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29. The color of the blood in the left ventricle is bright scarlet, being arterial, and charged with oxygen in greater proportion than carbon dioxide, as well as with the nutritive materials before referred to. So it remains in all the systemic arteries; but in the systemic capillaries it parts with portions of those materials, and its oxygen is largely consumed in uniting with the hydro-carbons and other substances, which enter the blood-vessels as refuse from the various tissues. Thus the blood acquires a dark venous character, and in this condition it passes through the systemic veins, the right side of the heart and the pulmonary artery. In the pulmonary capillaries, however, emitting carbon dioxide, water and organic matter, and taking up oxygen, it becomes again arterial, and so passes on to the left ventricle.

30. The principal force used in producing this constant movement of the blood is that of the muscular substance of the heart. Other assistant forces are those of the elastic walls of the arteries, the pressure of the muscles, among which some of the veins run, the movements of the walls of the chest in respiration, and perhaps, to some extent, the interchange of relations which takes place between the blood and the tissues in the capillary system.

The average time in which the blood completes its entire circuit in man, is less than one minute.

31. The right direction of the blood's current is maintained by valves, placed between each auricle and ventricle of the heart, at the orifices of communication between the ventricles and the main arteries, and in most of the veins. These valves open to permit the movement of the blood in the course just described; but close when any force tends to move it in the opposite direction.

32. Respiration is closely allied with the process we have just described. It has been already stated that one principal object of the circulation is to collect the various impurities, derived from tissue waste, and in part also from the elements of unassimilated food. These impurities are removed by means of *excretory* organs. One of the most abundant of these impurities is carbon dioxide, the removal of which and the introduction of fresh quantities of oxygen, constitute the chief purposes of respiration. Respiration in man and in all mammals is carried on in the minute cavities in the lungs called air-cells.