CIRCULATORY SYSTEM OF COCKROACH

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Introduction:

The circulatory system of Periplaneta is open or lacunar type as blood opens into spaces, called lacuna, among viscera. The blood or haemolymph flows freely with the haemocoel. It has heart and aorta but no capillaries and the blood bathes tissues directly. The circulatory system consists of blood or haemolymph, heart and aorta. It is poorly developed in cockroach. It is of open type and hence it is of low pressure.

The circulatory system is made up of following parts :

1. Heart:

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It is mid-dorsal in position. It is in the form of a thin walled, muscular, long and narrow tube. It extends from the ninth abdominal segment to the prothorax. The heart is situated in the pericardial sinus. The heart is made up of 13 chambers. Each chamber is somewhat funnel shaped. Each chamber communicates with the next anterior one by a valvular opening. The hinder end of each chamber has a pair of minute, lateral and valvular openings. These openings are called ostia. Through these ostia, blood from the pericardial sinus enters heart. When heart is contracting, the ostia get closed and the blood is forced in the anterior direction.

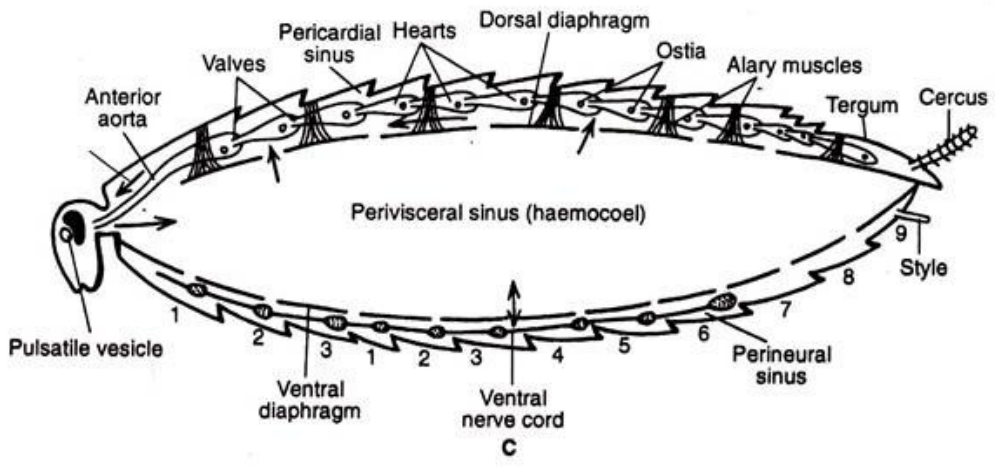


Fig. 18.57C: Blood vascular system of *Periplaneta*.

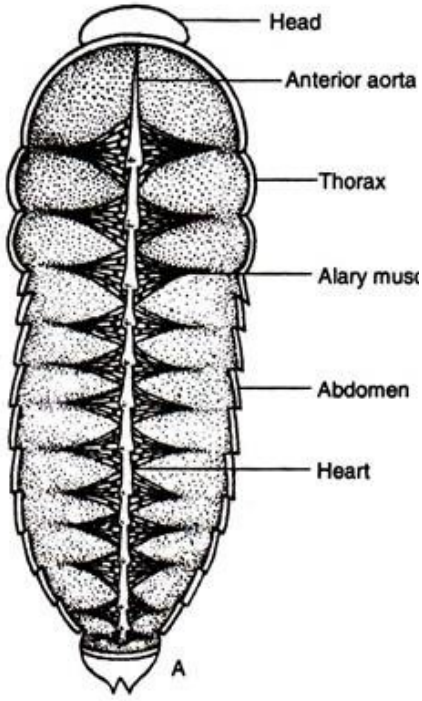


Fig. 18.57A: Showing the structure of heart of *Pe eta americana.*

2.

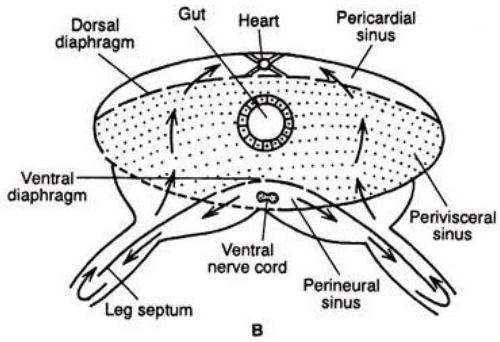


Fig. 18.57B: Course of circulation of blood through thoracic segment.

The heart is closed posteriorly, but at its anterior end continues into an aorta. The aorta goes in deeper region of head. It runs on the dorsal region of oesophagus and ends abruptly.

3. The heart beat

A heart beat appears to be a wave of contraction which begins at the posterior end and continues anteriorly. This contraction is due to the contraction of the striated muscles of the heart.

