Udai Pratap (Autonomous) College, Varanasi

E-learning Material

Module/Lecture	07
Subject	Zoology
Year/Semester	M.Sc. IV
Unit	II
Topic	Fish Anatomy
Sub-topic	Membranous Labyrinth or Internal Ear in Fishes
Key-Words	
Name	Dr Sanjay Kumar Srivastava
Department	Department of Zoology
Faculty	Assistant Professor
College	Udai Pratap (Autonomous) College, Varanasi
Mobile No.	9415390652
E-mail	drsanjay70@gmail.com

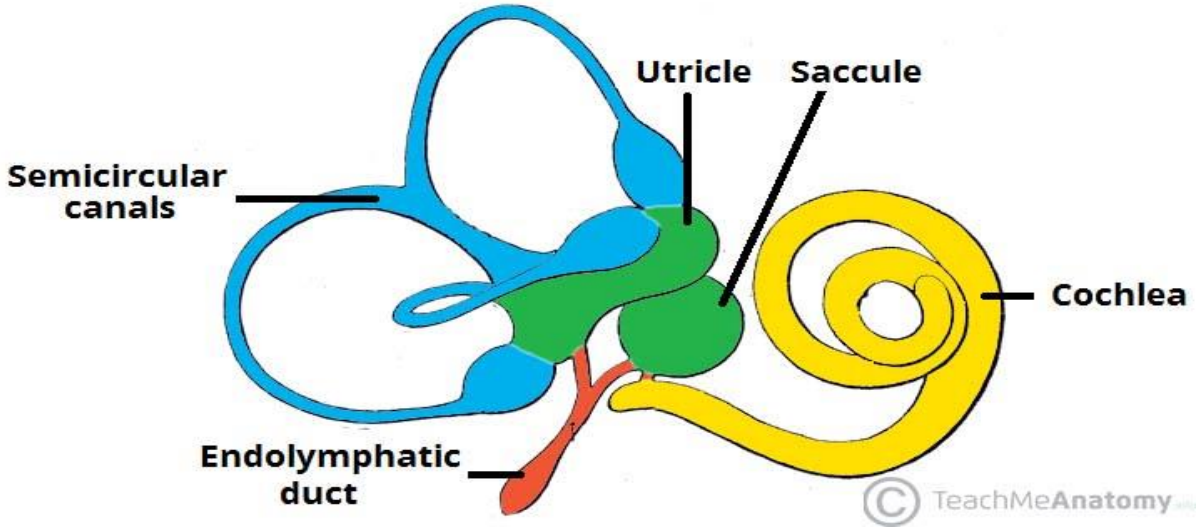
MEMBRANOUS LABYRINTH OR INTERNAL EAR IN FISHES :

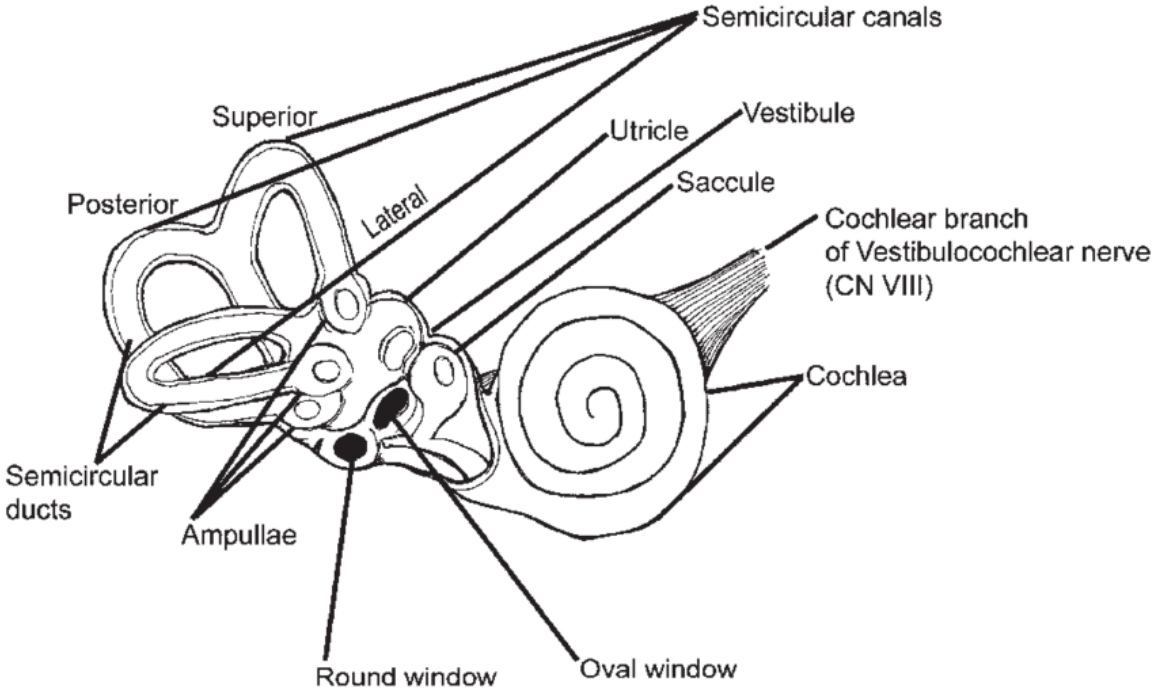
In fishes the external and middle ear apparatus are absent and have only the inner ear consisting of a more or less delicate membyrith with two senses i.e. heading and equilibrium. Fishes are actually sensitive to sound but are able to receive sound of low frequencies only. **"Moreover" species (Ostariophysi)** which possess **Weberian ossicles** and a gas bladder connected to inner ear are more sensitive to sound than others. The membranous labyrinth or the internal ear is the chief organ of hearing.

