

# WELCOME

## S.Y.B.Sc. STUDENTS

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## RESPIRATORY SYSTEM

In *Scoliodon*, the respiration is aquatic, i.e., respiration in water and it breathes by means of gills borne in a series of gill pouches. They are situated on either side of the pharynx.

Water enters the mouth and after passing through the buccal cavity, pharynx, gill-pouches and goes out through the gill slits after bathing the gills.

### Respiratory Organs:

There are five pairs of lateral gill-clefts are present in *Scoliodon*. They are situated in the lateral walls of the pharynx. They are arranged in a series on their side.

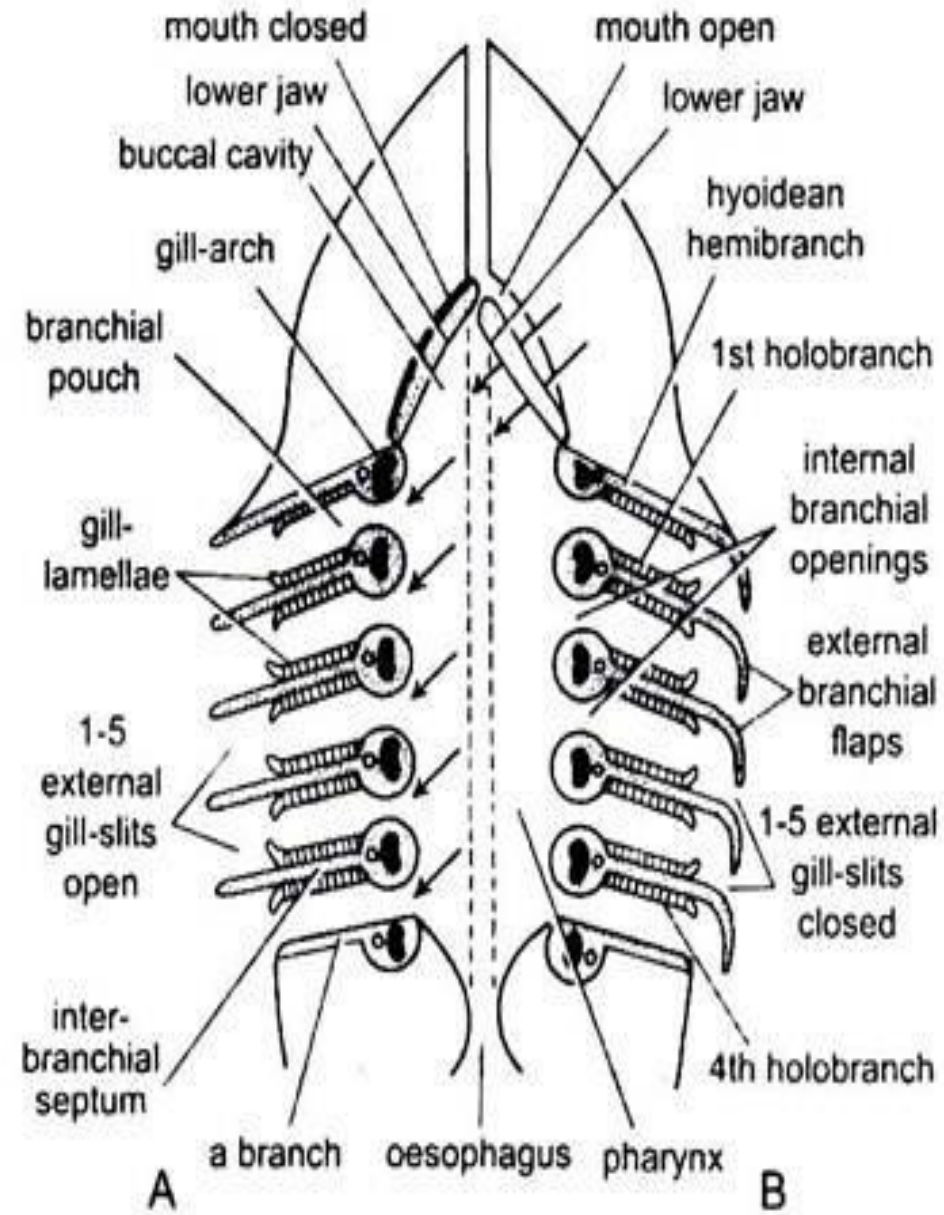


Fig. 14.27. *Scoliodon*. Respiratory mechanism. A-Expiration; B-Inspiration.

