

bacteria. A town where this is done may regard with equanimity the introduction of typhoid or cholera bacteria, even if the soil is foul and the season unfavourable—it has lost “its local and seasonal predispositions.” In order to prevent secondary outbreaks, extreme cleanliness and scrupulous disinfection of the surroundings of the sick bed are essential, and those (more difficult in the case of typhoid than in that of cholera) are only possible with the cordial co-operation of all medical men in the place.

SUMMARY OF A REPORT UPON THE POSSIBLE INFECTIVITY OF THE OYSTER.*

BY

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At the last meeting of the British Association, Ipswich, 1895, Professors Herdman and Boyce brought forward some results based upon the artificial feeding and cultivation of oysters in sewage contaminated sea-water. They concluded that the laying down of oysters in localities

provide a clear and chemically unobjectionable water, but also to keep at a distance all virulent where there was a good change of water, by tidal current or otherwise, was beneficial to the health of the oyster, and they surmised that by methods similar to those employed in the Bassins de dégorge-ment of the French ostreiculturist, where the oysters are carefully subjected to a natural process of cleaning, oysters previously contaminated with sewage could be freed of pathogenic organisms or their products, without spoiling the oyster.

Nature of present Report.—The present report, which is still incomplete, deals almost exclusively with the bacteriology of the oyster and the behaviour of the *Bacillus typhosus* in sea-water and in the oyster. The questions investigated are the following:—

- I. The identification and differentiation of the *B. typhosus* *B. coli commune*.
- II. The action of sea-water upon the growth of the *B. typhosus*.
- III. The Bacteria present in the alimentary canal of the oyster.
- IV. The infection of the oyster with the *B. typhosus*, and its removal by washing.

TABLE SHOWING DIFFERENCES OF REACTION. A.—*B. TYPHOSUS*.

Source.	Fermentation. (In simple or glucose gelatine.)	Indol Reaction.	Coagulation.	Potassium Iodide Potato Gelatine.
1. Institut Pasteur.	none	none	none	very small growth.
2. From Spleen of Typhoid patient.	"	"	"	"
3. Prof. Delépine.	"	"	"	"
4. Prof. Wright (Netley).	"	slight trace	clot slowly formed	"
5. } Dr. Sims Woodhead.	"	none	none	"
6. } "	"	"	"	"
7. } "	"	"	"	"
8. } Dr. Kanthack.	"	"	"	"
9. } "	"	"	"	"
10. Institute of Preventive Medicine.	"	"	"	"

TABLE B.—*B. COLI*.

Source.	Fermentation. (Glucose or simple gelatine.)	Indol Reaction.	Coagulation.	KI-Potato Gelatine.
1. Institut Pasteur.	well marked	marked pink	marked	growth abundant.
2. Prof. Delépine.	"	slight pink	"	"
3. Prof. Wright.	"	pink	"	"
4. } Dr. Sims Woodhead.	"	slight pink	"	"
5. } "	"	marked pink	"	"
6. } "	"	pink	"	"
7. } "	"	"	"	"
8. } "	"	"	"	"
9. } "	"	"	"	"
10. } "	"	"	"	"
11. } "	"	"	"	"
12. } Dr. Kanthack.	"	slight pink	"	"
13. } "	"	absence	"	"
14. Institute of Preventive Medicine.	"	"	"	"

* A report presented to the Liverpool Meeting of the British Association.

I. The identification and differentiation of the *B. typhosus* and *B. coli commune*.

The authors systematically tested the majority of the chief differential reactions upon samples of *B. typhosus* and *coli* obtained from numerous sources, and in all cases found unmistakable differences between the two bacilli.

Summary of constancy or variability of reactions.

A. For *B. typhosus*.

1. *Fermentation test*. Constant (Burri and Stutzer have shown gas formation).
2. *Indol reaction*. Slight indication in one case.
3. *Milk coagulation*. Slight clot in one case.
4. *Potassic iodide potato gelatine*. Characteristic invariably, very little use as a separating medium.
5. *Potatoes*. Constant with usual precautions.
6. *Reaction in gelatine*. Marked differences of rate of diffusion.

B. For *B. coli*.

1. *Fermentation*. Rate of gas formation variable, otherwise constant.
2. *Indol reaction*. Reaction not constant.
3. *Milk coagulation*. Rate variable. Constant with us, with others not constant.
4. *Potassic iodide potato gelatine*. Abundant growth.
5. *Behaviour in gelatine*. Diffusion very variable, in many cases less rapid than *B. typhosus*.
6. *Motility*. Very variable.

II. The action of sea-water upon the growth of the *B. typhosus*.

EXPERIMENT I.

No. of bacilli at time of mixing	...	...	...	29,250
After 21 hours	...	...	...	20,475
" 45 "	...	...	...	9,945
" 71 "	...	...	...	9,360
" 95 "	...	...	...	5,850
" 271 "	...	...	...	260
" 340 "	...	...	...	11

EXPERIMENT II.

At time of mixing	...	...	...	1,300
After 21 hours	...	...	...	1,105
" 45 "	...	...	...	780
" 71 "	...	...	...	650
" 95 "	...	...	...	325
" 271 "	...	...	...	2
" 340 "	...	...	...	0

EXPERIMENT III.

