

## THE DESTRUCTION OF TUBERCLE BACILLI IN MILK BY ELECTRICITY.

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WE have now completed a series of experiments on the treatment of tuberculous milk by electricity on the lines which have been described by us in a Report to the Health Committee of the City of Liverpool, and in various communications to scientific journals. These seem to us to establish fully the claims we have made, that this process is efficient for the total destruction of the bacillus of tuberculosis in a milk-supply. Reference to recent experimental investigations will help to make this clear.

### 1. Experiments on Naturally Occurring Tuberculous Milk.

Our experiments were carried out under the following conditions :

(a) Milk was collected from a cow with known tuberculosis of the udder. Portions of this were used for control experiments, and the remainder was passed through the tubes of the electrical apparatus at different velocities and with differences in the amount of current (Experiments 88, 89, 91, and 99), and the resulting sample was in each case inoculated into the groin of guinea-pigs. The control guinea-pig developed well-marked tuberculosis.

*Experiments 88 and 89.*—In these experiments the conditions of treatment were such that we fully expected that the complete destruction of the *B. tuberculosis* would not be effected, and the results proved this, for inoculation of a portion of this milk into guinea-pigs brought about definite tuberculosis in these animals.

*Experiment 91.*—The remainder of this sample was re-treated under more satisfactory conditions, and the inoculated guinea-pigs remained free from tuberculosis.

*Experiment 99.*—In case the second treatment should also fail, a third treatment was carried out, but the results were naturally similar to those of Experiment 91.

After much work we were able to establish a standard method of treatment, which had to be varied only slightly under different conditions of the milk, etc., and in the later experiments, which we now record, one passage through the apparatus has been sufficient to give satisfactory results.

(b) A cow was selected, known to be tuberculous, as determined by previous examination of the milk, and a litre sample of milk obtained. This was thoroughly mixed, and divided into two equal parts, one portion of which was electrically treated, the other portion remaining untreated. The "treated" and "untreated" portions were then dealt with as follows: 500 c.c. of each were taken and centrifuged as ten separate 100 c.c. samples; the cream and deposit of each 100 c.c. were then injected into guinea-pigs, five with the deposit and cream from untreated milk, and five with the deposit and cream from the treated milk. At the end of the necessary period the animals were killed and examined, with the following results:

TABLE SHOWING DESTRUCTION OF TUBERCLE BACILLI OCCURRING NATURALLY IN MILK.

Untreated.		Treated.	
Guinea-pig No. 1.	Tuberculous.	Guinea-pig No. 1	{ All were killed and examined most minutely, but no trace of tuberculosis could be found.
" No. 2.	"	" No. 2	
" No. 3.	"	" No. 3	
" No. 4.	"	" No. 4	
" No. 5.	"	" No. 5	

Thus, there is definite evidence of the destruction of all tubercle bacilli, and this under conditions of infection not likely to be met with in industrial practice. It will be noticed that the milk was the product of one tuberculous cow, whereas the milk-supply of a dairy or sterilizing depot is the mixed milk of many cows, with, therefore, a corresponding reduction in the relative number of tubercle bacilli.

## 2. Experiments on Artificially Infected Milk.

1. A sample of milk was copiously infected with an emulsion of living bovine tubercle bacilli. After the milk had been thoroughly mixed, two control animals were inoculated. The remainder of the milk was then treated, and a further two animals injected with the treated milk. The results were as follows: (a) The animals inoculated with untreated milk developed tuberculosis. (b) The animals inoculated with electrically treated milk showed no signs of tuberculosis.

2. A sample of milk was sterilized by steam in the autoclave, and afterwards infected with the caseous glands of a tuberculous guinea-pig. The infected material was added to the milk in the form of an emulsion made by the aid of a mortar. This artificially infected milk was then electrically treated, and guinea-pigs inoculated before and

after treatment. The result of inoculation was as follows: (a) The guinea-pigs inoculated with untreated infected milk developed well-marked tuberculous lesions. (b) The guinea-pigs inoculated with infected milk, after electrical treatment, showed no sign of tuberculosis on post-mortem examination.

### 3. Evidence on the Destruction of the Tubercle Bacillus occurring in Routine Practice.

During the testing of a larger commercial type plant further evidence was obtained as regards the destruction of tubercle bacilli. Deliberately infected milk was not used, for the apparatus was built in ordinary dairy premises, but on several occasions the untreated milk was found to be tuberculous and the corresponding sample of treated milk was non-tuberculous. The technique was the usual, namely, the injection into guinea-pigs of the cream and deposit from 100 c.c. of centrifuged milk, both before and after treatment.

TABLE SHOWING THE DESTRUCTION OF TUBERCLE BACILLI BY COMMERCIAL TYPE ELECTRICAL APPARATUS.

Date (1914).	Untreated Milk.	Electrically Treated Milk.
January 31 ..	Tuberculous	Inoculated guinea-pigs were killed, and on post-mortem examination showed no trace of tuberculosis.
February 10 ...	"	
" 11 ...	"	
" 16 ...	"	
" 24 ...	"	
March 10 ...	"	
" 14 ...	"	
" 24 ...	"	