

this coli group, the identification of the *B. typhosus* would be difficult in nature. They cannot, until their further experiments are completed, state whether the coli group found in these experiments indicated sewage contamination, or whether they were dealing with a group common in the intestine of the oyster and in salt-water. But, as bearing upon the next question, they found that the perfectly fresh oyster contained far fewer bacteria, and that the percentage of coli is much less.

IV. The infection of the oyster with the *B. typhosus*, and its removal by washing.

TABLE SHOWING NUMBER OF ORGANISMS PRESENT IN STOMACH AFTER INFECTING WATER.

Oysters.	Inoculated.	Examined.	No. of Colonies.		Organisms Present in Oysters.	Number Present in the Sea-Enter.
			Agar.	Gelatine.		
1	25 Aug.	26 Aug.	1,700		Almost entirely Typhoid.	Water in the same case 585,000 per c.c.
2	"	"	"		do.	
3	"	27 Aug.	7,020		do.	Water in the same case 468,000 per c.c.
4	"	28 Aug.	7,000		do.	Water in the same case 40,950 on Agar, 5,200 gelatine.
5	26 Aug.	29 Aug.	455		do.	
6	28 Aug.	30 Aug.	195		do.	Water in the same case 2,047,500.
7	"	4 Sept.	390		do.	
8	31 Aug.	"	325		do.	
9	"	10 Sept.	455		do.	

The above table showed that the typhoid bacillus did not increase in the body or in the tissues of the oyster. The figures indicated rather, comparing the large number of bacilli present in the water with those found in the alimentary tract, that the bacilli perish in the intestine.

In the following series of experiments infected oysters were taken, the duplicates of which as seen in the preceding table contained comparatively large numbers, and subjected to a running stream of pure clean sea water. The result was clear and uniform, there was a great diminution or total disappearance of the *B. typhosus* in from one to seven days.

ON THE USE OF THE "EQUIFEX SPRAY DISINFECTOR," FOR THE EFFECTIVE DISINFECTION OF ROOMS AND HOUSES, AS A SUBSTITUTE FOR THE FUMIGATION BY SULPHUROUS ACID GAS.

BY

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THE efficient disinfection of houses and premises, after an outbreak of zymotic disease, is a matter of so much public interest and importance, and one

that bears so intimate a relation to the successful administration of every sanitary district, that an apology is scarcely needed for drawing attention to it in these columns.

The certainty that we are adopting a means of disinfection in our districts, which can be relied upon as being positively effectual after the outbreak of any infectious disease, is scarcely second in importance to the early notification and immediate isolation of all first cases of such ailments. It, however, after the removal of a patient from a house, the method of disinfection adopted does not actually destroy the infectious condition of such building, and secure immunity from a recurrence

Oysters.	Inoculated.	Washed.	Examined.	No. of Colonies.		Kind of Organisms Present.
				Agar.		
1	25 Aug.	26 Aug.	30 Aug.	80		two colonies Typhoid.
2	25 Aug.	28 Aug.	"	23		Typhoid present.
3	26 Aug.	28 Aug.	"	44		"
4	26 Aug.	29 Aug.	"	40		"
5	27 Aug.	"	"	5		"
6	27 Aug.	"	"	5		"
7	28 Aug.	30 Aug.	31 Aug.	700		abundant Typhoid.
8	26 Aug.	28 Aug.	31 Aug.	55		Typhoid present.
9	27 Aug.	29 Aug.	3 Sept.	4		? B. Typhosus.
10	27 Aug.	29 Aug.	"	10		no B. Typhosus found.
11	28 Aug.	29 Aug.	"	8		three colonies of Typhoid.
12	28 Aug.	30 Aug.	4 Sept.	4		one colony of B. Typhosus.
13	31 Aug.	3 Sept.	"	200		majority B. Typhosus.
14	28 Aug.	3 Sept.	"	4		
15	31 Aug.	3 Sept.	6 Sept.	65		no Typhoid, but Proteus.
16	"	3 Sept.	"	5		? B. Typhosus.
17	"	5 Sept.	"	70		one-half colonies B. Typhosus.
18	"	3 Sept.	10 Sept.	1		no Typhoid.
	"	5 Sept.	11 Sept.	2		? Typhoid.

of the disease, but, on the other hand, allows infectious matter to remain undestroyed, we are leaning upon a broken reed, and the process is worse than useless, not only on account of its inefficiency, but, also, for the false sense of security which it affords.

