POTABLE WATER. HOW TO FORM A JUDGEMENT ON THE SUITABLENESS OF WATER FOR DRINKING PURPOSES

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HOW TO FORM A JUDGMENT ON THE SUITABLENESS

OF

WATER FOR DRINKING PURPOSES.

Addressed to Medical Officers of Health, and Sanitary Authorities, etc.

BY

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WHAT CONSTITUTES POTABLE WATER?

THE difference of opinion that unfortunately exists amongst analysts of undoubted eminence with reference to what may or may not be pronounced a fit water for drinking purposes forms the *raison d'etre* of this *brochure*. That this difference exists widely, and threatens to become still more marked, is assumed to be within the knowledge of those to whom these pages are addressed, as there are few people interested in the health of the community who have not experienced the inconveniences, resulting often in a dead-lock, that arise from it.

Now that the Public-Health Act has conferred powers on Sanitary Authorities to institute proceedings with a view to closing impure wells and other sources of supply, and has left the decision to the local magistrates, it becomes more than ever desirable that some standard should be set up as a guide in such matters. The bench of magistrates listening to the conflicting statements of experts is like a rudderless ship at sea, without any exact knowledge to guide their decisions, or data upon which to form an opinion. It is hoped and believed that a consideration of the question conceived in an unbiassed spirit may tend to reduce order out of chaos, and that here as in most other things common-sense will come largely to our aid.

A practical experience afforded by the analysis of nearly two thousand samples of water is not so much put forward by the writer as a reason and proof of his ability to deal with this question with a view to its elucidation, as the fact that in a large number of cases he has had the opportunity of personally

investigating the conditions under which the waters were collected; and further, that owing to the kindness of medical friends, he has enjoyed ample opportunities of examining waters that have given rise to enteric fever and other hardly less serious disorders. He has had too the good fortune to practise as an analyst in a district where, within a radius of 30 miles, every geological formation from the Chalk down to the Silurian is represented, and has thus had considerable experience of the diversities in the composition of water taken from the various strata.

The arguments in favour of this or that view have hitherto been conducted too much on *a priori* lines and an attack on the position from the other side,—an appeal to experience as opposed to mere anticipation,—will show us that pet theories are not only not always supported by facts but must sometimes be very much modified by them.

It is not proposed to enter into the consideration of any technical details relating to water analysis and happily it is unnecessary. The processes by which chemists arrive at their results and which during the last few years have been much improved in the direction of extreme accuracy are not the subject of variance, with one notable exception however, viz:—that of the estimation of organic matter. Of the several methods in use for the estimation of organic matter, each is vaunted by its originator, as being the best and only reliable one, and the only agreement that seems so far possible amongst analysts, (though here it must be admitted the unanimity is complete,) is in decrying every other person's process.

Notwithstanding this exception, as we shall see further on, the general conclusions that have been arrived at are in no way affected. The facts then, so to speak, in connection with water analysis are not the subject of dispute, but the deductions to be derived from the facts; and here we enter a region which is altogether outside the province of a chemist pure and simple,

his usurpation to the contrary notwithstanding, and the question becomes one rather for the medical expert. The chemist has no special knowledge or experience, beyond that pertaining to all intelligent educated men who take an interest in sanitary matters, to guide him in forming an opinion as to what may or may not be the conditions under which diseases may arise that are the outcome of unwholesome surroundings, and the sooner this is recognised and the matter relegated, in disputed cases, to those who are alone competent to give an authoritative opinion, viz :—those, who, practising medicine have made hygiene a special study, so much the better will it be for the health of the community.

In order to properly understand the subject it will be well to take a brief review of the various sources from which we take our water supplies.

To begin with rain water. This as being distilled from the clouds one would naturally expect to be as free from impurities as it is possible to obtain water : as a matter of fact however it ranks amongst the more impure supplies. Rain falling in the neighbourhood of dwellings and cultivated land washes out from the air the impurities, the result of emanations from the earth, which exist there, and is collected too on surfaces, such as roofs, which are in themselves more or less dirty. The Rivers Pollution Commissioners calculate that "half a pint of rain water often condenses out of about 3373 cubic feet of air, and thus in drinking a tumbler of such water, impurities, which would only gain access to the lungs in about 8 days, are swallowed at once," and they are of opinion, "that it is in vain to look to the atmosphere for a supply of water pure enough for dietetic purposes."

In the absence, however, of any evidence that such water is positively unwholesome, one is inclined to regard this condemnation as too absolute. It would be nearer the truth to say that although at the best but a vapid and uninviting fluid, its use,

failing better sources of supply, may be tolerated; always supposing of course that it is so stored as to render any contamination by sewage impossible.

In the case of a country district, known to the writer, which is entirely dependent on rain for its water supply, he has been unable in spite of diligent inquiry into the history of the place to trace any sickness to its use, and has not hesitated to allow his own family to drink the water there for many weeks together.

Rain falling upon the vast tracts of more or less uncultivated uplands, which form the gathering grounds of so many of our lakes and rivers, is naturally less contaminated in the first instance, and has much of what organic matter it might have contained taken up by the herbage over which it passes and thus gives rise to many supplies of undoubted purity. Loch Katrine which supplies Glasgow, the lakes of Westmoreland and elsewhere, and many a rapid running river, afford instances that will at once occur to everyone. To these sources of supply may be added that of rivers generally where they have not become so fouled by manufacturing refuse and sewage as to render them unfit for human consumption. Rivers, which are fed by springs and rain water in the form of surface drainage, seem to have a self purifying faculty, due partly to the subsidence of suspended impurity and to oxidation and the absorbing power of aquatic vegetation, and which is proportionate to the rate and bulk of the stream. As the poison of scarlet fever is disinfected and destroyed by free exposure to light and air, so it would appear that the poisonous germs which sometimes accompany sewage are destroyed by somewhat similar processes. Of course there are many rivers so impure as to be entirely unfit for human consumption, but there is no evidence that the health of towns that take in turn their water supply from such rivers as the Trent and Thames, and again pour their sewage into them, is injuriously affected by the use of such water; however repugnant and nasty the idea must be of drinking water that has been

mixed with sewage, and however desirable it may be to obtain water, if possible, from purer sources.

Probably the purest drinking water is that obtained from springs, the purity being directly proportionate to the amount of surface impurity, and the more or less thorough percolation through porous strata. Lastly we come to wells, where water is collected by sinking holes in the earth to varying depths and which too yield water of greater or less purity as the conditions of the collection of the water are more or less favourable.

The water from shallow wells is, as a rule, very impure and gives rise to the large majority of cases of typhoid fever which occur in this country and when we consider that it is computed that in Great Britain alone 200,000 suffer annually from this disease, of which number 20,000 die, it is hardly possible to over-rate the importance to a community of a proper water supply.

From this brief view of the sources from which we take our supplies, we pass to consider what the impurities are that effect water, how they may be estimated and what dégree of purity we may reasonably expect a drinking-water to attain to. A very little consideration will show that absolute purity is hardly anywhere attainable, and in using the word it must be understood that it is meant only in a relative sense, which is however sufficient for all practical purposes.

All waters, rain water alone excepted, contain more or less mineral matter in solution from the soil with which they come in contact. Water like that of Loch Katrine, which has passed over surfaces more or less impermeable, contains the lowest proportion, while such water as is procured from a permeable formation, like the Chalk, contains a much larger proportion. It is a custom of some analysts to speak of the mineral constituents as "impurities," but inasmuch as in most cases these so-called impurities actually add to the wholesomeness of a