

the interior of the cavity of the chest, and balances the pressure of the atmosphere on the exterior of the chest. The force, therefore, which is required for the expansion of the chest in inspiration is not more than is necessary for moving the weight of its walls and those of the abdomen, and overcoming their elasticity and that of the lungs.

39. The mechanism of respiration is effected in the following manner:—When the walls of the chest are raised, so as to expand the chest, the pressure on the exterior of the lungs is somewhat less than that of the air on their interior; the excess of pressure, therefore, impels more air into them through the windpipe. On the other hand, when the walls of the chest contract, the pressure is greater on the exterior than on the interior of the lungs, and air is forced out of them through the windpipe, the action being aided, as before stated, by the elasticity of the lungs.

40. The amount of air used in respiration may be calculated from the following data: The quantity of air that is changed in the lungs, in each act of ordinary tranquil breathing, in the case of healthy, young and middle-aged men, is from twenty to twenty-five cubic inches. The number of respirations in a healthy adult person usually ranges from fourteen to eighteen per minute.

41. By the law of the diffusion of gases the carbon dioxide evolved in the air-cells will, independent of any respiratory movement, tend to leave the lungs, by diffusing itself into the external air, where it exists in less proportion; and by the same law, the oxygen of the air will tend to enter the air-cells, in which its proportion is less than in the bronchial tubes, or external to the body.

This interchange of gases is also assisted by the difference in temperature between the air within and that outside of the lungs, and also by the mechanical action of the waving cilia on the mucous membrane of the bronchi. (Fig. 6.)

42. The changes produced in the blood by respiration are considerable. The most obvious is that of color, the dark purple of venous blood being exchanged for the bright scarlet of arterial blood. The essential alterations are, that arterial blood is one or two degrees warmer than venous; that it coagulates sooner and more firmly, apparently containing more fibrine, and that it contains more oxygen and less carbon dioxide and nitrogen. The quantity of oxygen contained