In fishes it is contained partly in the auditory capsule and partly in certain recesses outside and behind the capsule. It is made up of pars superior and pars inferior. The pars superior comprises three

semi-circular canal anterior- vertical, posterior vertical and horizontal canal. Each semi-circular canal enlarges at one of its anterior ends to form Ampulla and a sac like vesicle, the Utriculus.

Actually the rudiments of inner ear appear on each side in the form of Ectoderm thickening called the Otic or auditory placodes. Each placode sinks inwards forming an auditory vesicle that connects to the surface by a canal called the endolymphatic duct. The duct opens to exterior by a pore in Selachian but closes in other fishes.





The otic capsule later differentiate into a dorsal chamber called the Utriculus and ventral chamber the Sacculus. Three semi-circular canals arise from the Utriculus. These includes two vertical canals lying at right angles to each other and called the anterior and the posterior semi-circular canal and a third canal that lies in the horizontal plane and called the horizontal canal. Each canal swells into an ampulla at one end and connects with the utriculus at the other end.

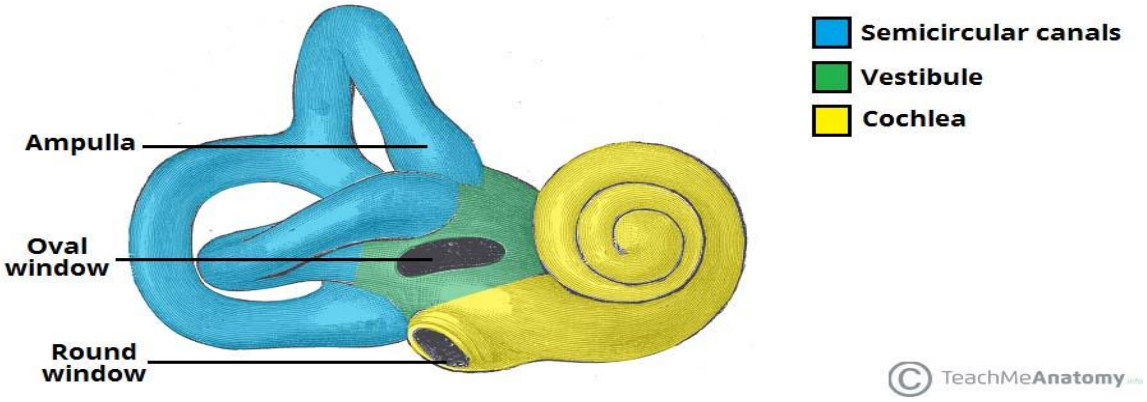
Sacculus lies below the Utriculus and distinguished from the latter by a horizontal constriction. It give rise to a blind diverticulum, the lagena, which is well develop in ***Cypriniformes*** but poorly formed in other fishes.