Each gill cleft communicates with the cavity of the pharynx through a large internal branchial aperture and with the exterior through an external branchial aperture (commonly called gill slit).

The mucous membrane of gill-cleft is raised into a series of horizontal folds to form gill lamellae.

They have a very thin covering membrane through which blood is exposed to seawater for an exchange of gases. The gill lamellae have a rich blood supply. The single set of gill lamellae is called as **hemibranch** (half gill).

The first gill cleft shows hemibranch. It is supported by hyoidean arch.

Each gill-cleft has two sets of gill-lamellae called as complete gill or holobranch. The 2nd, 3rd, 4th 5th gill cleft shows holobranch.

Each gill-cleft has two sets of gill-lamellae i.e. Anterior and posterior gill lamellae.

The anterior and posterior gill lamellae are separated from each other by muscular inter branchial septa of connective tissue (they should more correctly be called inter branchial septa).

The inner part of each inter brachial septum is supported by visceral arch.

The visceral arch gives comb like cartilaginous gill rays.

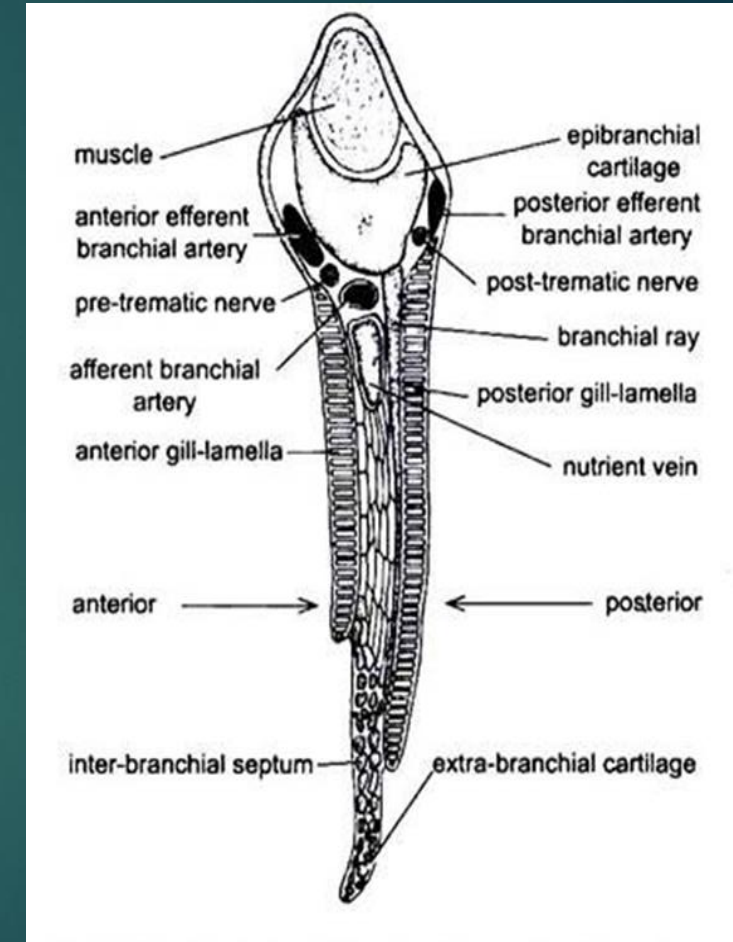
The gill ray prevents the entry of food in to respiratory passage.

The posterior hemibranch of each holobranch is larger than the anterior one.

### Mechanism of Respiration:

The floor of the buccopharyngeal cavity is depressed by hypobranchial (hypoglossal) muscles and the mouth is opened at the same time the viscera arches expand the wall of the pharynx, so that sea-water containing dissolved oxygen rushes in through the mouth.

Entry of the water into external brachial apertures is prevented by an anterior fold is then raised and the mouth is closed, and contractions of the wall of the pharynx force the water into internal brachial apertures, the oesophagus being closed, and then into gill – clefts, where it washes the branchial lamellae and goes out of the external brachial apertures.



