S. S. College, Jehanabad

Department: Zoology

Class: M.Sc. Semester IV

Subject: Zoology

Topic: Lateral Line System in Fishes

Mode of teaching: Google classroom & WhatsApp

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Q.(5.) Lateral line system:

→ The lateral line is a system of sense organs found in aquatic vertebrates, chiefly fish, used to detect movement & vibration in the surrounding water. The movement and vibrations sensory ability is achieved via modified epithelial cells, known as displacement caused by motion & transduce these signals in to electrical impulses via excitatory synapses. Lateral line serve an important role in schooling behaviour, predation, and orientation. They are usually visible as faint lines running length wise down each side from the vicinity of the gill covers to base of the tail. In some species, the receptive organs of the lateral line have been modified to function as electroreceptors, which are organs used to detect electrical impulses and as such these systems remain closely linked

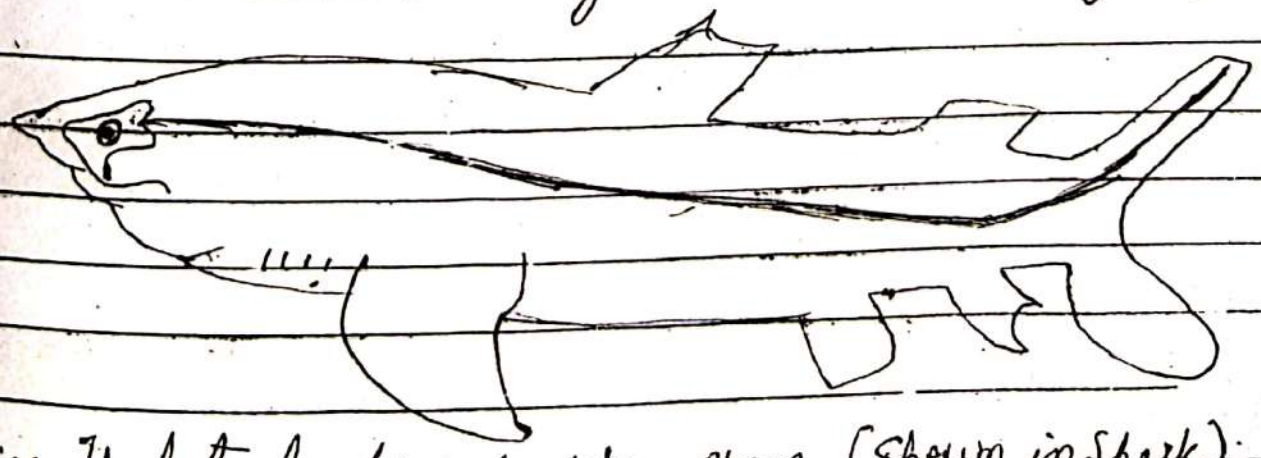

Fig: The lateral line sensory organ (Shown in Shark).

Most amphibian larvae and some fully aquatic amphibians possess mechanosensitive system comparable to the lateral line.

Lateral line system of fishes and amphibia serves as state acoustic receptor organ is better developed in fishes. Lateral line system is composed of a large number of sense organs called the neuromasts, each of which consists of a group of sensory cells with hair like projections. These sense organs of teleost fishes can be divided into two groups:—

(i) The ordinary type which are mechanosensitive

(ii) The specialized type which are electron sensitive.

The first type are found in all the teleosts and comprise free superficial neuromasts which in actively swimming fishes are enclosed in canals.

Each neuromast consists of a group of pear shaped sensory cells surrounded by supporting cells. The sensory cells possess a bundles of cilia on the apical surface and are called hair cells. The hair project above the surface of the epithelium and the cells are enclosed in a gelatinous tube or cupula which lies free and can be moved by the surrounding water. If the neuromast is enclosed in canal the cupula is moved by mucus.

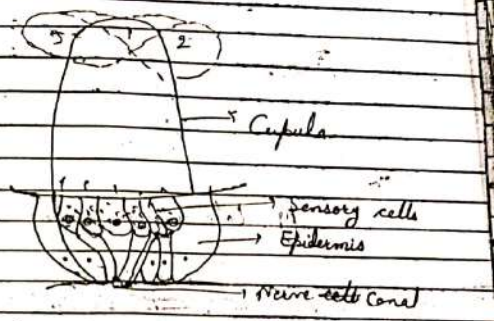

Fig. Free sensory hillock of the lateral line system.

Even a slight movement of water causes the cupula to bend. The sensory cells and their cupulae are generally situated in pits below the surface of the integument or in closed tubes, to protect them from injury.

Fig.

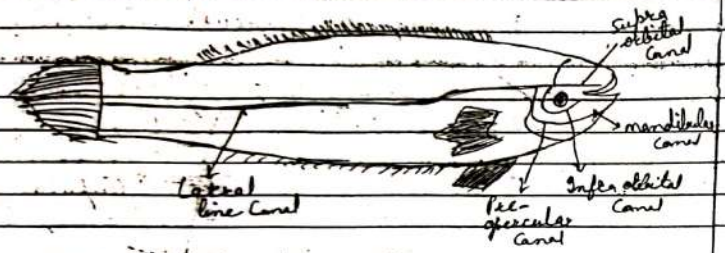

Fig. Lateral line system of Chonna Punctatus.

The neuromasts are found all over the Body of the fish and are arranged in ~~definite patterns~~ on the head. On each side of the body they exist in a canal extending from head to tail. The canals containing the neuromasts are in the form of open grooves in the primitive sharks, Chlamydoselachus. In Protopterus, the canals of the body are open but closed in the head region. Holocephali also posses open lateral line canals and in many deep sea fishes the neuromasts are fully exposed. But in most majority of Elasmobranch and teleosts. The lateral line system consists of closed tube filled with mucus. These

canals open to the exterior at intervals by means of tubules.

