

## B.Sc (Subsidiary) First year

Paper-1

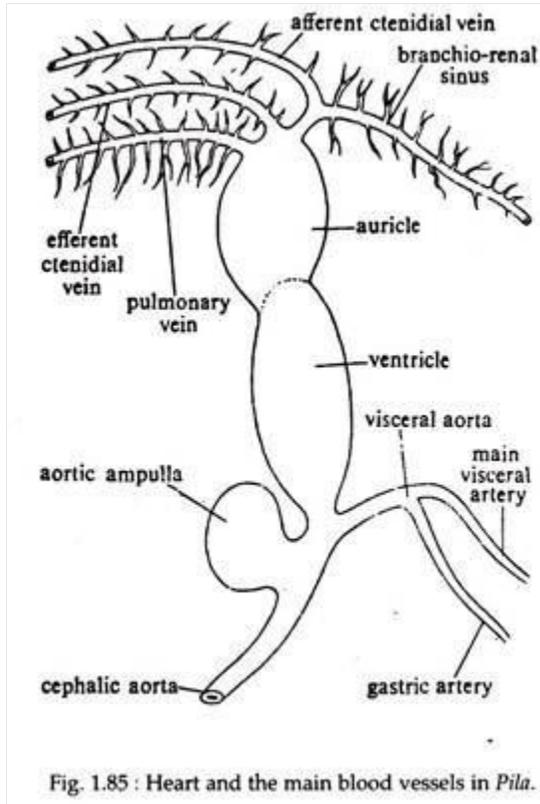
Dr. Mirza Imteyaz Baig

### Pila- Circulatory System

The circulatory system of Pila is well developed and has attained great complexity due to its double mode of respiration, involving a gill as well as a lung. The circulatory system consists of the heart, the pericardium, the arteries, the veins and the sinuses.

The pericardium is a thin-walled roughly ovoidal chamber lying dorsally on the left side of the body and extending anteriorly up to the stomach and the digestive gland. The pericardial chamber encloses the heart and the aortic ampulla.

The heart is situated in the left-hand side of the visceral whorl very near to the posterior end of the ctenidium. As the ctenidium lies in front of the heart, the animals are included under Prosobranchia. The heart consists of two chambers, an auricle and a ventricle (Fig. 1.85).



The auricle is a thin-walled, highly contractile and roughly triangular sac situated in the dorsal part of the pericardium. The dorsal part of the auricle receives blood from three main veins — ctenidial vein, branchiorenal vein and pulmonary vein. Ventrally the auricle communicates with the ventricle through the auriculo-ventricular aperture.

The auriculo-ventricular aperture is guarded by semilunar valves which prevent regurgitation of blood from the ventricle to the auricle. The ventricle is an ovoidal sac lying below the auricle. Its wall is thick, spongy and muscular. The auricle receives oxygenated blood from the ctenidium and pulmonary sac through efferent ctenidial and pulmonary vein, respectively.

The lower end of the ventricle gives rise to a large artery, the aortic trunk. The root of the aorta is provided with two semilunar valves which do not allow the backflow of blood into the ventricle. The aorta immediately bifurcates into two arteries, the anterior one is called cephalic aorta, supplying blood to the head region and the posterior or visceral aorta which supplies blood to the posterior part of the body.

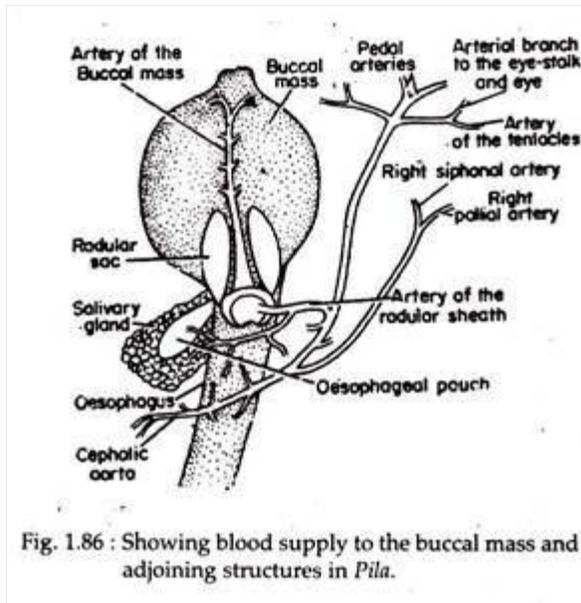
The cephalic aorta, just after its origin, gives a dilated sac-like outgrowth known as aortic ampulla. Both the aortae supply arteries to different parts of the body.

**The cephalic aorta, along its outer side, gives off three arteries:**

- (i) an artery to the skin,
- (ii) an artery to the oesophagus and
- (iii) an artery to the left part of the mantle, the osphradium and left siphon.

