S. S. College, Jehanabad

Department: Zoology

Class: M.Sc. Semester IV

Subject: Zoology

Topic: Respiratory organs in teleosts

Mode of teaching: Google classroom & WhatsApp

Date & Time: 28.07.2020 & 10:30

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Q) Respiratory organs in teleosts.

=> Introduction

Fishes are aquatic animals and their respiratory organs are the gills which obtain oxygen from water and pass out carbondioxide to water. Accessory respiratory structures are sometimes present in some fishes.

The major means of respiration in teleosts as in most other fish is the transfer of gases over the surface of the gills as water is drawn in through the gills. Some teleosts exploit habitats where the oxygen availability is low, such as stagnant water or wet mud, they have developed accessory tissues and organs to support gas exchange in these habitats.

Respiratory organ :

Fishes are aquatic animals and their respiratory organs are the gills which obtain oxygen from water and pass out carbon dioxide to water. Accessory respiratory structures are sometimes present in some fishes.

Respiratory organs in teleosts there are four pairs of gills which are situated on either side of the pharynx enclosed in

a pair of branchial or opercular chambers. They are covered with a pair of operculum, each of which is supported by opercular bones. The posterior edge of operculum is thin and membranous and is called branchiostegal membrane. It is applied to the ventro-lateral surface of the body. Due to the development of operculum there is a single external branchial aperture on each side.

Structure of gills :

The four pairs of gills are borne by the first four pairs of branchial arches. The fifth branch is without gills. The spiracle is absent. All the gills are holobranchs or complete gills. The demibranch or hyoid arch is absent. The gills are filiform. Each gill is formed of two halves or hemibranchs constituting a holobranch. Each holobranch bears two rows of gill filaments or primary gill lamellae. In teleosts the interbranchial septum between the two rows of lamellae is much reduced and thus the lamellae are free at their distal ends.

Histology

In Labeobita the gill septum extends midway down the length of Primary gill lamellae and the gill lamellae are alternately arranged. In other fishes they may be arranged interdigitally. The gill lamellae are united at their base but are free distally. But in L. rohita the adjacent lamellae are united at their tips also and thus leave a narrow slit-like aperture between them. The gill lamellae are supported by gill rays which are partly cartilaginous and partly bony. Each gill ray is bifurcated at its proximal end so as to make a passage for the efferent branchial vessel.

each primary gill lamella (also called gill filament) bears numerous minute flat leaf-like structures on its both sides and these are known as secondary lamellae. Each secondary lamella has a central vascular layer covered with epithelium. Gaseous exchange takes place in these highly vascular secondary lamellae.

Fig:—

Blood supply of the gills :—

In teleosts usually there is one afferent as well as one efferent branchial vessel running along the length of each gill arch. In L. rohita (and also in C. batrachus, F. fasciatus and A. testudineus) each arch however has two efferent branchial vessels. Each afferent branchial vessel gives off primary afferent branches supplying the primary gill lamellae. The primary afferent branches divide into a number of secondary branches and these again divide into some tertiary branches supplying the secondary gill lamellae. The tertiary branches break up into capillaries forming the vascular core of the secondary lamellae. The capillaries unite to form short vessels which carry oxygenated blood to primary efferent vessels(s) which run along the edge of the primary

gill lamellae and finally open into the main efferent branchial vessel.

Mechanism of respiration:

Breathing movements occur in two steps the gill chambers working as suction pumps.

i) Inspiration - During inspiration, operculla and branchiostegal membranes press against the body keeping the two external branchial apertures tightly closed. The gill arches bulge laterally enlarging the external capacity of bucco-pharyngeal cavity which acts like a suction pump. As a result the oral valves open and water flows in through opened mouth to fill the bucco-pharyngeal cavity.

ii) Expiration -

Now the oral valves close shutting the mouth the gill arches contract and the operculer and branchiostegal membranes lift, opening the external branchial apertures. Consequently water under pressure is forced to pass over filaments and out through the external branchial apertures.

Physiology of respiration:

The afferent branchial artery bringing deoxygenated blood breaks up into capillaries into lamellae of gill filaments where exchange of gases occurs by osmosis through their thin walls. As fresh respiratory water passes over gill filaments, their blood gives up CO_2 and absorbs O_2 from water. The efferent branchial artery carries away oxygenated blood from gill to the body. The fish needs a constant supply of fresh O_2 bearing water for life. If water is depleted of O_2 or fish is removed from water, it soon dies due to lack of oxygen, called asphyxiation.