The Dangers of Unfiltered Water.—I.

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From time to time whole districts are ravaged by epidemics, the source of which is often traced to the water supply, and the term "water-borne diseases" is now familiar as representing those diseases which are spread by means of drinking-water. Such scourges reflect upon the sanitary authorities, who should be responsible for the water supply, and they reflect also upon the individual, for by the use of simple precautions such calamities might be prevented.

Pure water contains only the two elements of hydrogen and oxygen, but absolutely pure water is a substance unknown in Nature. The nearest approach to it is the water that is obtained by distillation, and the clouds at the moment of condensation. As soon as pure water is in contact with the air it begins to absorb various gases, and as soon as it is in contact with the earth it begins to dissolve any soluble substance it meets, for absorbability and solubility are two of the characteristics of water.

The rain which falls from the clouds is the primary source of all water used for domestic and drinking purposes, but before it fulfils its purpose it takes roundabout ways, in the course of which it becomes more or less defiled, so that a clear, sparkling glass of water may contain fatal hidden poisons.

Rain has been called a purifier of the air, and so indeed it is, for in falling from the clouds it absorbs many gaseous and suspended impurities. It absorbs ammoniacal salts and sulphurous acid, and in the neighbourhood of the sea it absorbs common salt, and in every case it is very highly aërated. It takes into itself, in a state of suspension, various bacteria and microscopic plants, besides the pollen of grasses and flowers and the spores of fungi. The greater the amount of impurities in the air, the more impure does the water become, so that rain water which falls in large towns is unfit to drink. It is very rarely stored in towns, but in country districts the supply of rain water is carefully saved, and, if the first washings from the roof flow away, the rain which falls subsequently is tolerably pure.

When rain falls upon the earth it dissolves various mineral substances, and the amount of carbonic acid gas which the rain has absorbed renders it an easy matter for chalk to enter into the substance of water in a dissolved state, which causes the soft rain-water to become hard. When such hard water is boiled, the carbonic acid gas is driven off, and bicarbonate of calcium then becomes carbonate of calcium, or chalk, and forms a deposit which causes the fur on the bottom and sides of kettles and boilers. The hardness of water, which can be removed by boiling, is known as temporary hardness, and it can be removed by adding to the water a sufficient quantity of milk of lime, which is the method adopted when water has to be softened on a large scale. Provided that the bicarbonate of lime is not in an excessive amount, water of a temporary hardness is wholesome and pleasant to drink.

If the hardness of water is due to the presence of the chloride and sulphate of lime and the salts of magnesia, the hardness cannot be reduced by boiling, and so goes by the name of "permanent" hardness. Maignen's "Anticalcaire" removes the sulphates as well as the carbonates of lime, so that waters of "temporary" and of "permanent" hardness are softened by its use. There are certain districts where hypertrophy of the thyroid gland induces goître and its allied cretinism among the inhabitants. It has been remarked that the great majority of the water supplied to these districts is derived from magnesian limestone rocks, and in the past it was imagined that permanently hard water was the cause of goître. The water supplied to Sunderland is dolomitic in the highest degree, and yet the inhabitants are free from goître. Dr. St. Leger argues that the presence of metallic sulphides as iron pyrites is an important factor, but the real cause of goître yet remains to be discovered. It is certain, however, that water with a permanent hardness exceeding 7° or 8° causes dyspeptic symptoms and diarrhœa, and particularly among people who are not accustomed to drinking such hard water.

Deep well water is wholesome and very palatable, although sometimes rather hard. The term "deep" is misleading, for it is often stated that a deep well is one which has a depth of over 50 feet. As a matter of fact, many "deep" wells are not so deep as "surface" wells; the difference between them lies in the fact that, in digging a deep well, an impervious layer of soil is always pierced before the water is taken from a lower pervious stratum. By doing so, the water has its source in the rain which has fallen at a great distance from the well, and has had to pass great distances over sand and gravels, which are the best of all natural filtering media.

Water which is drawn from a shallow well should always be regarded with suspicion, as it does not travel far enough to be naturally filtered, and soakages from cesspools and manure heaps find their way easily into the water of a shallow well. Unfortunately, the suspended matters of such soakages are kept back by the gravel soil, and the water of such wells is not altered in flavour or in clearness. People accustomed to drink sewage-polluted waters are unaffected by them until infected sewage finds its way into the water and an epidemic follows its use. People unaccustomed to sewage-polluted water are attacked by diarrhœa when they first commence their use.

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