19 OBSERVATIONS ON THE MICROCIRCULATION IN THE WEB OF FROG

19.1 INTRODUCTION

In LSE-05 course you have learnt about the English physician, William Harvey who in the early 1860s discovered pattern of blood circulation. Further you are aware that blood carries nutrients, oxygen and various other materials to the body tissues and carbon dioxide and other waste products away from tissues. Harvey himself had never seen an important component of the circulatory system — the capillaries. These blood vessels are important as it is in the capillaries that materials are exchanged between the circulatory system and the cells. In the present exercise you will examine the circulation of blood through capillaries in the web of a frog's foot.

Objectives

After you have completed this laboratory exercise you should be able to:

- observe the circulation of blood in the web of the frog's foot,
- differentiate between arterioles, capillaries and venules,
- trace the path of a capillary from the other arterioles and venules,
- determine the effect of temperature and adrenaline on the circulation of frog.

19.2 MATERIALS REQUIRED

Live Frog

Compound microscope

Medicine droppers

Absorbent wet towel

Isotonic Ringer solution in dropper bottles

(1) chilled, (2) warm (room temperature) and (3) hot (40°)

Frog board made of balsa wood with a hole

Pins

String

Adrenalin solution

19.3 PROCEDURE

The skin between the toes of a frog is very thin. As a result you will be able to see the actual capillaries with the blood moving through them. Read the procedure carefully before you begin your laboratory exercise.

i) Carefully wrap a live frog in a wet towel, tightly enough to prevent it from moving much. Leave one foot exposed. You have to roll the frog in such a manner so that it cannot bend it legs, (Fig. 19.1). This procedure will not hurt the frog. It will be able to breathe through its skin as long as you keep the towel wet.

ii) Place the wrapped frog on the frog-board, and spread and pin the web of the foot

over the hole in the balsa wood frog board (Fig. 19.1). As there are no nerves in the frog webbing, you can put the pins through webbing without hurting the frog. Throughout the observation keep the frog and the skin of the web moist with tap water and Ringer solution (at room temperature) respectively.

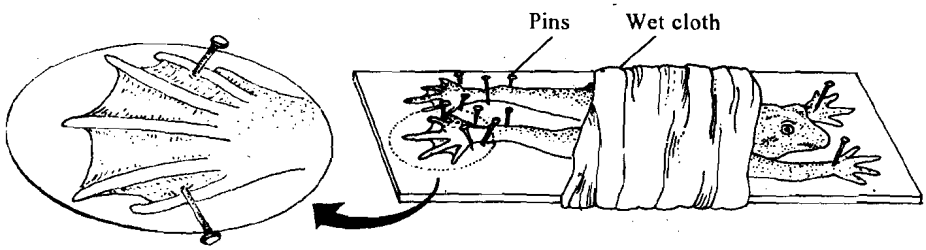

Fig. 19.1: Preparation of the frog for observation of web circulation under the microscope.

iii) Support the whole arrangement on the stage of your microscope, (Fig. 19.2) and move this set up under the low power of the microscope by moving the board until you see flowing blood in the frog web.

iv) Select a very small field of vision and observe carefully the size of the vessels, the thickness of their walls and the movement of blood flow.

v) Examine the web circulation carefully, keeping in mind the comparison you wish to make on relative size, comparative speed of blood flow and the amount of pulsation in arterioles, capillaries and venules.