## Physiology of respiration :

1. The gill lamellae are thin permeable and membranous.
2. They are richly supplied by blood of the capillaries.
3. The oxygen of the water passes by endosmosis through the thin capillaries walls into the blood passes into the water by a process of exomosis.
4. The oxygen is converted by the blood to all the parts of the body, while carbon dioxide brought to the gill in the venous blood is eliminated by the water of the outgoing respiratory current.
5. As the blood makes a complete circuit in the capillaries of the gills in a very short time.

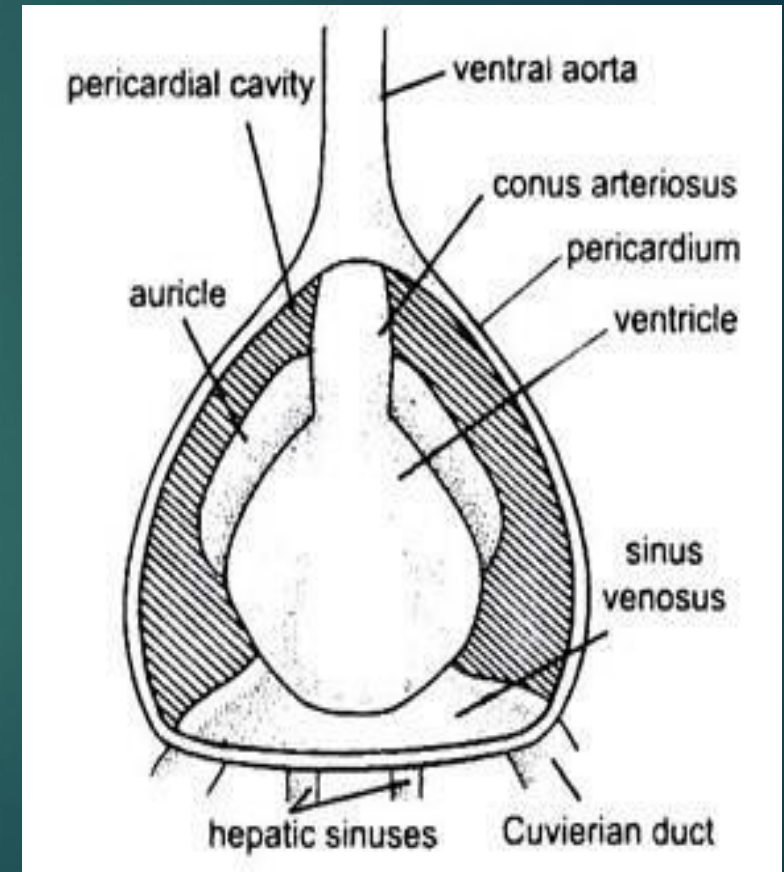
# External & Internal Structure of heart, Working of heart

## Heart and Pericardium:

The heart of Dogfish (Scoliodon) lies mid-ventrally beneath the pharynx in the head region. It is a simple dorso-ventrally bent S-shaped muscular tube. It lies in the pericardial cavity, bounded by a two-layered membranous pericardium. It is a median triangular cavity lying between the gills with the apex directed forwards, and is almost completely occupied by the heart. The heart of Dogfish (Scoliodon) contains only the impure blood, hence, it is called venous or branchial heart.

## The heart consists of four chambers:

- (a) The sinus venosus,
- (b) The atrium,
- (c) The ventricle and
- (d) The conus arteriosus.



