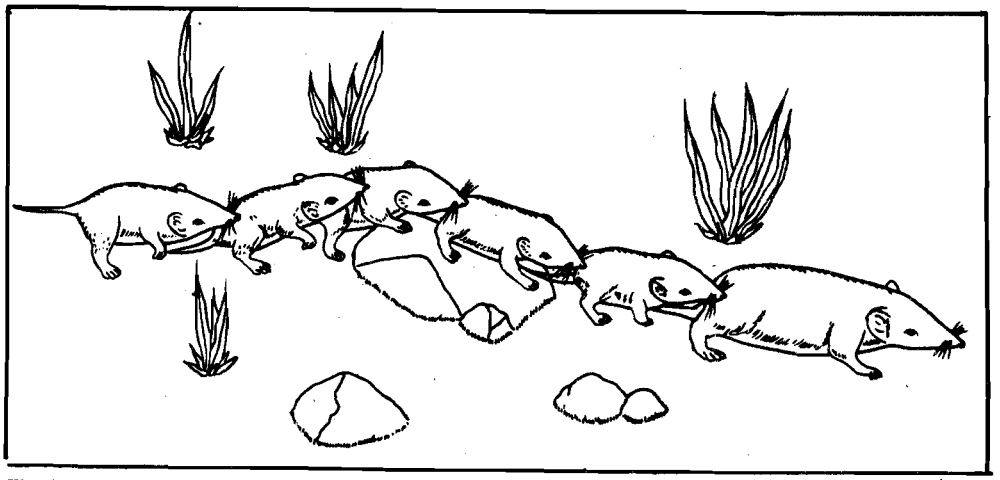

Fig. 14.8: Imprinting in shrews. Young shrews get imprinted on their mother's odor early in life and follow, her in a 'caravan'.

SAQ 4

Identify the type of learning that has taken place in the following examples.

a) A lamb follows the keeper who reared it on the bottle even after being weaned and after joining the flock.
b) A chimpanzee uses a stick to rake in a banana from outside its cage.
c) A loud cracker sound disturbs the pet dog but daily low flying planes over the house make no impact.

14.5 EVOLUTION OF BEHAVIOUR

That behaviour can be shaped and modified by evolution in a manner similar to anatomical and physiologica traits, is the subject of central importance in Darwin's Origin of Species. His concepts were further elaborated by the works of Konrad Lorenz, Karl Von Frish and Niko Timbergen for which they received the Nobel prize of 1973 and since then have been carried forward by other ethologists.

Until now we were concerned with the proximate differences between instinctive and learned behaviours. Now let us look at the ultimate or evolutionary basis of behaviours. We find that there is endless variety in the ways animals behave and those that possess suitable structures and behaviour patterns are the ones that survive. The process of natural selection forces all species to adapt themselves to their changing environments and the species keep expanding their range and invading new habitats. This process is endless and species keep on evolving. Evidence that animal structures have evolved has been provided by fossil records and it is often said that behaviour leaves no evidences hence it is difficult to prove that evolution of behaviour has taken place.

But this is only partially true. Fossil records often provide clues to behaviour patterns. For example, the *Archeopteryx* had wings but no keel suggesting that it glided rather than flew.

Another approach to the study of evolution of behaviour is by comparing fossil records with present day species. For example, the role of the head ornaments of dinosaurs can be inferred by comparing the behaviour of deer and certain beetles that possess head ornaments.

There is also a great deal of indirect evidence that supports the evolution of behaviour. Experiments have shown that particular genes or their mutations affect particular bits of behaviour. You have studied in Unit 13 in the subsection Genetic basis of behaviour that cross breeding experiments have linked behaviour to heredity (Refer to the nest building behaviour of crossbred species of lovebirds). Evidently mixing up genes mixed up the behaviour. That natural selection acts on behaviour in the way predicted by evolutionary theory is evidenced by breeding experiments of domestic animals. Selective breeding for behavioural traits has gone on over the centuries. Dogs have been bred for aggressiveness, speed, herding, various kinds of hunting and so forth. Another approach is to see how survival is affected when some kind of behaviour and its effect is eliminated. For if behaviour is a product of natural selection then its diminution should affect the survival and reproductive success. Experiments showed that gulls that removed the egg shells from their nests had a better survival rate because conspicuous egg shells increase the likelihood that the nest would be robbed by foxes.

Inspite of several such examples we find that it is difficult to say as to how a particular behaviour evolved, for behaviour is very flexible. While certain behaviour patterns like display are fixed within a species other aspects of behaviour may be flexible. Apart from this there may be a strong role of learning and experience in the particular behaviour. Animals can because of their behaviour move to different places, choose new foods and modify their environment in several ways. Any such action changes the selective forces acting on them. Let us explain this a bit further.

An animal may eat only blue berries, but one year there is a scarcity of blue berries. In such a situation only those with a behaviour flexible enough to switch to eating say, red berries may be the ones to survive. Over a series of such disasters, those who learn to eat alternate food will be favoured over slow learners till ultimately the survivers will not have to learn to eat red berries but will do so on first encounter as an instinct. Such an example indicates the complex and fascinating interplay between evolution and behaviour.

SAQ 5

a) What do you understand by the term evolution of behaviour? Explain briefly.

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b) Indicate whether the statements given are true or false.

i) In animals today we see the combination of structural adaptations and refined behavioural patterns, developed through many generations that enable them to survive.

ii) Crossbreeding experiments do not prove that behaviour can be changed through natural selection.

iii) Fossil records are totally lacking for evolution of behaviour, therefore no conclusive evidence for evolution of behaviour exists.