The cephalic artery on its inner side gives off a pericardial artery that supplies to the pericardium and then enters into the posterior renal chamber. The main trunk of the cephalic artery enters into the perivisceral sinus (space surrounding the buccal mass and oesophagus) and then crosses beneath the oesophagus.

It then gives off many arteries to the buccal mass, oesophageal wall, right side of the mantle, right siphon, copulatory organ, eyes, tentacles etc. (Fig. 1.86).



The visceral aorta, immediately after its origin, gives off an artery to supply the pericardium, digestive gland and skin. A little further, the visceral aorta gives rise to a stout gastric artery to the stomach. The main visceral artery runs along the left margin of the posterior renal chamber and sends branches to the intestine and the posterior renal chamber.

It then sends an artery to the digestive gland, the gonad and terminates in the wall of the rectum.

The blood, after being distributed to the various parts of the body by the arteries and their tributaries, passes into small spaces (lacunae). These lacunae unite to form large sinuses.

### **There are four main sinuses:**

- (i) peri-visceral sinus,
- (ii) peri-intestinal sinus,
- (iii) branchio-renal sinus and
- (iv) pulmonary sinus.

The perivisceral sinus sends blood to the ctenidium and pulmonary sac. The peri-intestinal sinus passes blood to the kidney for eliminating metabolic waste.

The veins carry blood to the auricle from different parts of the body either directly or through the gill, mantle and kidneys.

**The main veins are:**

- (i) afferent ctenidial vein,
- (ii) efferent ctenidial vein,
- (iii) afferent renal vein,
- (iv) efferent renal vein and
- (v) pulmonary vein.

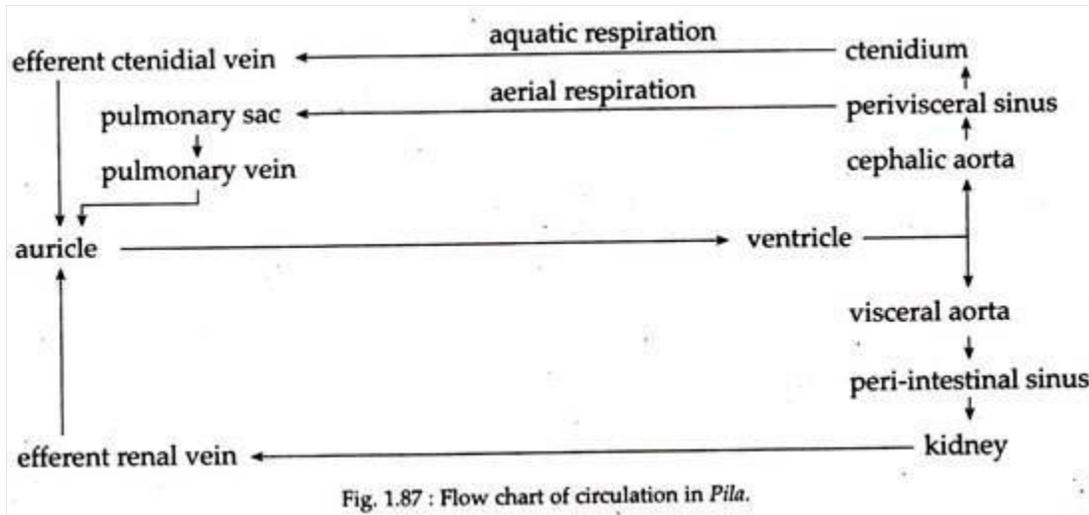
**Blood:**

The blood of Pila contains some colourless stellate amoeboid cells and a blue, copper containing respiratory pigment, called haemocyanin. The amoeboid cells are phagocytic in nature.

**Circulation of Blood:**

The ventricle of the heart pumps blood through the branches of cephalic aorta and visceral aorta (Fig. 1.87). The cephalic and visceral aortae supply blood to the different parts of the body. The cephalic aorta supplies blood to the head, mantle, buccal mass, oesophagus, copulatory organ, columellar muscle and associated structures.

The visceral aorta supplies blood to the visceral mass. Although there are four main sinuses, the blood is collected into the perivisceral and peri-intestinal sinuses. From these sinuses blood is conveyed either into the pulmonary sac, ctenidium or into the kidney.



During aerial respiration, blood flows into the pulmonary sac, while in aquatic respiration most of the blood from the perivisceral sinus goes to the ctenidium (Fig. 1.87). After purification, the blood comes to the auricle by the pulmonary vein or by the efferent ctenidial vein. The blood from the peri-intestinal sinus passes either into the anterior or posterior chamber of the kidney.

On its way through the anterior renal chamber, the blood gets rid of nitrogenous waste and flows either into the ctenidium or into the posterior renal chamber. The posterior renal chamber gets blood either from the peri-intestinal sinus or from the anterior renal chamber. The blood gets rid of its excretory product but without being aerated. Thus mixed blood goes to the auricle for distribution via the ventricle.