The lateral line system in Scoliodon includes the inter communicated liquid filled cephalic canals and lateral line canals on the each lateral margins of trunk & tail.

(a) ~~Cephalic~~ cephalic canal :- cephalic canals lodge in the dermis and its epithelium possesses ~~of~~ contains the epidermal receptors cells or neuromasts usually inserted in groups. It is innervated by the 7th lateral branches of vagus cranial nerves.

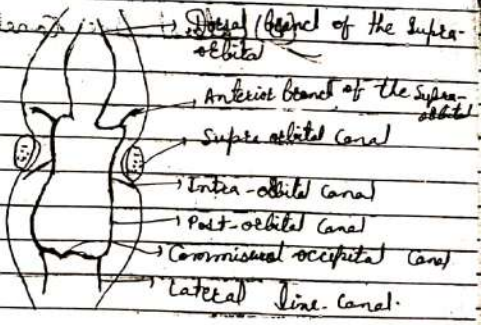

Fig. Cephalic canals on the dorsal surface of head.

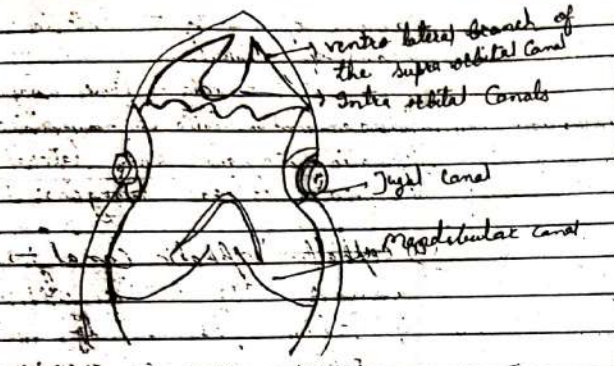

Fig. Course of cephalic Canals on the ventral surface of the head.

(b) Lateral line Canals → Lateral line Canals are lodged in the skin at the Junction of dorsal and ventral region of lateral muscles. It extends from the head to tail. At the cephalic region it gives a number of small canals viz. Commissural, otic, supra orbital, infra orbital, jugal and mandibular canal with small branches both on the dorsal and ventral sides of the cephalic canals. All canals are inter connected to each other.

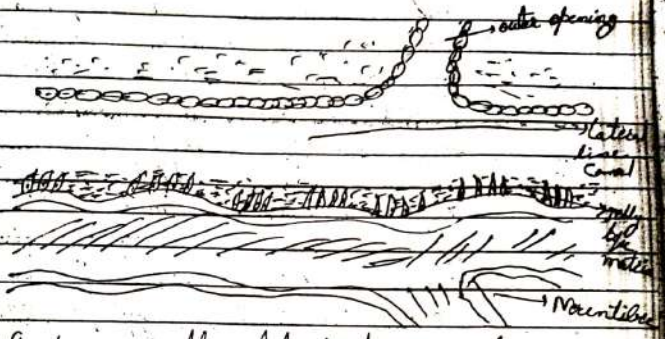

Fig. L.V.S. of the lateral line system.

Lateral line receptors control the wave pattern of water and get stimulated accordingly thus for these are also termed as current receptors or coreceptors. Through this system, the fishes are able to identify any obstacles or enemy even in darkness. But because of this system, fishes become unable to give responses for vocal action.

Ampullae of Lorenzini →

These are a number of poses at the dorsal and ventral region of the head. Each pore leads into an elongated tube, the Ampulla of Lorenzini. At the distal end of the tubes there is a

smaller structure the ampullary sac. Each sac is composed of 8-9 chambers which are arranged around a central core. Tuft trunks of cells are found in the ampulla. Pear shaped cell secreting jelly like substance which are filled in the ampullary tubule and another type called sac. Sensory cells having sensory hairs and sense as receptor cells. It exists in groups. Its a supra orbital group lies around the supra orbital canal. Outer buccal groups is located in between the supra and infra orbital canals and inner buccal groups is distributed below the infra orbital canal. Ampullae are innervated by the opthalmic superficials of 7th cranial nerve and also by the buccal and hyomandibular branches.

Ampullae act as a temperature receptor.

Organ.

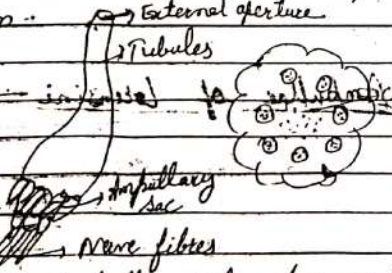

Fig: Ampullae of Lorenzini

Pit organ :- It is also a receptor of organ. It lies in the pits of lateral dorsal surfaces of the head. It comprises ectodermal pits having the receptors. It is also innervated by the cranial nerves.

The ampullary receptors are rhythmically active and sensitive to low frequency (0.1-10 Hz) the tuberous receptors are phasic often discharging in synchrony with the electric organ discharge. Lorenzinic are sensitive only to high frequencies (300-1000 Hz) giving best responses to step changes in voltage.

The pattern and arrangement of the receptors and their length & other accurate characters allow the fish to obtain directional information.

Various behavioural responses have been seen in electric fish. Aggressive electrophorus attacks metal rods but not to insulators. Most weak electric fish swim with body rigid to simplify the process of electrolocation. Fishes may sense the potentials induced while they are swimming through earth's magnetic field & exhibit particular behaviour patterns when an earth quake is impending (Aday & Darwin 77).