14.6 ADAPTIVENESS OF BEHAVIOUR

As no animal can change its physical characteristics during its life time, change or modification of behaviour is the only means of continued adjustment with the ever changing environment. Behaviour of an individual can vary or change in response to environmental demands only to a certain extent.

Those individuals or groups whose behavioural characteristics are most appropriate for a given environment survive in large percentage and also live longer than others. Such individuals or groups leave more numerous offspring than the less suitable. Thus the population is perpetually dominated by such types who are behaviourally (and physically of course) most in tune with a given environment or in other words the best 'adapted' ones.

Fig. 14.9 : Cliff nesting habitat of Kittiwake gulls. Kittiwakes have clawed feet that help them to cling to the narrowest of cliff ledges.

How do we know whether a particular behaviour is adaptive i.e., it increases the fitness of the individual or the species as a whole? Behavioural ecologists or adaptationists use several methods to explain this by additional observations by experiments or comparing data from related species that occupy different habitats. A classic example using the

comparative approach was a study of nesting habits of Kittiwakes (*Rissa tridactyla*) that live on cliff ledges and those of ground nesting gulls. As a result of predator pressure, Kittiwakes retain some of the features of ground-nesting gulls and seem to have lost many of the antipredator adaptations. For example, they fail to camouflage the nest, they rarely give alarm calls and they do not mob predators (ground gulls attack any predator that approaches their nests collectively, a behaviour known as mobbing). In fact Kittiwakes have special adaptations for cliff-nesting (Fig. 14.9) thus, comparison of closely related species living in different habitats can often reveal those aspects of behaviour which are particularly important in adapting the animal to its environment. You will study adaptive behaviour in more detail in the last unit (Unit-16) of this block.

SAQ 6

Why is behavioural adaptation the only means of continued adjustment with the ever changing environment?

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14.7 SUMMARY

In this unit you have learnt that:

- Basic questions about behaviour can be put in two categories. **How** genetic, developmental and physiological mechanisms cause an individual to behave in particular ways, and **why** do animals behave in a particular way through out evolution.
- As a consequence of differences in anatomical and physiological characteristics, species have differential capacities for behaviour.
- If a behavioural pattern develops in an animal apparently without learning (either from others or by trial and error) it is designated as 'innate'. But it should be noted that behaviour neither develops exclusively within the animal nor exclusively under the influence external environmental factors.
- Innate behaviour in simplest organisms (protozoa, coelenterata etc.) develops as 'taxes' while 'reflexes' are present in a wide variety of organisms both lower and higher. 'Instinctive' behaviour is also observed in diverse groups of animals from honey bees to birds and mammals.
- Learning leads to appropriate alterations in behaviour to the extent anatomical and physiological characteristics permit (capacity). This alteration helps animals keep in tune with the ever-changing environment.
- As anatomical and physiological changes in accordance with environmental changes can not take place during the life time of individuals, alteration of behaviour is the only means of adaptation of individuals to changing environment.

14.8 TERMINAL QUESTIONS

1. Give two examples of FAPs?

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2. Explain what is meant by the term 'innate behaviour'.

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3. Differentiate between 'taxes' and 'reflexes'.

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4. Define the term 'instinct' and explain how instinctive behaviour develops.

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5. What is the ecological advantage of an animal's ability to slightly alter its behaviour through learning?

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6. Can animals maintain conformity with the changing environment in which they live, without being able to alter their behaviour?

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7. What do you understand by 'adaptiveness of behaviour'?

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8. Summarise as briefly as you can, the phenomenon of 'evolution of behaviour'.

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14.9 ANSWERS

Self-assessment Questions

1. a) i) proximate, ultimate.
   ii) anatomical, physiological.
   iii) ecological.
   b) Instinctive behaviour is sterotyped, genetically programmed behaviour, learning may or may not be involved. While learnt behaviour is behaviour that is modified by experience.
2. a) i) F, ii) T, iii) T, iv) F
   b) Innate Behaviour
3. i) Storage, somewhere in the individual's nervous system (brain in case of higher animals) of all observations and experiences, which may lead to alteration of behaviour in the best interest of the concerned animals, is called learning.
   ii) conditioned learning.
4. a) imprinting
   b) insight
   c) habituation
5. a) Gradual changes in behaviour, brought about by natural selection, generation after generation, are called evolution of behaviour.
   b) i) T, ii) F, iii) F.
6. Because anatomical and physiological characters of a species do not change but the behaviour can be modified gradually to suit the changing environment.

Terminal Questions

1. i) Yawning in humans. No matter who is yawning they all last for about 6 seconds and are different to stop midway and are infectious. Yawing releases yawns in other people if they see or even hear a yawn!
   ii) Food begging behaviour in baby gulls is a FAP that is released by seeing the red dot at the end of the beak of the parent herring gull.
2. When behaviour appears to originate and develop independant of learning, it is designated as 'innate'.
3. A clear cut distinction between 'taxes' and 'reflexes' is very difficult if not impossible. However, taxes usually involve orientation of the whole body of an organism while reflexes are responses of only a part of the body.
4. The term 'instinct' is used for a category of behaviour which equips the animal with ready made adaptive responses, without the direct involvement of learning. Instincts are regarded as the outcome of complex interactions of internal conditions and external influences which have become a behavioural characteristic of a species.
5. Learning abilities provide the animal an opportunity for making appropriate alternations in its behaviour during its life time.
6. No, animals will not be able to remain in tune with a regularly changing environment if they do not alter their behaviour accordingly.
7. Establishment of appropriate behavioural responses in the population of a species dwelling in a particular environment is the adaptiveness of behaviour.
8. The regular process of adaptive changes in the behaviour of a species brought about by the process of natural selection is evolution of behaviour.