

B.Sc First year Zoology (Subsidiary)

Paper-1

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Circulatory system of Palaemon(prawn)

The blood circulation in prawn is open type, i.e., blood flows through the body spaces. Such spaces are called haemocoels. The circulatory system includes—blood, heart, true blood vessels and haemocoelomic spaces.

A. Blood:

Blood includes both the circulating fluid and the body fluid. The cellular part of the blood includes only amoeboid leucocytes. The liquid part, plasma, contains a copper-containing respiratory pigment haemocyanin in dissolved state. This pigment is responsible for the blue colouration of the blood. The blood can coagulate very rapidly.

B. Heart:

It is more or less a triangular organ with inner spongy cavity. It is placed beneath the carapace and above the gonads.

Heart is united with the pyloric stomach by a cardio-pyloric strand. The anterior end of the heart, called the apex is pointed and the broad end base is directed posteriorly.

The entire structure is enclosed within a haemocoelomic space, called pericardial sinus, the wall of which serves as pericardium. Two lateral and one median longitudinally fibrous tissue strands connect the heart with the body wall and thus fix it to its position inside the pericardium.

The wall of the heart is pierced by five pairs of slit-like openings, called ostia. There are two pairs on the lateral sides, one pair in the ventral, one pair in dorsal and one pair at the posterior end of the heart. These ostia are contractile and work as valves to permit only flow of blood from pericardial sinus to the heart.

C. True blood vessels:

These are the vessels which possess definite walls. As all of them originate from the heart to supply blood to different parts of the body, they are better called arteries. From the heart of prawn six large vessels originate.

They are:

(i) single ophthalmic artery,

(ii) paired antennary arteries and

(iii) paired hepatopancreatic arteries— all originate from the anterior end and

(iv) a single mid-posterior artery emerges from the posterior end (Fig. 18.11).

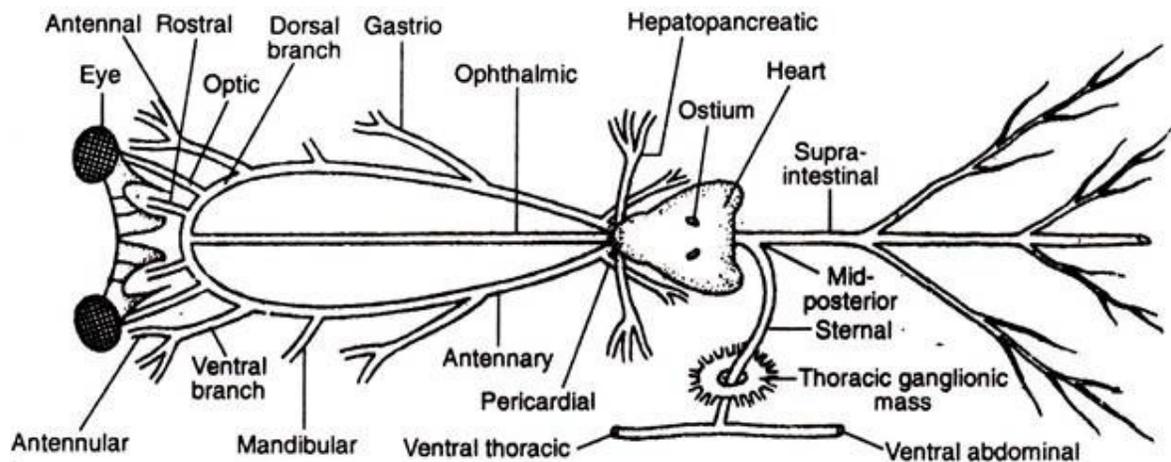


Fig. 18.11: Heart and principal arteries of *Palaemon*. Ventral arteries are partially drawn.

(i) Ophthalmic artery:

The single ophthalmic or cephalic artery originates from the apex of the heart and runs anteriorly along the mid-dorsal line up to the base of the rostrum and unites with the branches of two antennary arteries.

(ii) Antennary artery:

Each antennary artery originates from the heart and from the sides of the ophthalmic artery. It runs anteriorly along the outer border of the mandibular muscle.

Each antennary artery sends the following branches on its own side:

- (a) Pericardial branch to supply blood to the pericardial wall,
- (b) Gastric branch to supply blood to the cardiac stomach,
- (c) Mandibular artery to the muscle of the mandible. Each antennary artery then splits into,
- (d) A ventral, and
- (e) A dorsal branch.

