PRELIMINARY NOTE ON THE STERILIZATION OF BILHARZIA-INFECTED WATER.

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A series of trials carried out with the apparatus devised by Major C. H. H. Harold, O.B.E., Royal Army Medical Corps, for the sterilization of drinking water by chloramine solution had proved so satisfactory that the question arose as to whether this method might prove effective in dealing with the very important problem of the purification of bilharzia-infected waters.

As the result of previous work, it has been generally accepted that the cercariae remain alive for at least an hour in water containing from four to ten parts per million of available chlorine, and hence the use of chlorine for this purpose is unpractical under field service conditions. It might be used for fixed water-supply plants, where it could be combined with de-chlorination.

We were encouraged to try the effect of the chloramine solution because of its apparently much greater efficiency as a protoplasmic poison.

The standard strength of available chlorine in the chloramine procedure for the purification of water is one part per million. To enable us to reproduce this concentration in our small scale trial, the following calculations were made: To 104 gallons of water, 6 gallons of chloramine solution are added to produce 1 part per million of available chlorine. Therefore, if three cubic centimetres of chloramine solution are added to fifty-two cubic centimetres of water, a similar result will be attained.

An infected snail (Planorbis boissyi) was placed in a 100-cubic centimetre cylinder of tap-water until a sufficiently heavy contamination with cercariae was obtained. To fifty-two cubic centimetres of this water three cubic centimetres of the chloramine solution, prepared according to the instructions for the mono-chloramine method, were added. The cercariae were observed with the assistance of a hand lens. Immediately on the addition of the chloramine solution there was greatly increased activity. This was followed by complete cessation of movement after about five minutes. Following the cessation of movement, the cercariae developed a "fluffy" appearance, in marked contrast to their previous sharp-cut outline. The typical "anchor-bar" shape normally presented when not in motion was lost, and they gave the impression of being upside down and of sinking gradually.

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Examination, at intervals, during the following twenty-four hours, yielded no sign of any return of mobility; the organisms gradually sank to the bottom and seemed almost to agglutinate.

Examination in hanging-drop preparation under a low power of the microscope showed them to be broken up, as it were, sometimes the bifid tail segment and sometimes the head and body segment being seen.

This experiment was repeated twice and the same results were obtained. These results were so different from what had been expected, that it was decided to change over to ordinary bleach solution, as controlled by the use of Horrocks' box.

Bleach of an available chlorine content of from twenty-two to twenty-five per cent was used, and a series of trials was carried out on similar lines to the foregoing.

Three different types of water were used: (i) Tap-water (as in the first series); (ii) unclarified water from the River Nile; (iii) water from the aquarium in which the snails were housed, and which closely resembled the water in any of the local irrigation channels, the natural habitat of the snails.

The usual "6-cup" test was carried out and the figure varied from 1 for the tap-water to 4 or 5 for the Nile and aquarium waters.

For the purpose of laboratory tests with small quantities of infected waters it was found convenient to use in each case 160 cubic centimetres, which was found to be the average amount contained in one white cup. This was chlorinated by the addition of the requisite number of drops from the Horrocks apparatus. Water so treated, if free from cercarinae, should show a trace of chlorine after half an hour's contact and would provide a bacteriologically safe water at that time.

The trials were carried out in graduated cylinders and with freshly secreted cercarinae, as before. The results were astounding. In all three types of water, on the addition of bleach, controlled as above to give the amount of chlorine necessary for destruction of pathogenic bacteria, the cercarinae became motionless in from five to fifteen minutes, and subsequently showed the same signs as had been observed in our previous experiments.

A possible objection seemed to exist in the smallness of our scale, that is to say, the distribution factor might come in. A drop of bleach solution in 160 cubic centimetres, well swilled round in a measuring cylinder, might conceivably expose the cercarinae to an individually bigger dose of chlorine than a scoopful in 110 gallons.

With this point in view, the cylinders were left for half an hour: the proper persistence of a trace of chlorine being demonstrated at the end of this period, and then the cercarinae were added. They all died within twenty minutes, loss of mobility being taken as evidence of death.

One further trial was carried out. A 110-gallon tank was set up on the bank of the River Nile and filled by means of a pump. The Horrocks test was carried out, and the four scoopfuls thus indicated were made into a
paste and added. After vigorous stirring for three minutes, some of the water which now gave evidence of much free chlorine, was added to an equal part of freshly infected tap-water. The cercarias were dead in under five minutes, i.e., killed by less than the proportion of chlorine which would be employed for disinfection in the ordinary way.

**DISCUSSION.**

The snails used were undoubtedly *Planorbis boissyi*. The cercarias obtained from these were bifid-tailed, closely resembling the picture of *Schistosoma* cercarias, shown in fig. III, facing page 223 in "Memoranda on Medical Diseases in Tropical and Sub-tropical Areas" (fourth edition, 1924).

No animal inoculation tests have been carried out to prove their identity.

**CONCLUSIONS.**

Cercarias obtained from snails of the species *P. boissyi* were rendered immobile, and in many cases showed evidence of disintegration, by approximately one part per million available chlorine, well within the thirty-minutes contact period ordinarily allowed for the sterilization of a drinking water.

These cercarias showed close morphological resemblance to the pictured representation of *Schistosoma* cercaria.

Without a greatly extended series of trials we are not prepared to draw any further, or more definite, conclusions.

The matter would seem worthy of further investigation, especially in view of the wide interests at stake.

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