The rate of heart beats in cockroach is about 50 to 70 per minute.

4. Segmental vessels:

There are six pairs of segmental vessels which are very fine and lateral. One is present in mesothorax; the other in metathorax and remaining four are in abdominal segments numbering 3, 4, 5 and 6.

These vessels carry blood from the heart to the lateral parts of the body. Each such vessel has a valve at the beginning to prevent backflow.

5. Diaphragms:

The body cavity of cockraoch is called haemocoel. It is the coelom which is filled up with blood.

Haemocoel is divided into major sinuses due to presence of incomplete as well as perforated partitions called diaphragms. The diaphragms are fibromuscular. These diaphragms are as follows.

i) **Dorsal diaphragm:** This diaphragm is present in dorsal region of the body, but ventral to the heart. Due to the presence of this partition a part of haemocoel which is around the heart gets differentiated. This part is called a pericardial sinus.

ii) **Ventral diaphragm:** This diaphragm is present in ventral region of the body, but dorsal to the mid-ventral nerve cord. This diaphragm is also incomplete as well as perforated. Due to the presence of this diaphragm, the haemocoel further gets differentiated into a perineural sinus which is present around mid-ventral nerve cord and a perivisceral sinus which is present around visceral organs.

6. Alary muscles

There are 12 pairs of muscles called alary muscles in the pericardial sinus. These extend from the anterior margin of the terga to the dorsal diaphragm and meet each other in the middle line beneath the heart.

` The alary muscles are triangular in shape. Their pointed outer ends are inserted into the terga and the broad inner ends are attached to the dorsal diaphragm.

The main function of the alary muscles and the dorsal diaphragm is to give mechanical support to the heart. It also minimises any pressure exerted on heart by the alimentary canal.

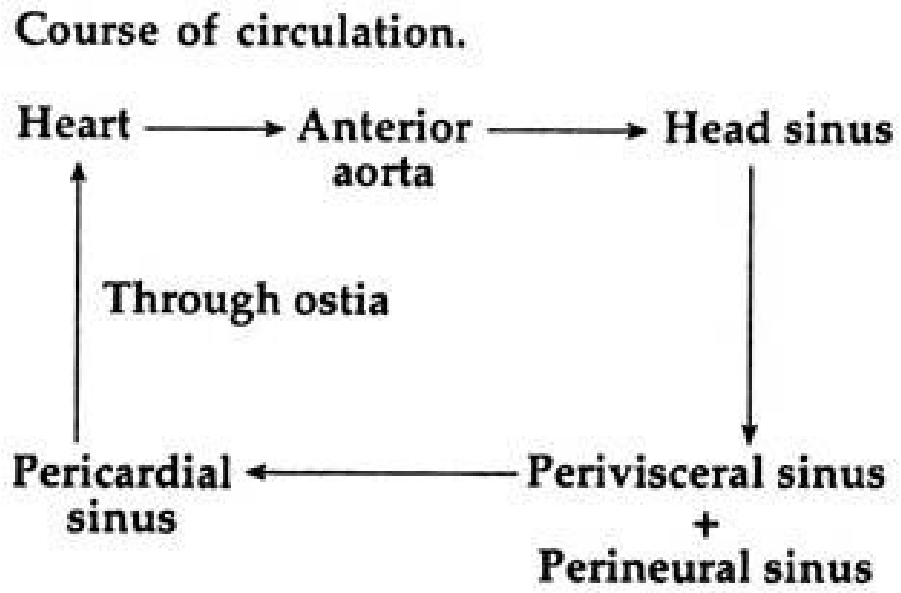
7. Blood or haemolymph

In cockroach, blood is slightly acidic and colourless. Blood is divisible into a fluid part called plasma and the corpuscles. These corpuscles are also called haemocytes. These are about 30,000 ml of blood. All these are nucleated.

8. Circulation

By the waves of contraction of the heart, the blood is pumped forward. The blood reaches tissues through aorta and segmental vessels.

At the anterior end of the heart, the aorta brings much of the blood into cephalic region. Therefore, the pressure of blood in cephalic region and the anterior part of the perivisceral sinus increases considerably.



Hence, blood comes backwards to enter posterior part of perivisceral sinus. Through pores of ventral diaphragm, some amount of blood reaches perineural sinus. This blood is provided to nervous system.

The blood from perineural sinus and perivisceral sinus then reaches pericardial sinus.

When a chamber of heart is relaxing, the ostia are opened and the anterior valve is closed. Therefore, blood from pericardial sinus enters the heart. When a chamber of heart is contracting, the ostia get closed and the blood is pumped forwards.

9. Special pulsatile organs:

At the base of each antenna, there is a special accessory pulsatile vesicle. It pumps blood into respective antenna.