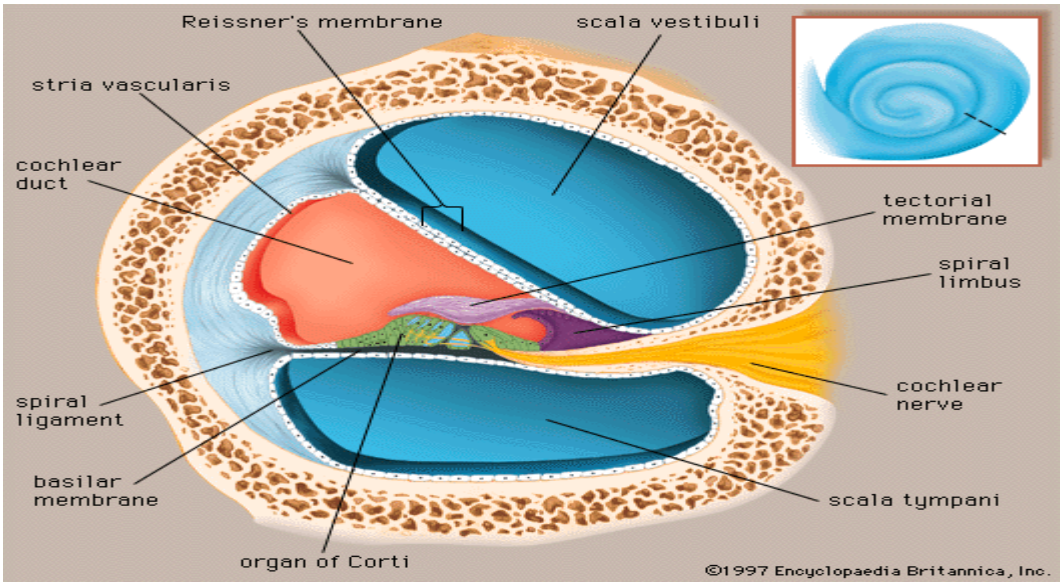
The membranous labyrinth is filled with a fluid called endolymph and the space surrounding it is occupied by the perilymph. Various endogenous crystals of Calcium, Salts combined into loose masses of Otolith are found in the endolymph.

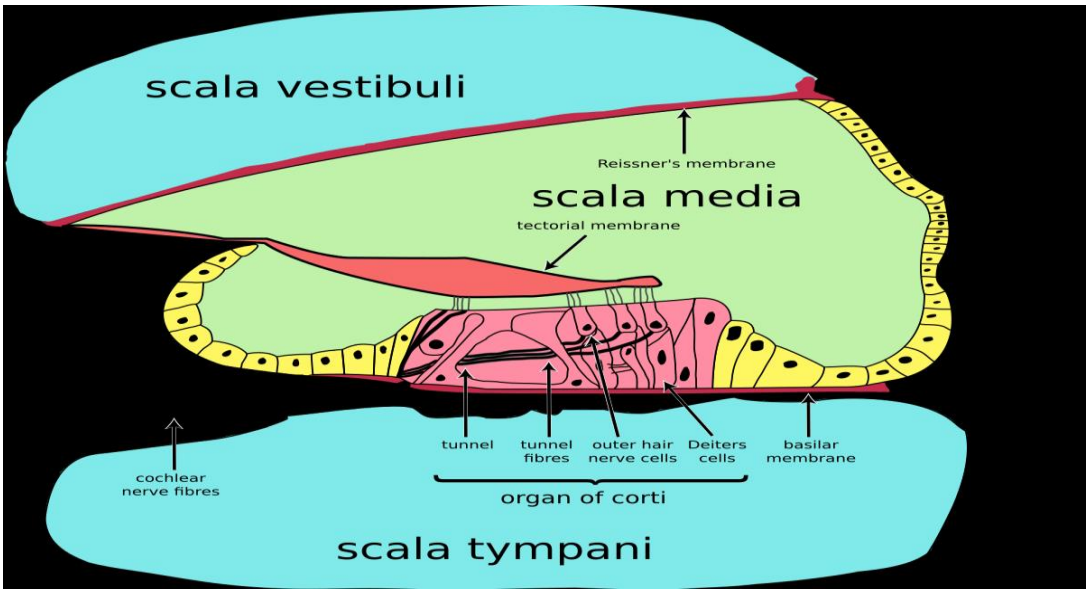
The Otolith are called Lapillus, Sagitta and Astericus and are useful in estimating the age of a fish. Due to their discontinuous growth. The Lapillus lie horizontally on the sensory hair cells of Utriculus and is the largest of the three.

The Sagitta and Asteriscus are present in Sacculus and Lagena respectively and lie vertically on the hair cells.

In Bony fishes, the Utriculus, Sacculus and Lagena comprises lapillus, Sagitta, Asteriscus which are calcified in nature and are secreted by ectoderm and composed of Calcium carbonate, Keratin and Muco-polysaccharides. In fishes the sensory hair cells of ear form a sensory membrane called the “Macula” resemble with the hair cells of vertebrates.