The ventral branch supplies vessels to the first and second antennae. The dorsal branch sends an optic artery to the eye and then the two dorsal branches of the two antennaries unite with the median ophthalmic artery to run within the rostrum as paired rostral arteries.

(iii) Hepatopancreatic artery:

The hepatopancreatic or hepatic artery of each side originates from the postero-median end of the heart and runs transversely to enter within the hepatopancreas.

(iv) Mid-posterior artery:

The midposterior artery immediately after originating from the postero-median end of the heart divides into:

- (a) Supra-intestinal artery and
- (b) Sternal artery.

The supra-intestinal which is also known as dorsal abdominal artery runs posteriorly along the mid-dorsal line up to the hind gut. It supplies the alimentary canal and the muscles on the dorsal sides.

The sternal artery runs transversely towards the ventral side. It pierces the thoracic ganglion mass and bifurcates into an anteriorly directed ventral thoracic and a posteriorly directed ventral abdominal arteries.

The ventral thoracic artery supplies blood to the different parts on the ventral side of the cephalothorax and ventral abdominal sends branches to the ventral side of the abdomen.

All the arteries ultimately break up into finer branches and open within the haemocoelomic spaces. Thus the Circulatory system of prawn lacks network of capillaries.

D. Haemocoelomic spaces:

Small haemocoelomic spaces are called lacunae. These lacunae open into larger spaces, called sinuses. The passages connecting lacunae and sinus or two sinuses are known as haemocoelomic channels.

Blood after flowing through different small haemocoelomic spaces or lacunae is collected in a pair of common elongated space, called ventral sinus. These are placed beneath the hepatopancreas and continued up to certain length within the abdomen. The two ventral sinuses are interconnected by several small slender channels.

From the ventral sinus six afferent branchial channel take the deoxygenated blood to the gills. First afferent branchial channel supplies blood to the podobranch and arthrobranchs while the remaining five vessels supply to the five pleurobranchs.

From gills oxygenated blood is collected by six pairs of efferent branchial channels and is finally drained into dorsal or pericardial sinus.

Mechanism of blood flow:

The heart contracts to drive the oxygenated blood to the different parts of the body through arteries (Fig. 18.12). These arteries instead of forming capillary network open directly within haemocoelomic spaces. From different haemocoelomic lacune deoxygenated blood is collected within paired ventral sinuses.

From these large spaces, blood is sent for oxidation to the respiratory organs through the afferent branchial channels. From gills the blood returns to the pericardial sinus through efferent branchial channels.

When the pericardial sinus is full its wall starts to contract and forces the blood to enter within the heart through ostia. When heart contracts the lip-like borders of the ostia close and thus blood is permitted to travel only through arteries.

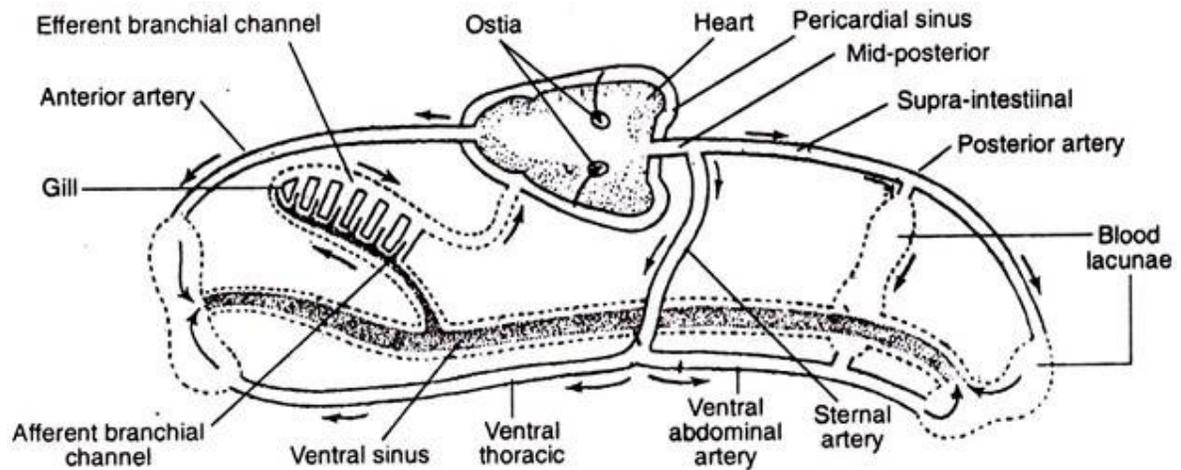


Fig. 18.12: Schematic route of blood flow in *Palaemon*.