The method or methods which have, hitherto, been adopted for the disinfection of houses and premises in my districts, and indeed in most other sanitary areas, has been fumigation by sulphurous acid gas, produced by the burning of sulphur; more rarely, also, by sulphurous acid applied in the liquid form; and, occasionally, by chlorine gas. These processes have well-known inconveniences. They involve the surrender of the room or building for at least a day. To produce even the limited efficiency which laboratory experiments have shown them to possess, the access of air has to be hermetically barred, a condition extremely difficult to fulfil, and which, it is safe to say, very rarely is fulfilled in practice.

I do not think it necessary to enter in detail into the conclusive results which have proved the inefficiency of this method. It is matter of common knowledge that experimentally they have, for the last fifteen years, been known to be untrustworthy. The complete demonstration of this circumstance in regard to sulphurous acid was given in the classical report of Wolffhügel, in 1881, in which, with the concurrence of Dr. Koch, he strongly recommended the disuse of sulphurous acid for the purpose of disinfection. His results have been confirmed over and over again. Cassedebat, for example, using sulphurous acid in the maximum concentration possible in practice, found, not merely spores, which are known to possess an extreme resistance, but, also, the non spore-bearing organisms of diphtheria, typhoid fever, cholera, and dysentery, to resist its action, either in dry or wet air. Trétrop, of Antwerp, obtained similar results, using the liquid gas. Sternberg has described the method as amounting, in many cases, to little more than "a pure farce"; and at the present time the intrinsic efficiency of this gas as a disinfectant would not seriously be entertained by anybody.

Why, then, is it that this obsolete and untrustworthy process continues to be the most widely used for the disinfection of rooms? It has been suggested by some writers that the very pronounced odour, which the gas possesses, leads to efficient ventilation after the attempt at disinfection has ceased, and that, in this way, germs are removed from the infected room. There is no doubt a great deal in this. The only chance that a medical officer has of recognising the failure of a disinfection process is by the occurrence of return cases; and germs that are removed by ventilation from a house naturally cannot determine a return case there. Borne out on the wind, and exposed to light in an atmosphere containing little or no nutrient matter, their chance of prolonged survival

is unquestionably reduced, and, to that extent, the ventilation is a public advantage. It is not, however, the case that the organisms are necessarily destroyed, and, as a matter of fact, many of them survive for several hours, or even days, under appropriate conditions, liable always to occur in the atmosphere. The consequence of disinfection by ventilation may, therefore, be, and I am persuaded very often is, little more than the transference of the germs from the house which has suffered, to another house, which thereby, either then, or at some later period, becomes a fresh focus of infection.

The necessary connection between sulphur disinfection and ventilation, though the latter may be the most valuable part of the disinfecting process, is, of course, not the reason which leads to the continuance of the practice. I should say that this deplorable circumstance is due to the natural *inertia* of local authorities, supported by the extreme difficulty of obtaining evidence of the failure to disinfect. It must be remembered that disinfection is of the nature of an insurance. Uninsured houses may very well escape fire; and the inhabitants of houses disinfected by sulphur may escape re-infection. The object of disinfection is to give protection against this danger when it arises. In my own experience, during the last twenty years, I have constantly seen recrudescences of measles and scarlatina, especially the latter, in localities and in individual houses which had previously been infected. At the time, these recrudescences were to me entirely inexplicable, because I had not then arrived at the conclusion that the use of sulphurous acid was other than trustworthy protection against renewed infection, and I could trace no local cause to determine the outbreaks. In the light, however, of my present knowledge, I have no hesitation in saying that these cases were, in all probability, the result of infection which sulphur fumigation had failed to destroy, and which had persisted and come again into virulent action after long intervals of time, in the well known way.

The above data clearly show that some other method must be sought for and substituted to meet the requirements of effectual disinfection. The facts previously mentioned afford, I submit, ample grounds for the consideration of a process, which appears to possess every essential for securing perfect house disinfection, together with a minimum of trouble and expense.

During the summer of 1895 an outbreak of small-pox occurred in two of my districts, and I was brought face to face with the problem of efficient disinfection. I fully recognised that sulphur fumigation was useless, and I had to decide what other course to adopt. My attention had been drawn earlier in the year to the method of spray disinfection which was exhibited during last year at the Congress of the British Institute of Public Health, at Hull, and upon which a paper was read.

