

fixing itself in the blood-corpuscles and paralyzing them so that they cannot carry on the function of respiration. To the inhalation of this gas is chiefly due the pale color of those who spend much time in apartments heated by stoves and poorly ventilated. Its presence cannot be recognized by the senses, as it is tasteless, colorless and inodorous.

Carbonic acid is produced in two ways, as before explained—by combustion and by breathing. The quantities thrown off in breathing is very much increased—often nearly doubled—during *active digestion*. As the fullest meal is taken at dinner, and digestion is most active soon after, it follows that the exhalation of carbonic acid gas is greatest during the early part of the afternoon, and therefore during this time ventilation needs more attention. Of all the impurities found in the school-room, this is vastly the largest in amount, and popularly considered the most important. It is once and a-half as heavy as air. At first sight, it might be supposed that, being heavier than air, it would sink to the floor and settle there in a layer of uniform height and density, like so much water. But this is not the case for it is even more expansible than air. (Coefficient of expansion of air = .00366; of CO₂ = .00371.) Now, the laws which governs the mixtures of gases is this:

The mixture of gases in free communication, whatever their density, takes place rapidly, and is homogeneous—that is, the mixture contains the gases in the same proportion; so that the percentage of carbonic acid gas is about the same in all parts of the room.

If ample provision is not made for the removal of the vitiated air, the proportion of carbonic acid gas continues to increase; and, as it is much heavier than air, the density becomes greater. Now, this increase of the air's density interferes with and retards the diffusion between the impure gases

held in solution in the blood and the oxygen of the atmosphere—in other words interferes with respiration. The consequence is that the blood is not purified of the carbonic acid gas which it holds in solution and combination. Not being removed as fast as it is formed in the body, it accumulates in the blood; the blood carries it throughout the system, circulating it through the delicate tissues of the brain. As the brain is the organ of the mind, it is by and through the brain that we think, reason, memorize, learn. For its healthy and vigorous action, a full supply of pure blood is an imperious necessity. The effects produced by this gas, when circulating through the brain in excess, are drowsiness, dizziness, dull head-ache, an inability to fix the attention, a dislike for application, a weakening of the memory, and a general torpor of the intellectual powers. An explanation of how and why these effects are produced would involve certain principles of mental physiology—a subject not within the scope of this paper.

Special attention is requested to this statement by Dr. Routh:* “Experiment has shown that if an animal be kept confined in a narrow, closed apartment, so that the air supplied is always more or less vitiated by the carbonic acid which it expires, however well fed that animal may be, tubercle (consumption) will be developed in about three months.” If this be the case, a large percentage of cases of consumption should be met with among the inmates of badly ventilated schools. But, fortunately, the disease is comparatively infrequent under the age of fifteen, and added to this is the protecting influence of the active exercise in the open air usually indulged in by school-children. It is upon the teachers that its blighting effects are most apparent, as they are predisposed by

* “Infant feeding,” part iv., chap. iv.