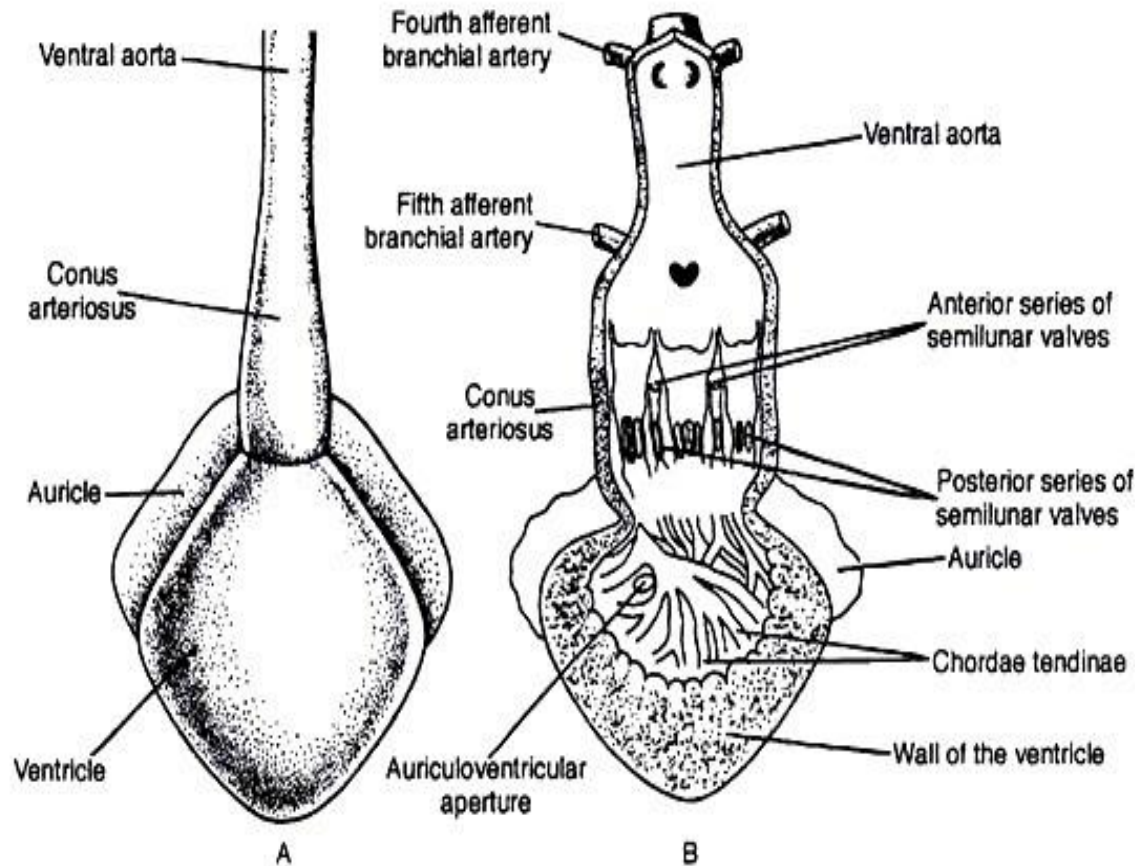


Fig. 1.35 : Heart of *Scoliodon* : A. An intact heart showing the position of different chambers. B. Diagrammatic longitudinal sectional view of the heart

