

there is not even a pretence of ventilation, while the cattle are packed in as close as they can conveniently be put. A cow has about four or five times the lung capacity of a man, yet on many of the farms each cow has only a tithe of the space required by a child under seven years of age, and that without any ventilation.

Fresh outside air contains only a trace of carbonic acid, about four parts in 10,000. The air of a room would be only fairly good with eight or nine parts in 10,000, yet some barns have as much as fifty or sixty parts of carbonic acid in 10,000; and I have no doubt, if the percentage were taken during cold weather in winter when the barns are tightly shut up, the air would be very much worse. When only a small quantity of carbonic acid is contained in the air, the carbonic acid in the lungs is very readily diffused through the atmosphere; but when that atmosphere has become impure, when it contains a large amount of carbonic acid with organic impurities, then the carbonic acid in the lungs is not so readily diffused through the air—it has found its level, and is retained in the system, where it lowers the vitality, causing the dullness and lethargy experienced by anyone after sleeping all night in a close room.

In calculating the amount of impurity in the atmosphere of a barn, the carbonic acid is taken as the standard of impurity only because so far no simple means has been discovered by which the other impurities can be determined, so that the amount of carbonic acid shows only relatively the amount of impurity in the air.

When a ray of light penetrates a dark place, innumerable particles are seen floating in the air. In a barn these particles of so-called dust are organic matters given off by the occupants, as well as fungi, bacteria, dried manure and particles of hay and grasses. It is this dust that is so dangerous as a source of infection in tuberculosis. The manure, as pointed out by Billings, contains the bacilli; when dry it becomes pulverized and powdery, and along with the discharges from the nose, it mixes with the dust and chaff and the other impurities in the air which are breathed by the cattle—ventilation which would rid the atmosphere in the barn of these impurities, being altogether lacking.

Drainage, and dark and damp cellars under the barns have a close relationship to the ventilation and warmth of the barn. The wet and filth usually found in the cellar, keep the air of the barn damp and chilly; while the decomposing animal and vegetable matters give off a quantity of carbonic acid which contributes largely to swell the amount already in the barn.

The cellar is considered by many farmers to be a necessity. There the manure is kept; there odd tools and implements are stored; and if the barn upstairs gets too crowded, one or more animals will be turned into the cellar. It is always dark and damp; the sunlight never penetrates there; the manure is thrown down, the liquid portion runs along and soaks into the ground; in many cases it is a little lower than the yard, and more or less of the surface water flows into it. It is never drained; usually it is damp and wet all summer long;