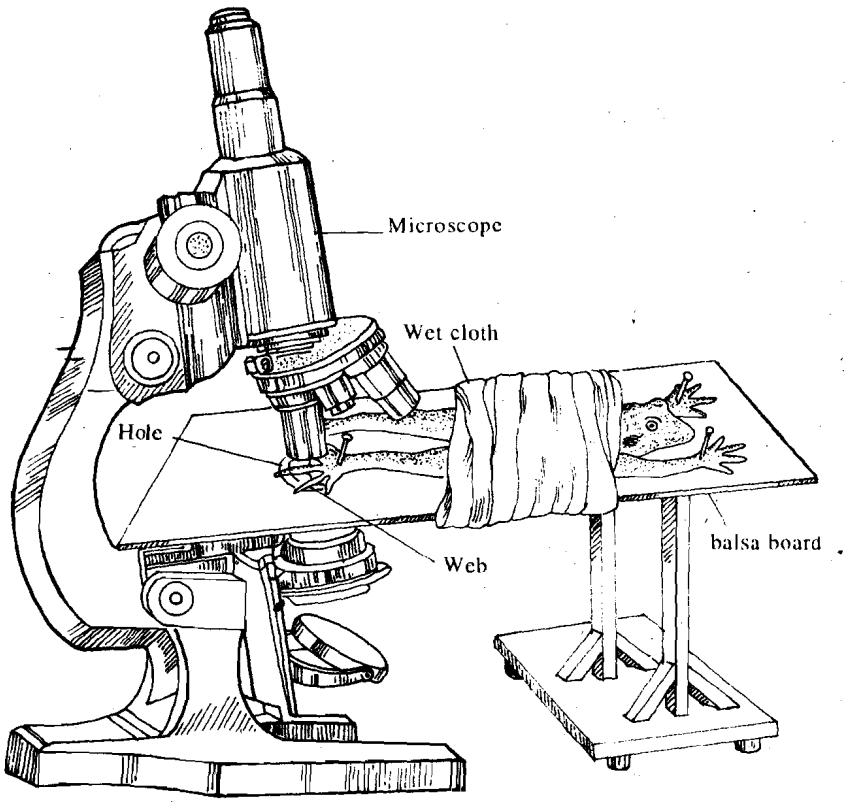

Fig. 19.2: Set up for microscopic observation of web circulation.

Activity 1

On the basis of the size of the blood vessels, distinguish them into arteries, veins and capillaries.

SAQ

1. Can you can observe the moving red blood cells?

2. Which of the blood vessels have thick walls? Thin walls?

Activity 2

In the space below, make a drawing of one of the blood vessels you have observed. Label the red cells, in your drawing.

vi) In a capillary you will see red blood cells moving through in a single file and in other blood vessels you will observe more than one red blood cell moving side by side at a time.

Activity 3

Blood enters the capillary from small arteries called arterioles. Try to trace a capillary back to an arteriole.

Activity 4

Focus on a capillary, then on a vein or artery.

SAQ 3. In which blood vessel does the blood move the fastest and in which the slowest?

vein —

artery —

capillary —

4. Does the red blood cell appear to be a flexible structure? How do the red blood cells move through very thin capillaries?

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5. Does a capillary appear as a rigid glass tube? Do the vessels stretch to allow more blood to flow through?

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Activity 5

Focus a particular region of the webbing. Draw all the blood vessels you see in this region and indicate the direction of flow of blood in these vessel by means of arrows.

Factors Affecting Capillary Circulation

Blood flow and its velocity are affected by a number of factors. Chemical substances such as ethyl alcohol constrict the blood vessels and decrease the rate of blood flow. Contrarily nicotine and lactic acid dilate the blood vessels and increase the rate of blood flow.

In the present laboratory exercise we will study the effect of temperature and adrenaline on the capillary circulation in frog.

Activity 6 — Effect of temperature on circulation

Carefully examine the capillary network at room temperature and become familiar with the normal blood flow. With the help of a Pasteur pipette, apply several drops of chilled frog Ringer solution (isotonic salt solution) to the surface of the capillary network in the webbing. Observe for five minutes. Is there an observable change in the blood flow? Does the speed of the blood flow increase or decrease?

Record your results in your note book.

a) Rinse the frog webbing using warm (room temperature) Ringer solution. Now apply Ringer solution heated to 40°C to the capillary net work in the webbing and observe the rate of circulation.

Record your result again in your note book.

b) Wash off the warm Ringer solution from the frog web tissue. Then place one drop of adrenalin solution on the capillary bed. Record your observations.

On the basis of the data you have recorded, answer the questions given below, regarding the effect of these factors on peripheral circulation.

6. It is known that the quantity of lactic acid in muscle tissue increases during exercise. Do you expect more oxygen to be delivered to the muscle tissue of a person who is running than to that of a person who is resting?

Adrenalin is released into the blood stream at times of stress. Why would a person who is frightened become pale rather than red and flushed?

Precautions

1) You should always keep the frog, including the web of frog moist.

2) Take care not to put the pins through the frog leg. Put the pins only through the web.