Notes on Physiology for Probationers.

Lectures Delivered to the Nurses at the National Hospital for Heart Disease.

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TWO large veins, named the Superior and Inferior Venæ Cavæ, convey blood from all parts of the body to the right auricle, from which chamber the blood is transmitted through the tricuspid valve into the right ventricle; it is now necessary that it should reach the left side of the heart, but, as I have pointed out to you previously, there is no direct communication between the left and the right sides of the heart; and, further, as it is essential that the blood become purified before reaching the left side, it passes along the pulmonary artery to the lungs, and after it has been purified, it is brought to the left auricle by the pulmonary veins. It now passes through the mitral valve into the left ventricle, leaves this cavity by coursing through the aorta, the largest artery in the body, which gives off numerous branches, which in turn divide into numerous, but smaller, branches, which ultimately end in capillaries; these minute tubes join the smallest veins, which in turn become larger and larger, and finally end by forming the two venæ cavæ, and the blood is once more conveyed into the right auricle, the point I started from in my description of the circulation.

It is obvious, from the above description, that the blood travels in one constant direction, and the great factor in causing its progression is the contraction of the heart; and it now behoves us to study this subject, for, without a fair knowledge of the main facts of the action of the heart, it would be impossible to have a clear idea of the physiology of the circulation.

In following the course of the blood through the heart, we associated the auricle with the ventricle of each side, on account of the direct communication between the two; but in considering the contraction we must associate the two auricles together and the two ventricles together, because the auricles contract at the same moment, and the ventricles work also as one ventricle. So when I mention auricular or ventricular contraction, you will know that I refer to the contraction of both auricles or both ventricles, as the case may be. Two technical terms are used, with which you must familiarise yourselves; they are Systole and Diastole, the former denotes contraction and the latter rest, *i.e.* cessation from contraction.

The ventricle becomes filled with blood, partly by the contraction of the auricle, but mainly due to its own suction power, in the same manner as a Higginson syringe fills itself. To enable blood to get into the ventricle the auriculo-ventricular valve must be open, and to keep the blood in the ventricle the semilunar valves must be kept shut, a circumstance brought about by the pressure of the blood in the large artery leading from the ventricles; and they cannot be opened till the pressure in the ventricle becomes greater than that in the blood-vessel, a condition only arrived at when the ventricle becomes completely filled. At this stage the semilunar valves are forced open to allow the blood to pass into the aorta, at the same time the mitral valve is closed to prevent blood regurgitating into the auricle, as I have drawn your attention to the fact that the blood must always pass in one direction. The reason why the auriculo-ventricle valves close is not yet satisfactorily explained, the generally accepted explanation being that it is due to the reflux pressure of the blood against them. The contraction of the ventricle squeezes all the blood into the aorta, the pressure in which rises sufficiently high to close the semilunar valves, the closure of which prevents any blood being regurgitated into the ventricle. The ventricle now begins to dilate; at the same time, the mitral valves are opened, and the blood comes pouring in from the auricle by the suction of the dilating ventricle; the last few drops of blood are propelled into the ventricle by the contraction of the auricle, this contraction of the auricle being called the auricular systole; when the ventricle becomes full the mitral valve shuts, the aortic valves open, and we get a repetition of the above phenomena.

If we assume that one complete cardiac revolution takes one second, and this is very nearly the time it does take, the ventricular systole lasts one-third second, therefore the ventricular diastole lasts two-thirds second; the auricular systole occupies one-ninth second, therefore the auricular diastole occupies eight-ninths second. The ventricular systole follows immediately the auricular systole, and together we have four-ninths of the cycle occupied by contraction, and consequently five-ninths occupied by rest.

Sounds of the heart.—There are two sounds, called the first and second sounds respectively. The first sound is best heard at the apex; this sound commences directly the ventricle begins to contract, but does not go on quite to the end of the contraction. It is longer, louder, and duller than the second sound; it is due to:—

1. Closure of the auriculo-ventricular valves.
2. Muscular contraction.
3. Impulse of apex against the chest walls.

There is a slight interval, and then we have the second sound, which is short, sharp and deep. It

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