

germs diminish. A few feet under the surface, below the roots of the vegetation, there is practically no organic substance and there are no bacteria. Since vegetables depend for their sustenance on inorganic material, the roots may and do penetrate beyond the layers of soil rich in germs and organic waste.

Hence spring waters (coming from deep sources), artesian or driven wells are sterile. Surface waters passing over contaminated surfaces and through the upper layers of the soil convey a percentage of their impurities to the streams and lakes, where the germs continue to flourish until their food supply fails. Sunlight also is inimical to their growth.

In ordinary parlance we say if there be animal organic waste there is sewage contamination, and in time the water will purify itself, all of which is true with proper limitations.

The animal constitution has such recuperative powers that we can dispose of a vast amount of injected dirt, but there are some varieties that even the strongest constitutions cannot handle with impunity. These are some of the pathologic microbes that can live a long time in water that is sewage tainted and are specially malevolent. For example, let the ejections of a case of typhoid fever, cholera, etc., get into a well, lake or stream, even in small quantity, and the result: an outbreak of disease in those who have ingested the water, if it had not been sterilized by boiling, as in tea, coffee or other cooked preparations.

The remedies are patent to all: Avoid tainted water or remove tainted material.

The two methods are made use of, but they are beginning to border on the difficult, if not impracticable. Let us consider the salient points.

The untutored savage could camp beside the spring, lake or river with impunity. His successors followed the same role, and all went well until the tainting of the water overcame the natural powers for purification. Careless and ignorant people built their byres, stables, outhouses, etc., so that they drained into the water courses, underground as well as above ground. Cupidity throws all varieties of waste from the many types of factories into adjacent water courses, as it costs less

to do so than otherwise to dispose of objectionable matter. These conditions are not difficult to remedy, but crowded communities mean concentration of objectionable material and less place to put it. This gives rise to the garbage cart and common sewer that, when well carried out, fairly well fills the bill, and the water supply may, with care, be unobjectionable, but to assume that large rivers can receive tainted effluents and so dispose of them as to continue to be good potable water is not in accord with the experience of to-day.

The mighty St. Lawrence and its confluents and the Great Lakes were assumed to be perfection, but now they are tainted and disease-producing. This need not be wondered at when we consider the number of large cities and towns that discharge sewage and offal into these basins, and a population increasing and to increase; of the thousands of steamers and boats that are continually dumping offal of every type into those potable (?) waters. The time has come when concerted action must be adopted, very different from what now obtains. The remedy by filtration is being adopted, but at what cost and with what result the future will determine.

Every stream and lake over the whole of the country where population is dense is in like condition because these basins, being the lowest places, must be the reservoirs of drainage of all kinds.

The conditions above detailed to a variable extent prevail in detached buildings and rural communities.

Let us summarize present processes for treating waters more or less tainted.

1. *Dilution*—But this has failed with our largest lakes and rivers.

2. *Exposure to Air and Sunlight*—But the length of time needed to obtain the desired results too often vetoes this process.

3. *Chemical Treatment and Filtration*—But this, in addition to cost of maintenance, as well as installation, becomes a serious question where millions of gallons are daily required.

4. *Filtration and Bacteriological Filter Bed*—In addition to cost is very often inefficient, myhap due to a part of the bed allowing an impure stream to mingle with the purer.