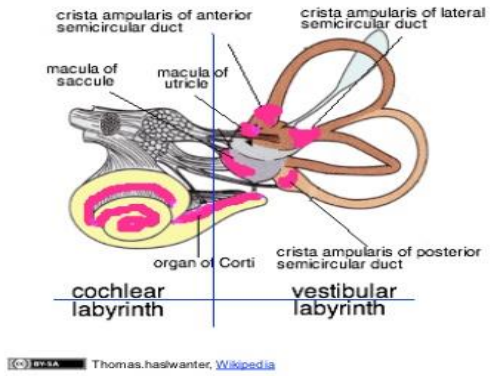

Semicircular canals
Vestibule
Cochlea
Ampulla
Oval window
Round window
TeachMeAnatomy

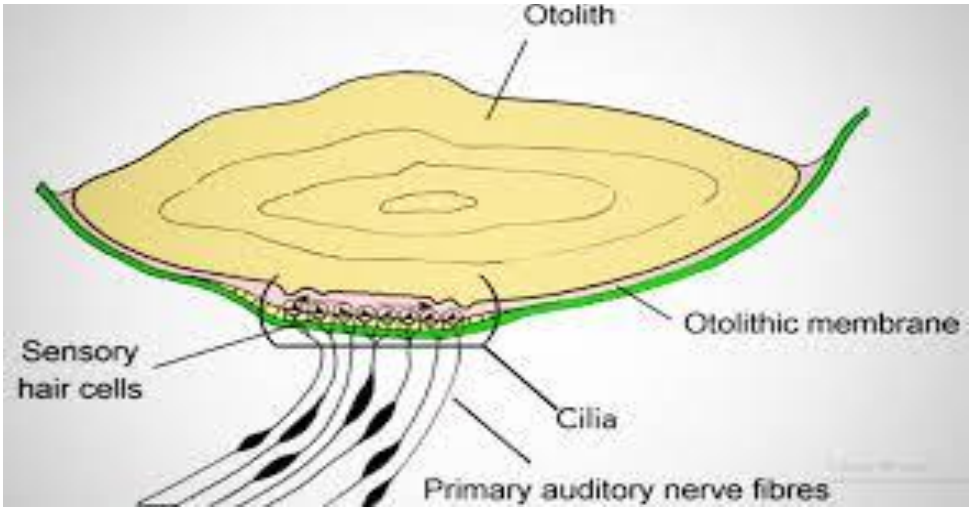

Reissner's membrane
scala vestibuli
stria vascularis
cochlear duct
tectorial membrane
spiral limbus
cochlear nerve
spiral ligament
basilar membrane
scala tympani
organ of Corti
©1997 Encyclopaedia Britannica, Inc.


scala vestibuli
Reissner's membrane
scala media
tectorial membrane
tunnel
tunnel fibres
outer hair nerve cells
Deiters cells
basilar membrane
cochlear nerve fibres
organ of corti
scala tympani

The sensory hair cells of fish are elongated and cylindrical lying on a basement membrane and are surrounded by supporting cells. Bipolar afferent nerve fibres synapse with the basal part of the cells and penetrate the basement membrane forming the auditory nerve. Fine efferent fibres also terminate in the sensory hair cells. Each sensory cells bears a group of Stereocilia and a larger kinocillium. The stereocilia increases in length towards the kinocillium within each Macula there are different types of hair cells, bearing stereocilia and Kinocilia of varying height.

Sensory regions in Membranous Labyrinth





The hair cells are sensitive to mechanical deflection of hairy processes. Electrical potential exist at the apical and baso-lateral ends of the cell, due to differences in the ionic contents of extra and intra cellular fluid. Deflection of cilia to one side causes flow of ions across the cell membrane. It has been reported that afferent fibres are excited when stereocilia bend upwards the kinocillium which deflection in the opposite direction results in inhibition of the afferent fibres.

So that in fishes the semi-circular canal and Utriculus are mainly responsible for the maintenance of equilibrium, while the Sacculus and Lagena are the seat for sense of hearing.

Hearing ability is important in the life of a fish as it capable of locating the enemy or prey from a distance and can also recognise members of its own species.

Sharks have a membranous stretched over their endolymphatic fossa, which acts perhaps like the tympanum of the amphibians in transmitting the sound waves to the interior.

References :

1. Anatomy and Physiology of Fishes by Dr Santosh Kumar and Dr Manju Tembhre
2. A Text Book of Fish Biology and Fisheries by Dr S. S. Khanna and Prof. H. R. Singh
3. A Text Book of Fish Biology and Indian Fisheries By Dr Rahul P. Parihar.
4. Fish and Fisheries of India by V.G. Jhingran
5. Images from www.Google.co.in

Declaration

The content is exclusively meant for academic purpose and for enhancing teaching and learning. Any other use for economic/ commercial purpose is strictly prohibited. The use of the content shall not distribute, disseminate or share it with anyone else and its use is restricted to advancement of individual knowledge. The information provided in this e-content is authentic and best as per knowledge.