3. Sign Stimuli

When a response depends much more on certain characters, these characters are often referred as **sign stimuli.** The effectiveness of such characters is more or less specific to one response. The responsiveness to such sign stimuli is a regular feature of instinctive behaviour in situations where learning can be ruled out.

Examples : Red throat of the rival stickleback is most important for aggression. For courtship response, the swollen belly of the female ripe with eggs is the most important stimulus.

There are many examples of auditory and chemical sign-stimuli too. Turkey hens that are breeding for the first time accept as chicks any object which makes the typical cheeping call. The deaf turkey hens kill most of their chicks because they never receive the auditory sign-stimulus for parental behaviour.

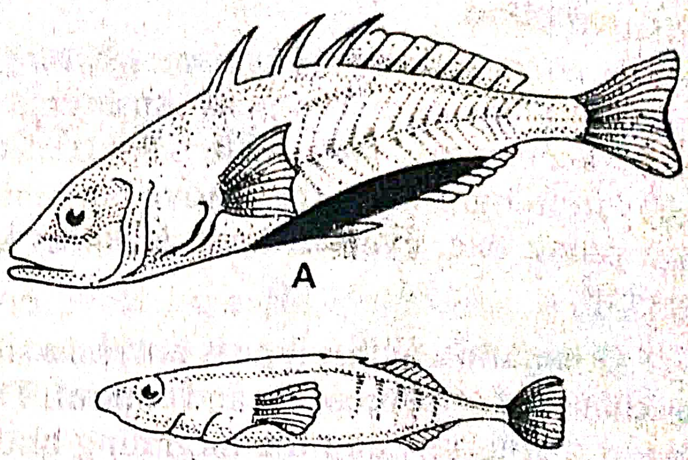

Fig. 1. A-Red belly of stickleback acts as a sign stimulus to B.

Usually there is more than one sign stimuli which evokes a response. In such cases the lack of one stimulus is compensated by an increase in another. Honeybees guarding their hive entrance detect potential robber bees partly by colour and partly by their characteristic hovering flight.

Selective responsiveness to sign stimuli is of great adaptive significance in the lives of many animals. Driving away rival males from its territory is so important to a male stickleback that it must show extreme responsiveness to red. Again animals must never fail to respond to the sign stimuli provided by a predator or by alarm calls of other individuals.

Recognition based upon complex feature is common in higher mammals. For example, the members of a monkey group know one another individually, and a whole range of stimuli provided by the dominant male will allow the others to recognise him by posture, movement and the particular place where he sits. We may also consider the complex range of features by which we recognise a particular human face. There are no sign stimuli here, but almost every aspect combines to produce a unique pattern.

FILTERING OF STIMULUS

Q. 6. Describe how the stimulus filtering takes place in animals.

Discuss filtering of stimulus in animals.

Usually animals select one part of the environment to respond and ignore the rest. This raises the question that how far the ignored stimuli present and where such filters are located which separate them from the sign-stimuli and render them ineffective. These filters operate predominantly at the periphery or more centrally placed.

1. Peripheral Filtering

Animals response to stimuli is limited to sense organs. These act as filters. Our own eyes filter off ultraviolet light and the ears transmit no sound with a frequency higher than 20 kilohertz. Some times selective transmission by sense organs produces the effects of a sign stimulus.

Frog provides a good example of a visual filter at the periphery. While feeding, it responds much more strongly to small, dark-coloured objects moving close to it than to large objects or the whole background. **Lettvin** has shown that the light receptors of frog's retina are connected to each other so as to form a receptor field. Some of these fields are specialised to respond to the intermittent movement of small, dark and convex objects. These are called **bug detectors.** This responsiveness in frog is produced by peripheral filtering.

2. Central Filtering

Central filtering is also called as the innate releasing mechanism. There are several cases where animal's responsiveness to a sign stimulus cannot be ascribed to its sense organs. **Burghardt** (1971) has studied the feeding response of garter snakes and water snakes. These are aquatic animals living in rivers and ponds in U.S.A. These feed largely on small fish and worms. These snakes detect their prey by smell and taste with the help of chemoreceptors located in pits on the roof of mouth in Jacobson's organ. The snake's tongue on flickering out picks up chemicals from the air or on contact with the prey and carries them to Jacobson's organ where they are tasted.

Burghardt found that different species of garter snakes show different levels of attack to cotton swabs dipped in solutions extracted from various types of prey-fish, frogs, salamanders, worms, etc. This preference is always related to the prey type which they most commonly took in the wild. Such preferences were even found in new born snakes also which had never been fed, no matter what diet had been fed to the mother snake during her pregnancy. Thus in snakes, an inborn genetically coded preference for certain chemicals seems to be very strong. It was also found that forced feeding to young snakes on an artifical diet of liver extract for months together did not change their original preferences at all. When the snakes themselves switch over to another prey, their preferences for chemical extracts do change rapidly. Thus adult snakes living near a fish hatchery abundant with goldfish, preferred goldfish extract to that of naturally occurring prey fish such as minnows. Young snakes fed on goldfish in the laboratory also responded in just the same way.

Different types of preys present chemical stimuli of varying types and of varying concentration to the Jacobson's organ. These are passed on the brain and filtered to determine whether the snake should attack that prey or not. The filter has a genetically determined bias which is modified according to experience.

- According to **Lorenz,** there is a special mechanism which is responsible for stimulus filtering and proposed the tern 'Innate Releasing Mechanism' (IRM) to describe it. An IRM is a special neurosensory mechanism that releases the reaction and is responsible for its selective susceptibility to a special combination of sign stimuli.