At time of mixing	...	...	...	22,750
After 5 hours	...	...	...	17,550
" 23 "	...	...	...	11,700
" 48 "	...	...	...	3,250
" 72 "	...	...	...	3,260
" 247 "	...	...	...	455
" 316 "	...	...	...	325

EXPERIMENT IV.

At time of mixing	...	...	...	130
After 6 hours	...	...	...	41
" 23 "	...	...	...	31
" 48 "	...	...	...	38
" 72 "	...	...	...	negative
" 247 "	...	...	...	1
" 316 "	...	...	...	0

EXPERIMENT V.

At time of mixing	...	...	...	31,200
After 172 hours	...	...	...	9,360
" 244 "	...	...	...	325

EXPERIMENT VI.

At time of mixing	...	...	...	325
After 172 hours	...	...	...	2

EXPERIMENT VII.

At time of mixing	...	...	...	325
After 504 hours (water kept at 8°C. to 10°C.)	...	...	...	79

EXPERIMENT VIII.

At time of mixing	...	...	...	325
After 504 hours	...	...	...	0

These results were fairly uniform. When a large number of bacilli were added to the water their presence could be demonstrated longer than in cases where smaller quantities were used. Fourteen days appeared to be the average duration in sea-water incubated at 35°C., whilst kept in the cold their presence was demonstrated on the twenty-first day. There appeared to be no initial or subsequent multiplication of the bacilli. Between forty and seventy hours after infection there is less decrease than at other periods; but there is no evidence of increase in numbers of the bacilli when grown in sea-water, either when incubated or at ordinary temperatures. The authors very wisely add: "We do not think, however, that these experiments can be taken without reserve as an indication of what might take place in Nature."

III. The bacteria present in the alimentary canal of the oyster.

This research proved of very considerable utility in guarding the authors against errors in their subsequent infection experiments, and of further interest in demonstrating the large number of cases in which the colon bacillus was normally present.

Methods. In analysing the contents of the stomach they, in all cases, cauterised the mantle over the region of the stomach, and inserted a sterilised fine glass pipette and withdrew a quantity of fluid varying from $\frac{1}{20}$ to $\frac{1}{10}$ of a cubic centimetre. The contents of the tube were then mixed with liquefied agar, ordinary gelatine or sea-water gelatine, and Petri dishes made. The agar dishes were incubated at 37°C., the gelatine at 21°C. to 24°C. There was an enormous difference between the number of organisms appearing upon the agar

incubated at the high temperature, and the simple or sea-water gelatine incubated at the low temperature. This heat method of separation proved quite equal to, if not better than, the carbolic acid or potassic iodide methods.

Experiments.—In the first six cases examined the oysters were especially fresh, in the other cases they were obtained haphazard from the various shops.

Remarks.—The number of organisms taken from the stomach of the oyster which could survive a temperature of 37°C., were comparatively small. In a very large proportion of cases ($\frac{1}{3}$ to $\frac{1}{2}$) the organism present was *B. coli* in overwhelming numbers, and next in frequency were species of *Proteus*. In one instance, at least, the organism approached in its reactions the typhoid type. The authors believe that on account of the presence of

OYSTERS.	NO. OF COLONIES.		BACILLUS ISOLATED, GIVING FOLLOWING REACTIONS:					
	Agar.	Salt-water gelatine.	Fermentation.	Indol.	Coagulation.	KI gelatine.	Motility.	
A	0	not made						Coli not looked for
B	5							
C	0							
D	0							
E	1							
F	6							
Shop 2	108		active	marked	marked	marked		decolorised
	1,040							
	390							
" 4	455							
" 5	2		active	marked	marked	marked	very motile	decolorised
	2							
	102							
	350							
	12							
	1,170							
	21							
	195							
" 6	5							
	20							
" 7	3							
	2							
" 8	3							
	70		active	none	marked	marked	motile	decolorised
" 9	9		active	none	marked	marked		decolorised
	5							
	65							
	260							
" 10	195							
	520							
" 11	65		active	marked	marked	marked	motile	decolorised
	70							
" 12	650							
	260		active	none	marked	marked	motile	decolorised
" 13	150		active	marked	marked	marked	motile	decolorised
	195							
" 14	6		none	none	marked	marked	motile	decolorised
	2							
" 15	100		active	marked	marked	marked	motile	decolorised
	5							
" 16	20		active	marked	marked	marked	motile	decolorised
	70							
" 18	25	3,025	active	marked	marked	marked	motile	decolorised
" 19	1	2,330						
" 20	265	13,000						
" 21	100	1,755	active	marked	marked	marked	motile	decolorised
" 22	35	2,330	active	marked	marked	marked	motile	decolorised
" 23	15	3,025	active	marked	marked	marked	motile	decolorised
" 24	40	6,500						
" 25	5	13,000						
" 26	2	8,775						
" 29	325	17,550	active	marked	marked	marked	motile	decolorised
" 30	50	20,475						
" 31	65	2,925	active	marked	marked	marked	motile	decolorised

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.