

WONDERS OF THE ANIMAL WORLD

Objectives: To take learners through a captivating journey of the hoarded wealth of the marvellous animal world.

Desired Outcome: Curiosity will be ignited in the mind of learners, to know more about the fascinating world of animals which would enhance their interest and love for the subject of Zoology.

1:1 Echolocation in Bats and Cetaceans - Dolphins and Whales

The highly refined auditory mechanism of mammals and birds in which an animal emits high-frequency sound pulses and uses the returning echoes to detect the directions, distance, size and texture of objects in its environment is called Eco location. This sonar-like use of auditory signals is developed to its maximum in two groups of mammals: the microchiropteran bats and some cetaceans, such as porpoises and dolphins.

Echolocation in bats: Bats navigate by detecting the echoes of sounds from their wingbeats and locate their prey by homing in on the buzzing of insect wings. Bats emit ultrasonic cries and use the echoes of these sounds to 'see in the dark'. It is observed with highspeed photography that a bat using echolocation can capture two separate insects within half a second. Fish-eating bats use echolocation to find and capture their underwater prey with the help of ripples that are produced on the water surface when a fish swims underneath.

Three phases of echolocation are:

- cruising phase was undertaken during straight flight,
- detection phase where the bat detects its prey,

- homing phase to home in on the prey.

The sound produced is as intense as the noise made when a jet plane takes off and passes only 100m overhead. The intensities of both, the bats cries and the very much less intense echoes, are reduced with the distance travelled. In bats morphological and neuronal modifications help in detecting the echoes. Its snout is covered by complex folds, and the nostrils are spaced to produce a megaphone effect. The pinnae are very large and help to capture any echoes. The ear drum and ear ossicles are small and light. During the emission of sound, muscles controlling the auditory ossicles contract briefly, reducing sensitivity of the ear.

Fig. 1.1: Echolocation in Bat

Echolocation in Cetaceans: Echolocation is used by all odontocetes (toothed whales and dolphins) to detect obstacles and preys. Production of sound in odontocetes is associated with the upper nasal passages situated ventral to the blowhole. The basic sound production system includes a pair of phonic lips surrounded by fat filled bursae suspended by muscles and ligaments below the blowhole. When air is forced through, the slit opens and echolocation clicks are produced when the slit is slapped shut subsequently causing vibrations. The melon, orange helps to propagate the sound forward, thus focusing the sound waves into a beam underwater.

Cetaceans ears serve as separate hydrophones that allows the animal to localize an echo and discriminates between the times the sound is received by each ear; sound transmitted through water cause vibrations that are transmitted by the entire skull. If the middle and inner ear bones were attached rigidly to the skull, vibrations would reach the ear

from many directions simultaneously, thus allowing localization of the sound. The tympanic bullae are not fused to the skull in cetaceans. Foam filled sinuses surround the bullae, thus effectively insulating the bullae from the rest of the skull. In addition the extremely thin posterior part of the lower jaw acts as an acoustical window. Sound passes through the thin part of this bone to the intramandibular fat body, directly leading towards the wall of the auditory bulla. The jaw is the most acoustically sensitive area of the dolphins head.

1:2 Pearl formation: Pearl formation is an art concerned with biological production of one of the finest gems, 'the pearl' nature's perfection of beauty and splendour! It is produced by the pearl oyster, a bivalve mollusc. The soft color and smooth luster of pearls produced by the oyster remains unmatched.

The first practical work to produce artificial pearls was done by the Chinese in the 13th century. However, the credit for the development of modern pearl culture goes to Japan. They developed and perfected the techniques of pearl culture in the marine pearl oyster.

The major species of pearl culture in Japan is *Pinctada fucata* from the sea and *Hyriopsis schlegelii* from the lake. Round pearls are produced by *P.fucata*.

The shell of pearl oyster is reddish-brown but many exhibit different colour patterns. Externally 6 to 8 vertical reddish-brown bands emerge from the umbo towards the free edge of the shell. The hinge line is fairly long with well-defined teeth. The nacreous portion of the shell has bright metallic luster. The shell of pearl oyster is composed of three layers. The outermost layer is the organic conchiolin layer of

periostracum. The middle prismatic layer consists of many layers of calcite crystals of calcium carbonate arranged vertical to the surface of the shell. The innermost nacreous or mother of pearl layer is made up of aragonite crystals.

The pearl is formed by the secretion of mantle tissue. The outer epithelial layer of the mantle is responsible for the secretion of the nacreous layers forming a pearl. The outer epithelium has the capacity to rearrange and regenerate itself. It also remains viable when disturbed within or removed from its original position and transplanted in other tissues of the animal. On the other hand, the inner epithelium and connective tissue disintegrate when transplanted.

The outer epithelial cells of the mantle if falls accidentally into the body of the oyster, resulting in a sac consisting of a single layer of cells, called the pearl sac. Inside this the natural pearl grows due to the secretion of nacre. Thus a free, beautiful, natural pearl is formed having commercial value. The same can be artificially done in cultured pearl by introducing specially developed beads/nucleus under the mantle. The pearl oyster-*Pinctada margaritifera* of the Gulf of California and *P. vulgaris* of the Gulf of Kutch produce pearls of superior quality.

This wonderful contribution from the pearl oyster is not only limited to aesthetic creation but also to the medicinal use.

Fig. 1.2: Process of pearl formation