1901

South Kingstown in the Revolution

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T.H.E.S.I.S.

WATER: ITS INFLUENCE ON HEALTH AND DISEASE.

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CLASS OF 1901.

WATER: ITS INFLUENCE ON HEALTH AND DISEASE.

The subject of sanitary science received no marked attention until the middle of the seventeenth century; although from time immemorial, the highest value has been set upon a pure and plentiful water supply.

Hundreds of years before the Christian era, water had been regarded as an indispensable article. In Egypt, lakes were built for purposes of irrigation; in India, tanks and reservoirs were erected for the same reason, and parts of the country at that time were far more highly cultivated than they are to-day. Attention was also paid to the purity of these water supplies. Hippocrates wrote upon the value of pure water some four hundred years before the present era. He also believed that boiling and filtering even were necessary to obtain a good drinking-water.

The nearest approach, however, to the present ideas of sanitary engineering, was in the Roman period, when hundreds of miles of aqueducts were built in order to furnish the city of Rome with an abundant supply of pure drinking-water. It is stated that these conduits delivered 300,000,000 gallons per day or about 300 gallons per head.

the population of the city being approximately 1,000,000.

With the decline of the Roman Empire these magnificent structures were allowed to fall into partial decay, though they were not abandoned until the fourteenth century. To-day six of the same aqueducts supply the city with water still taken from the old sources.

In the Middle Ages the whole world, and especially Europe, fell into a state of bigoted religious ignorance. Instead of cleanliness, which naturally follows a plentiful supply of water, only filth abounded. Even the leaders of the Christian church taught its adherents that cleanliness was inconsistent with godliness, and that bodily filth was a mark of deep and holy piety. Such instruction was eagerly followed by the people. Bathing went out of fashion, homes reeked with filth, and the streets were too often used for garbage and excretory matter. Pestilences as a result were common, and in 1522 over 70,000 persons died in Paris alone from one of these visitations. In 1665 what was known as the Black Death, appeared in England and claimed over 100,000 victims. It is calculated that from

the beginning of the thirteenth to the end of the seventeenth century over 40,000,000 people were carried off by these scourges.

At last with the dawn of the seventeenth century the cloud of intellectual and social darkness which had lain like a heavy pall upon the world, slowly lifted, and people began to realise that the causes for this immense sacrifice of life were due to lack of hygienic precaution rather than to Satanic influence or the wrath of offended deity.

This transformation due largely to increased interest in and study of the laws of nature did not, however, destroy superstition at one stroke. Many years of earnest and patient teaching were required before the change came about. Even in 1774 when Jenner showed that smallpox could be prevented by vaccination and isolation, he was unanimously denounced by both medical men and clergy.

During this period chemistry and biology were taken up as separate sciences, and very soon afterwards road improvements, drainage and the supplying of towns with pure water became popular questions of the day. About 1750 a system of drains to carry off the rainfall was built in

London and later it was made compulsory that these same drains should take away the sewage as well.

The first public water supply to be constructed in the United States, was at Boston, Mass.,in 1652, when the water was delivered through wooden pipes from neighboring springs.

Prior to 1800 there were in this country only five public water-works. From 1851 to 1860 there were built 81; while from 1861 to 1870 104 were added. Now they are counted by the thousands; and, besides furnishing water for drinking and all domestic purposes, they maintain an enormous supply for fire protection.

It has been proved by scientific experiment that our most dreaded diseases; as cholera, typhoid fever, smallpox, yellow fever and others of like character, spring from germs which inhabit fouled waters. These germs are readily taken into the system where, under favorable conditions, they multiply with enormous rapidity, and disease results.

The germs which are the cause of all zymotic diseases are called bacteria, are of a fungoid nature, and are considered to belong to the lowest form in the vegetable kingdom. These parasitic bacteria are found everywhere

endeavoring to live and increase on all organic matter. Heat and moisture are necessary to their growth; and when the requisite conditions are present, the decay of organic matter and increase in numbers of bacteria proceed very rapidly. As a result air, soil and water may become impregnated with morbific germs.

Until the discovery of oxygen and hydrogen and the combination of these elements in combustion, at the end of the eighteenth century, water had always been considered an elementary substance. It was found, however, to be composed of hydrogen and oxygen and the proportion is two volumes of hydrogen to one of oxygen. When these gases are brought together in this proportion and heat applied, water is formed as a result of the chemical affinity of the two gases.

Pure water is tasteless, inodorous, and for drinking-purposes should be colorless; nor should it contain anything which may act injuriously on the system. It is almost impossible, however, to obtain water under ordinary conditions in nature which does not contain some organic matter, and it is this in excess which makes it objectionable, particularly if of animal origin.

Organic matter may sometimes be detected by the color or odors given off; and when such is the case, the water should be rejected for drinking purposes until it has been thoroughly analysed by a competent bacteriologist or chemist. These analyses may not always be adequate, as the origin of the odor may not have become sufficiently decomposed to allow them to prove the quality of the water.

Odors may come from many different sources. At one time the water which is brought from Hemlock to Rochester, a distance of thirty miles, and which was considered to be extremely wholesome, suddenly became offensive, emitting a fish-like odor which continued for several months. The root of the evil was, that fish had somehow found their way from the lakes to the main pipes and there underwent slow decomposition.

