LOOK AFTER YOURSELF

HEART,CIRCULATION & BREATHING

(14 pages)

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Demands on the Heart & the Circulatory System

The healthy heart & circulatory system responds to the demands made on it by physical activity by becoming stronger and more able to meet these demands.

Different demands from different activities

Endurance activities make most demands on the circulatory system, and the endurance muscle fibres (slow twitch); whereas speed, strength and power activities make most demands on the skeletal system and fast twitch muscles. Therefore training for these two broad categories of activity results in specific adaptations, and it is the rare all rounder that can develop the two equally. Technical demands are also important, e.g. although the elements of the triathlon are all endurance events, there is a tremendous difference in the demands and effects of swimming, running and cycling training and performing.

QUESTION BOX 17

Explain how body weight is involved in the main difference between the demands of running, and both cycling and swimming.

ANSWER BOX 17

In running the legs have to bear the body weight, but not in cycling and swimming.

Structure & Function of the Heart

The circulatory system consists of the heart, a complete circuit of blood vessels, and the blood.

Function of the Heart

The heart is a muscular pump which pumps the blood around the body. It is in the centre of the chest cavity, tilted slightly to the left side of the body. An untrained heart is about the size of a fist, and weighs less than a pound. It is divided into right and left sides, and the blood passes through the heart twice during each complete circulation of the body.

Cardiac Output

The amount of blood pumped out by the heart in a minute is called the cardiac output. The size of the cardiac output is determined by the number of heart beats per minute, multiplied by the volume of blood pumped out on each contraction or stroke volume.

Cardiac output = heart rate per minute x stroke volume

The cardiac output to the body is increased during exercise as a result of the increase in the heart rate and the stroke volume.

	At Rest	During Exercise
Stroke volume in cm^3	75	150
Heart rate b.p.m.	65	200
Cardiac output in cm^3 per min	4875	30 000

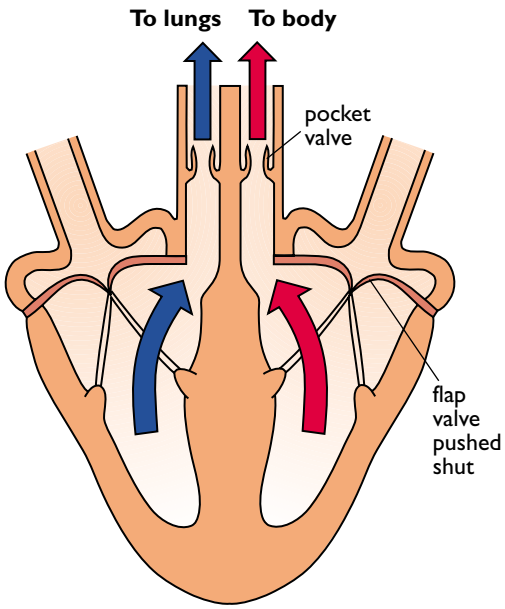
The working muscles therefore receive much more blood, and therefore much more oxygen and nutrients. Also heat, carbon dioxide, and lactic acid are carried away from the tissues more quickly.

Effects of Exercise on the Heart - The heart gets stronger as a result of all the extra work it has to do during exercise.

Endurance exercise (cross country running and swimming etc.) results in the heart, especially the ventricles, getting larger with an increased volume and proportionally thicker walls. The ventricles can then pump more blood, more powerfully on each contraction.

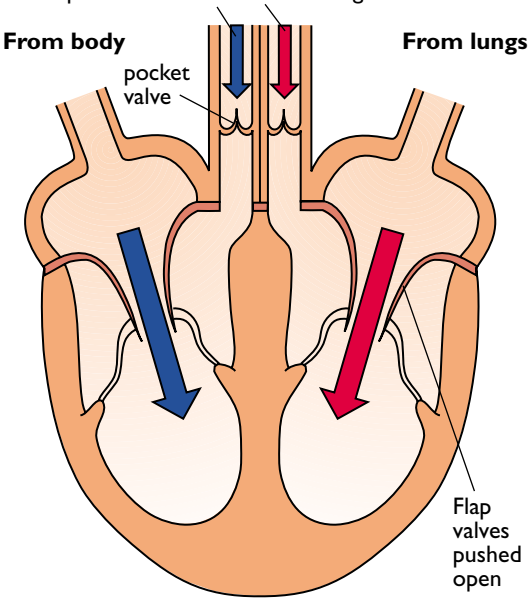
The heart gets more efficient as it gets larger, so the resting heart rate slows down. The average resting heart rate per minute is between 70 and 80. Highly trained endurance athletes have resting heart rates as low as 28.

Weight lifting and other forms of power work increase the thickness of the ventricle walls, but not the stroke volume. As a result the resting heart rate does not slow down.



When the heart has filled with blood, the ventricles contract pushing blood up, forcing the flap valves shut *(making the first heart sound)*, and forcing blood up the pulmonary arteries *(to the lungs)*, and aorta *(to the body)*, opening the pocket valves.

Blood falls back down when ventricles relax, closing the pocket valves *(making the second heart sound)* which prevents the blood re-entering the ventricles.



When the heart relaxes it fills with blood, de-oxygenated blood from the bodyon the right side, and oxygenated blood from the lungs on the left side.