Respiratory mechanism

The wall of the pharynx is highly vascular. The water current entering into the pharyngeal cavity brings fresh oxygen dissolved in water. The gill-bars contain blood vessels with many lateral branches. The blood circulates so close to the surface that these blood vessels are able to absorb oxygen and give off carbon dioxide very efficiently.

Since the blood of Branchiostoma lacks any respiratory pigment and also occurs in lymph-spaces in the fins and meta-pleural folds, it is doubtful whether the pharynx has any role in oxygenation.

Many workers are doubtful about the respiratory role of pharynx and lay more emphasis on its role in food concentration. They advocated that a considerable part of required amount of oxygen is drawn through these superficial areas.

Circulatory System of Branchiostoma

The circulatory system in Branchiostoma is well-developed. The blood is colourless, i.e., it lacks any respiratory pigment. The blood is also devoid of cells (such as corpuscles or amoebocytes).

Since respiratory pigment is absent in Branchiostoma, the question of oxygen carriage remains unsolved. It is presumed that the tension of dissolved oxygen acquired by diffusion is sufficient to carry on the vital activities.

Oxygenation in the gill-bars is negativated by Orton (1913) by establishing the fact that the blood actually leaves the gill- bars less rich in oxygen than when it enters into them. Oxygenation actually takes place in the lacunae situated close to the integument, especially those present in the meta-pleural folds. The blood vessels, except the dorsal aorta, are without any lining.

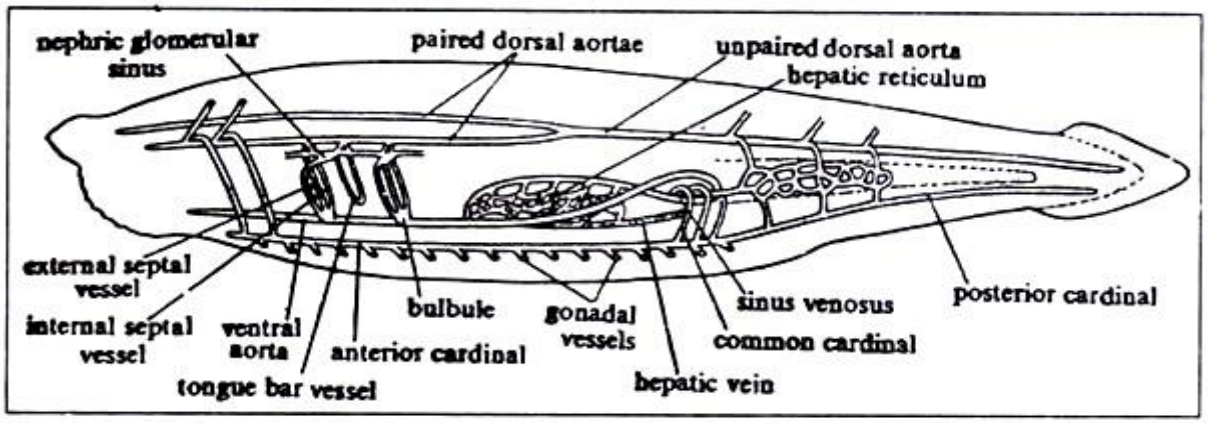
The heart is absent in Branchiostoma and there is no pericardial cavity. The blood vessels are muscular and pulsatile in nature. The anatomy of the system shows like that of all higher chordates but histologically similar to the circulatory system of invertebrates. A description of the main vessels and their branches is given below.

Sinus venosus

The blood from the different parts of the body is collected into a large sac called sinus venosus. The sinus venosus is situated below the posterior end of the pharynx.

Ventral aorta

From the sinus venosus a large median artery arises which extends forward below the pharynx. This artery is named the ventral aorta or truncus arteriosus or endostylar artery. The ventral aorta gives the branchial vessels carrying blood to the gill- bars. The branchial vessel, at the base of each primary gill-bar, dilates to form a tiny expansion, called branchial bulb or bulbule (plural bulbilli).



Dorsal aorta

From the gill-bars the blood is collected by the paired dorsal aortae, situated one on each dorsolateral side of the pharynx. These paired aortae join posteriorly to form an unpaired median dorsal aorta. This dorsal aorta extends posteriorly up to the tip of the tail as caudal artery. The paired dorsal aortae give small arterial vessels to the nephridia. These vessels form a net of minute vessels, called nephric glomerular sinus.

The paired and unpaired dorsal aortae have many branches which lead into the lacunae, called myocoel (the space between the myotomes and the body wall). The whole of the intestine and the hepatic diverticulum have extensive blood plexus. True capillary system is absent in Branchiostoma.

Sub-intestinal vein:

The blood from the tail region is collected by a caudal vein. It proceeds forward to join the sub-intestinal vein. The sub-intestinal vein collects blood from the intestinal plexus.

Hepatic portal system

The sub intestinal vein proceeds anteriorly as the hepatic portal vein. It runs ventrally along the hepatic diverticulum where it breaks into a capillary net-work. From hepatic diverticulum blood is collected by a hepatic vein which

runs along the dorsal side of the hepatic diverticulum and joins with the contractile sinus venosus.

Hepatic portal system, first found in Branchiostoma, is the precursor of the hepatic system of vertebrates.

Cardinal veins

The blood from the ventrolateral sides of the body wall is collected by two pairs of cardinal veins — the anterior cardinals and the posterior cardinals. The anterior and posterior cardinals of each side unite to form a common cardinal or ductus Cuvieri which passes ventrally to join the sinus venosus.

The sinus venosus, ventral vessel, branchial bulbs, nephric glomerulae and sub-intestinal vein are contractile. The rate of contraction is very slow and occurs once in two minutes. The phenomenon of contraction is irregular and is not controlled by any coordinated system.

Course of circulation:

The course of circulation in Branchiostoma is as follows

(a) The blood circulates from the posterior to the anterior end through the ventral vessel, sub-intestinal vein and the posterior cardinal veins, whereas

(b) The paired and unpaired dorsal aortae and the anterior cardinal veins drive blood from the anterior to the posterior direction.