In 1874, the water which supplies the city of Cherbourg, France, gave off an odor as from a pig sty; on enquiring into the matter the authorities found that one had been built near the source from which the city received its water.

There are many ways by which water may be polluted.

One of them, and by far the most important, is by sewage. Opinions of scientific men differ greatly as to whether water into which sewage has been poured, should again be used for drinking-purposes. One English authority says that "once sewage always sewage;" if this is the case, the water is useless; while Merriman says that a stream into which impurities have been thrown will again become pure after a sufficient flow. On the other hand, the London Water Commision states that there is not in England or Scotland a river long enough to effect the oxidation of sewage.

The results of pollution of water are often very great. Hundreds of cases could be cited were they necessary, and it may be well to mention a few striking examples.

Mason says that it is an old custom in Europe for women to take their weekly wash to the nearest available water-course; and in Messina, Sicily, a portion of the public water was deflected for their benefit. In 1887 the town was visited by an epidemic of cholera. The plague lasted from September 10 to October 25 and there were 5000 cases with 2200 deaths. The population

stampeded, falling from 71,000 to 25,000. When the government inquired into the cause, it was found that contamination had resulted from the deflected water finding its way back to the mains. Acting upon its convictions the government sent tank ships to the mainland, filled them with pure "Serino" water from which the people were supplied, and the number of cases fell at once from 70 to 5.

At Manilla, in the Philippine Islands, cholera was exceedingly common twenty years ago, but after the introduction of a water supply, it almost disappeared.

No doubt it will be a source of satisfaction to all to know that this year in Havana, Cuba, the month of April opened without a single case of yellow fever, for the first time in the city's history. This of itself is a powerful argument and tends to show how quickly the effects of a little practical sanitary engineering are seen.

In 1885 a severe epidemic of typhoid fever attacked the town of Plymouth, Pa., the population at that time being about 7800. It first appeared on April 8, and during that month there were 718 cases; in May, 261, and in June,

130 making a total of 1104. Of these, 114 died. On investigation, it was found that during the month of December there had been a case of typhoid fever in one of the suburbs of Philadelphia, and that the excreta of the patient had been thrown out into the snow on the banks of the river which supplied water to Plymouth. When the snow melted, the refuse had been washed into the river and by this thoughtlessness lives were sacrificed.

In 1892 Hamburg was visited by a terrible cholera epidemic. Adjacent to Hamburg and forming with it one continuous city are the distinct municipalities of Altona and Wandsbeck. Hamburg used the unfiltered water of the river Elbe; Altona used the same water but thoroughly filtered it, while Wandsbeck derived its supply from a lake. The total number of deaths was 8976; the deaths in Hamburg being 134 per thousand, in Altona 23, and in Wandsbeck 22. Analysis proved that the cholera bacillus existed in the water of the Elbe, and there can be no doubt that the people of Hamburg were infected by this water, while the filtration of the Altona supply rendered it perfectly harmless.

As before mentioned, a good drinking-water should be without taste or smell. If an odor is given off, the supply should at once be abandoned and a thorough investigation made in order to locate the trouble.

To render water purer, nature comes to our aid. It does its work by two different methods, namely-sedimentation and aeration. Sedimentation, or settling, occurs when a body of water is kept quiet, so that the suspended matter may slowly settle. A great deal of the matter held in suspension is inorganic, which, as it slowly falls, drags down with it a considerable portion of organic material. Aeration is caused by bringing the water into contact with air, so that the oxygen may enable the bacteria to decompose the suspended organic matter.

Another method for the purification of water is artificial filtration. By this we mean that some method is devised for the purpose of separating the different solids from the water required for use. With this intention filters of various kinds have been invented. The most successful of these is the sand filter; this is used in many different forms, yet it has always proved the most

efficient. The fineness of the sand combined with its compactness gives it a marked superiority over all others.

The principal difficulty with other kinds of filters, as those which use coke or charcoal, is that they quickly become clogged and require constant changing.

The sandbed method of artificial filtration is used to a large extent in Europe. In the United States the same method has been adopted at Hudson and Poughkeepsie, New York, Lawrence, Mass., and a few other places. At Lawrence the typhoid fever death rate was reduced one-half in th the first year of its use.

The development of water supplies in America since 1870 has been so rapid that the question of abundance has received more attention than that of purity; but the time has now come when this can no longer be disregarded, and several cities have already made preparations for the introduction of the sandbed filter plant.

A few years hence the work of the sanitary engineer will be recognized and more thoroughly appreciated than it is to-day. And why should this not be so? He is working slowly and patiently to overcome the superstitions

and prejudices which have for so many hundred years enthralled the world, but which, happily, have almost passed away. When that day arrives, he will be hailed as one of the worlds benefactors and his work classed as second to no single invention or discovery of the age. He labors to save life while the others with the exception of a certain few, seek only to ease life's burdens.

From all this we might justly say, that the purer the water supply, the scarcer will become those zymotic diseases which so often and without the least warning thrust their unwelcome presence upon us. And though we hardly hope to realize the ideal in this matter we may at least approximate it by unwearied perseverance.