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A STUDY OF A CONTAMINATED WATER SUPPLY.

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A pure water supply is one of the most valuable possessions which nature can give to any community. The value of a pure water supply is realized more readily by those who live in a city or town where the population is concentrated than by those living in the country where the families are isolated.

A contaminated water supply is a very expensive possession for a city, and as the natural result of experience, great attention is given to insure a pure water supply by the larger cities and towns. Expensive water works and filter beds are erected in order that pure water may be supplied, and the money spent for this purpose is one of the best investments that can be made by a city or town.

In the country and small towns, shallow wells are used as a means of obtaining a water supply. The water which is furnished by these shallow wells is, no doubt, at first in a pure condition, but in course of time little or no attention is paid to the surroundings, and a natural result is that a condition is reached which is favorable for the contamination of the well.

The average individual depends entirely on the taste and smell of a water to determine whether it is pure or not. As long as the water remains clear and has no offensive taste or odor, the water will be regarded as pure. And in this lack of realization, as it were, by those who use shallow wells, there is no doubt the cause of many an epidemic of diseases, the germs of which are readily distributed by means of water. A recent epidemic of typhoid fever gave an opportunity for a chemical investigation of a number of shallow wells, the object of the investigation

being to determine, if possible, the source of the epidemic. It was recognized after an investigation of the hygienic conditions that the water or milk supply must have been the means of transmitting the germ which caused the epidemic. A thorough investigation of the water supply proved that there was no indication whatever of any contamination; and, naturally, attention was given to the milk supply as the probable cause of the disease.

A chemical examination was made of every well which supplied water to those who furnished the milk supply. All of the samples collected were analyzed at once on reaching the laboratory. The results of the analysis showed that all of the wells furnished good water except one shallow well, which gave the following results:

Free Ammonia	.054	parts per million.
Albuminoid Ammonia	.174	" " "
Solids on Evaporation	904.	" " "
Solids at 180°	752.	" " "
Solids on Ignition	440.	" " "
Nitrogen as Nitrites	.2	" " "
Nitrogen as Nitrates	24.	" " "
Oxygen consumed in 15 minutes	.16	" " "
Oxygen consumed in 4 hours	.96	" " "
Chlorine as Chlorides	24.	" " "

When the results of this analysis are examined it will be noticed that the amount of nitrogen as nitrates is 24 times that of the standard of the State Board of health. The large amount of chlorine and solids in addition to the large amount of nitrogen as nitrates shows most conclusively that the well was contaminated.

A second analysis of water from the same well a short time after the first analysis gave the following results:

Free Ammonia	.104	parts per million
Albuminoid Ammonia	.086	" " "
Solids on Evaporation	874.	" " "
Solids at 180°	714.	" " "
Solids on Ignition	506.	" " "
Nitrogen as Nitrates	40.	" " "
Nitrites	.16	" " "
Oxygen consumed in 15 minutes	.64	" " "
Oxgen consumed in 4 hours	.06	" " "
Chlorine as Chlorides	26.	" " "

In comparing the results of the second analysis with the first analysis, it will be noticed that the amount of nitrogen as nitrates, has increased from 24 parts to 40 parts per million, while the albuminoid ammonia has decreased.

These results indicate that the nitrogen in the organic matter which was present in the water has been changed during the process of nitrification into nitric acid. This change has probably taken place during the passage of the water through soil in which the conditions were favorable for the nitrifying process.

When inquiries were made regarding the use of this well, the claim was made by the owner that it was not used, but that a deeper well, which was near the shallow well, furnished the water. It was discovered, however, on visiting the place one morning, that a bucket of water was being pumped from this well for drinking purposes, and was supplied to a number of men working on the railroad near the place. The deep well proved to have a very limited supply of water when tested; and it was then claimed that the shallow well water was used only for washing out the milk cans, etc. A case of typhoid fever had occurred in the family of the farmer during the summer, and on tracing the case it was found, that this case and the epidemic were closely related when consideration was given to the time necessary for the development of the disease The number of cases were from forty-five to fifty, and almost the entire number of patients came from those who used the milk furnished by the farm with the contaminated well. It was also found on investigation by the physician that a number of the laborers on the railroad had developed cases of typhoid fever. The conclusion naturally reached is, that the well was contaminated from some source, and at the time at which the case of typhoid fever was in progress in the family of the farmer, contained the typhoid germ. The use of this water for washing milk cans without boiling, transmitted the germ to the milk, and by the milk to the digestive system of the persons using the milk.

The well which proved to be the source of the epidemic was the only one which was contaminated among the wells examined, yet we cannot but realize that there are distributed in the small towns and on the farms many such wells, which are in the condition of a gun which is not supposed to be loaded, but is liable to "go off" at any time with disastrous results.

There is no doubt that little or no attention is given to the water and milk supplies as long as Providence in some mysterious manner protects those who tempt her in many ways, but when the penalty is paid, it is a costly one, for instruction furnished by "experience" is in many cases very expensive.

DIPHENYL ETHER DERIVATIVES.

ALFRED N. COOK.

(1) HISTORICAL INTRODUCTION.

(2) PREPARATION OF A NITRO-METHYL DERIVATIVE.

(3) OXIDATION OF THE METHYL GROUP TO AN ACID AND THE PREPARATION OF SOME OF THE SALTS OF THE ACID.

(4) REDUCTION OF THE NITRO GROUP TO FORM A BASE AND THE FORMATION OF THE PLATINUM SALT.

(5) BIBLIOGRAPHY.

HISTORICAL:—In the year 1854, Dr. K. List and Dr. H. Limpricht (Ann. 90, 190) were studying the products of the destructive distillation of copper benzoate and succeeded in identifying the principal product as phenyl benzoate. During the process of purification they separated from this by fractional distillation a substance to which they assigned the formula, $C_{22}H_9O_2$, and called it phenyl oxide. (Dr. John Steinhause had previously studied the products of the distillation of copper benzoate (Ann. 53, 91), but did not detect the substance in question). Limpricht