A suitable apparatus is made in England by Messrs. Defries and Sons, of 147, Houndsditch, London, and when the difficulty as to the disinfection of the houses infected by small-pox arose, I communicated with Mr. Wolf Defries, a member of the firm, and he was good enough to place at my disposal one of the Equifex Sprayers, and the houses were disinfected with it. The disinfectant used was the mercury per-chloride, one per thousand, acidulated with three per thousand hydrochloric acid. The first disinfections were carried out personally by myself, in order to instruct my sanitary inspectors in the use of the apparatus. It answered most admirably, and no case of small-pox occurred in any house that had been disinfected by this means. Indeed, I attribute the limited nature of the outbreak to the perfect disinfection that was secured by the use of the Equifex Sprayer, and I expressed the very great obligations which I, and two of my District Councils, were under to Messrs. Defries for their exceeding courtesy to us under the emergency that arose.

I now propose to give a brief outline of the action of this apparatus, and show what it has done as regards disinfection both here and abroad.

The Equifex Sprayer consists essentially of a strong metal reservoir; a hand-pump, by which air is compressed above the disinfectant; and extension tubes (which may be of any length) for projecting the spray against the surface to be disinfected. The formation and the delivery of the spray is characterised by means for independently and separately controlling the fineness of division and the force of projection. For this purpose the channel for the disinfectant is so arranged as to reduce the velocity of the liquid at the point of delivery to a rate which is very small, and capable of being exactly controlled by the turning of a tap. The force of projection, regulated by another tap, is determined by the velocity of the air, which depends upon the pressure to which the pump is worked, and by the extent to which the air-tap is open. The importance of a fine division of the liquid disinfectant rests on the fact that it enables the work to be done with a minimum useful amount of disinfectant, and the saving of the expense and inconvenience of waste liquid.

The experience derived from the use of the Equifex Sprayer in other countries for some years has shown that it *does efficiently* and with the *minimum of inconvenience* what sulphur fumigation has been finally shown to be incapable of doing.

These sprayers have been substituted by the Paris Municipality for fumigations. The experience of that body is of the greater value, inasmuch as it deals with a relatively large number of cases. In 1893, for instance, the number of houses in which spray disinfection was practised by the municipal sanitary authorities was 34,822; in 1894, 37,915;

and in 1895, 38,646, as stated by the Medical Officer of Health for Paris, Dr. Martin, in the last number of the *Annales de Micrographie*. The results are most satisfactory. The recurrence of house epidemics in Paris has practically ceased through the prompt and rigid use of this method, and epidemics are got under and arrested in a considerably shorter period than has previously been possible.

As far as this country is concerned, I understand that the Equifex Sprayer has been adopted with great success by the health authorities in the Port of London; also in Dublin, Edinburgh, Keswick, Crewe, Barnsley, and other towns.

It may be thought that I have gone into this subject at some unnecessary length. Considering, however, the very important bearing which it has upon the check of infectious disease, there is, I think, ample justification for discussing the question so fully. I believe it is no exaggeration to state that nine out of every ten cases of the recurrence of zymotic disease in houses previously infected are the result of the inefficient disinfection of rooms, bedding, and clothing. Of course, with regard to the two latter, the only method of purifying them is by steam or else destruction by fire; and every sanitary authority should possess a steam disinfectant. With regard to houses, it cannot be too clearly understood that we have at our command a method upon which health authorities can safely rely for the effectual purification of infected dwellings within their district, as opposed to the obsolete and useless sulphur fumigation.

ON THE OPERATIONS OF THE SANITARY COMMITTEE (MANCHESTER) IN REGARD TO INSANITARY DWELLINGS.

BY

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IN dealing with the back-to-back houses in the City, the Sanitary Committee have had in view so to alter these houses where possible as to give to the occupants a sufficient supply of fresh air and light, while putting them under conditions favourable to the easy maintenance of cleanliness both inside and outside the houses.

Where it has been found impossible, by any alterations, to attain these elementary requirements of healthy existence, or where the houses were in a hopeless state of dilapidation, they have been permanently closed. In pursuing the object of obtaining pure air, light, and cleanliness for the altered houses, the Committee have had to vary considerably the plans on which alterations could be effected. Generally these objects, especially with wide streets at the front and back of the houses, are best attained by removing the two

* From Dr. Niven's Annual Report for 1895.