

or 68° F., the typhoid bacilli would increase in such numbers as apparently to kill out the ordinary water forms. It has been observed that at lower temperatures their vitality is impaired, and that at 46° F. they would disappear in six days, the ordinary water forms maintaining their supremacy. Prof. Dixon, of Philadelphia, obtained similar results in five days with typhoid bacilli in Schuylkill water.

At this point, however, we must guard against an incorrect argument that might be based on the fact just mentioned; I refer to the fallacious supposition that impure water will yield pure ice, and that freezing will kill pathogenic germs. The endemic at Plymouth, Pa., four or five years ago, has furnished us with one of the notable proofs of the fallacy of this supposition. Plymouth is supplied from four reservoirs at different elevations, fed by a mountain stream. When the supply to these becomes scarce, water is pumped from the river. This was the case from the 20th to the 26th March, the lower three of the reservoirs being nearly empty; but on the 25th a thaw set in, and on the 26th the upper two reservoirs became full; the water was let down from the third into the fourth, and the town was supplied from this water. About fifteen days later an epidemic of typhoid broke out. It was afterwards ascertained that during February, and portions of January and March, the dejecta of a typhoid patient had been continuously thrown on the snow and frozen ground, within seventy feet of the bed of the stream, a short distance above the third reservoir. The thaw which set free the mountain stream and filled the reservoir also carried into the lower two the frozen accumulations from the typhoid patient.

The direct bearing of such observations on our ice supplies is obvious, and I must here commend the action of our health authorities, last winter, in stopping the cutting of ice from the bay, and the fairly ready acquiescence of ice dealers and their enterprise in obtaining good supplies from purer sources in the less densely populated portions of the province.

Whilst a low temperature so lessens their vitality that they gradually die out, freezing suddenly stops all vital action and keeps them stored for action in the future. Another way in which the bacillus is stored and propagated is by being

dried and pulverized, as when excretal slops are thrown upon the ground, dried, and blown through the atmosphere. The experiments of Kraus show that the vitality of the typhoid germ is greater than that of cholera—that it will live longer in the struggle with the ordinary water forms.

Last year Karlinski published in the *Centralblatt* the results of investigations regarding the behavior of typhoid bacilli in typhoid dejections. He arranges them as answers to the following questions:

1. In what time can the specific typhoid bacilli be demonstrated in the dejections of patients?
2. Can the demonstration of typhoid bacilli in the fæces be looked upon as a diagnostic sign?
3. How long does the vitality of bacilli in typhoid dejections last?
4. How long do the bacilli in typhoid stools, in pits, retain their vitality?

Search was made from the fourth day onwards, dating from the initial chill. The bacillus was not found before the ninth day in any case. In the greatest number of cases (nine) it was found on the fourteenth, the range being very wide—from the ninth to the twenty-first; the actual numbers being two on the ninth, two on the tenth, four on the twelfth, nine on the fourteenth, two on the seventeenth, and three on the twenty-first. The time at which they began to disappear seemed to have a marked coincidence with the fall of temperature in the patient and the cessation of diarrhoeal stools. In many cases this was about the twenty-fourth day, and in no case were they found later than the fiftieth day.

The bacilli in the stools did not in any case retain their vitality for more than three months. This limitation, if substantiated by later observations, is worthy of note; showing that in its natural medium the bacillus dies out more rapidly than if it starts off and finds fresh fields and pastures new under favorable conditions. The keeping of them in different temperatures had no noteworthy influence on the duration of the vitality in the stools; but the addition of some other forms of bacteria had.

*Modes by which the disease is spread.*—I need not dwell upon the numerous methods by which the typhoid bacilli obtain admixture with our food and water, and gain entrance into the *prima via*, nor upon their immense multiplica-