

Marks - 12

What is echolocation? Discuss the morphological and neurological modifications of microchiropteran bat for echolocation.

The highly refined auditory mechanism of mammals and birds have led to evolution of a truly remarkable form of acoustical orientation in which the animal utilizes the returns echoes of high frequency emitted sound pulses to detect the direction, distance, size and texture of objects in its environment. This sense like use of auditory signals is termed echolocation.

Morphological and Neurological modification.

A number of morphological and neural modification in echolocating bat contribute to these phenomenal abilities such as -
The snout is provided with complex folds and a nostril opening that make for a megaphone effect.

② The pinnae of the ears are greatly enlarged to help capture echoes.

③ The ear drum and ear ossicles are specially small and light for high frequency fidelity. Contraction of the muscles of the auditory ossicles during sound emission briefly reduces sensitivity, a characteristic of the mammalian ear.

4) Blood sinuses, connective tissue and fatty tissue isolate the inner ear from the skull, reducing the direct transmission of sound from the mouth to the inner ear.

⑤ The auditory centre of the brain are enormously enlarged relative to the small size of the brain. A number of specializations of the auditory centres of bats are important in the neurophysiology of echolocation. In this special form of lateral inhibition, one of these is contralateral inhibition, the activation of auditory nerve fibres on one side of the head that are sensitive to certain wavelengths lead to an inhibition of cells in the auditory centre by the activated auditory fibres. The effect of the contralateral inhibition is to increase contrast between the intensities perceived on the two sides of the head that are sensitive to certain wave

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- lengths lead to an inhibition of cells in the auditory center of the opposite side, homologous to the areas innervated by the activated auditory fibres. The effect of the contralateral inhibition is to increase contrast between the intensities perceived on the two sides of the head, thus enhancing the ability to discriminate the direction of an echo. Two other important specializations are the auditory system's rapid recovery after a loud sound, and its short-term enhanced sensitivity to sound having characteristics similar to the (emitted) sound just heard. Thus, for a period of 2-200ms (the time it takes an echo to return from an object 34-340 cm away) following a given emission, the auditory apparatus is hypersensitive to a second sound (the echo) of similar frequency. Thus, the bat has a facilitated ability to perceive its echoes over this critical range of distances.