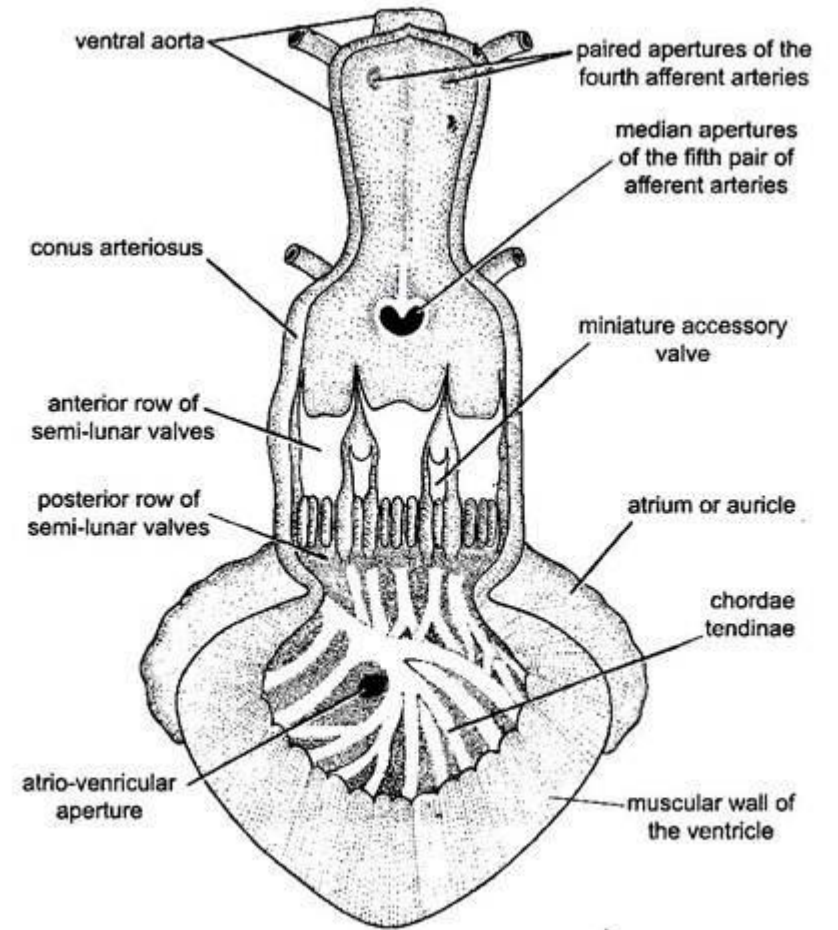


Fig. 14.30. *Scoliodon*. Heart dissected from ventral side to show internal structure.

## **(a) Sinus Venosus:**

The sinus venosus is a triangular, thin-walled posterior chamber extended transversely and lying fused along the base of the pericardial cavity.

Laterally it receives two large veins, the ducti Cuvieri, one on each side, while two hepatic sinuses open into it in the postero-median line.

The sinus venosus opens anteriorly into the atrium through the sinu-atrial sinu-auricular aperture, guarded by a pair of membranous valves, the sinu-atrial valves.

These valves prevent the backward flow of the blood.



## **(b) Auricle:**

The atrium (auricle) is a large triangular sac, lying in front of the sinus venosus and dorsally to the ventricle.

It occupies the dorsal half of the pericardial cavity.

Its walls are somewhat thicker than those of the sinus venosus.

Its lateral posterior angles produced into processes which project laterally at the sides of the ventricle like ears it opens into the ventricle through the atrio-ventricular aperture, guarded by a bilabiate valve which prevents the backward flow of the blood.

### **(c) Ventricle:**

The ventricle is the most prominent pear-shaped chamber of the heart.

It has very thick muscular walls because it propels the blood to the entire body.

The inner surface of the ventricle is produced into numerous muscular strands which give it a spongy texture.

The opposite walls are held in place by chordae tendineae and also protect the ventricle to expand beyond its capacity.

It communicates dorsally with the atrium through the atrio-ventricular aperture and anteriorly with the conus arteriosus.

## (d) Conus Arteriosus:

The conus arteriosus is a stout muscular tube which arises from the ventricle and extends up to the anterior end of the pericardial cavity. Its inner wall is provided with two transverse rows of semi-lunar valves, each row containing three valves, one dorsal and two ventro-laterals in position.

In addition to these, there is always a small accessory valve on either side of the dorsal valve.

The anterior valves are larger than the posterior valves.

The free-ends of the valves are connected to the walls of the ventricle by fine tendinous threads to keep the valves in position. These valves prevent the backward flow of blood into the ventricle.

The conus arteriosus is continued forward through the wall of the pericardium as the ventral aorta. The ventricle and conus constitute the forwarding pump for the blood.

## Working:

The Scoliodon shows single type of circulation i.e. the heart circulates only deoxygenated blood. Such heart is called as branchial / venous heart.

The heart is myogenic type.

The sinu auricular node (S A Node) is present in sinus venosus where the heart beats starts.

For the circulation of blood the sufficient pressure is required. This pressure is provided by the rhythmic contraction and relaxation of heart.

The rhythmic contraction called systole and relaxation called as diastole.

The rhythmic contraction and relaxation of heart is called as heart beat.

The four major veins collect the blood from the different part of the body in the sinus venosus.

The contraction starts in sinus venosus.

During contraction the blood passes in to atrium through sinu atrial aperture.

Then during the atrial contraction the blood is passes to ventricle through the auriculo ventricular aperture.

The backflow of blood is prevented by sinu atrial valve. During the ventricular contraction the blood is passes in conus arteriosus.

The back flow is prevented by auriculo ventricular valve.

From the conus arteriosus the blood is passes to gills for oxygenation by ventral aorta.

The backflow is prevented by semilunar valves.

