

water," in apparent contradiction to the wide and more certain results of clinical induction, led to a series of experiments being made by Dr. Klein on this subject.

He points out that possible error has arisen in previous experiments by subjecting a *small amount only* of the water in question to test. In connection with this, he quotes the apposite instance of the Worthing epidemic of 1893. "The water that was distributed to the public in Worthing was in part taken from a well which was proved to have been open to contamination from sewage-polluted soil; and this water, when I used, in examining it by the culture test, the particulate matter of so large a volume as 1,200 c.c. yielded only a limited number of colonies of the typhoid bacillus amongst more numerous colonies of bacillus coli. Had only 10 to 50 c.c. been used for my cultivations no colonies of typhoid need have been found. These bacilli were, indeed, so sparsely found by me in the water that not more than a single bacillus could be assigned to each 200 c.c. of the water." There is the further fallacy that some doubt may be entertained as to whether, in the experiments here criticised, a sufficient quantity of the nutritive material was introduced with the bacilli. Under the supposed analogous natural conditions, we have to imagine the intermingling of intestinal dejecta with the water, producing pabulum for the continued vitality and possible multiplication of the typhoid bacilli.

(a) *Sterile Distilled Water*.—When an appreciable amount of nutritive material was introduced into the distilled water along with the typhoid bacilli some of these microbes persisted over three months, notwithstanding that their number markedly diminished after the first week. In an earlier experiment, when nutritive material was not added along with the typhoid bacilli, after the lapse of twenty-one days no living bacilli were present in the whole of the 100 c.c. of sterilised distilled water originally infected, while at the end of only three days no living bacilli were found in 1 c.c. of the experimental water.

Cholera vibrios introduced into sterile distilled water, without nutritive medium, and in small numbers, diminish in number and disappear, though not quite so fast as the typhoid bacilli in like circumstances.

(b) *Filtered London Water*.—After adding a large number of typhoid bacilli, with a trace of nutritive material, to samples of London waters previously sterilised by filtration, living bacilli were recoverable therefrom in two out of three samples, after the lapse of eight weeks. The two river waters (Thames and Lea) showed no early increase of bacilli, but a stationary number for sixteen days, and then a considerable decrease; while the Kent (chalk) water showed increase of bacilli for four days, and at the end of sixteen days they were still in larger numbers than at starting. It may turn

out that lime salts are among the inorganic elements that favour the vitality and multiplication of the typhoid bacillus.

Cholera vibrios survived for more than five weeks in the same water supplies, under the same conditions as above.

For details of further experiments on the same subject, the original report should be consulted.

ON A GROUP OF CASES OF ENTERIC FEVER CAUSED BY SEWAGE CONTAMINATED OYSTERS.

BY

G. S. ELLISTON, M.D., M.O.H. of Ipswich.

THE week before Bank Holiday, July 25th to 31st, three Ipswich gentlemen—viz., Mr. R. Bennett and Mr. T. Bennett (cousins), and a friend, Mr. Burgess—were cruising in the yacht *Zephyr*. On Thursday morning, July 30th, before leaving Brightlingsea for Ipswich, the skipper purchased for them 350 Anglo-Spanish oysters from a "laying" in Brightlingsea Creek. At lunch on the 30th, and again on the 31st, the two Bennetts ate heartily of the oysters. Mr. Burgess, not liking oysters, did not partake; but on reaching Ipswich the afternoon of July 31st, he took his share of 100 to Mr. Field, with whom he lives. Mr. Field ate heartily at supper off the shell. Two ladies had three or four, but they took theirs on a plate, and cut them with a fork, adding vinegar.

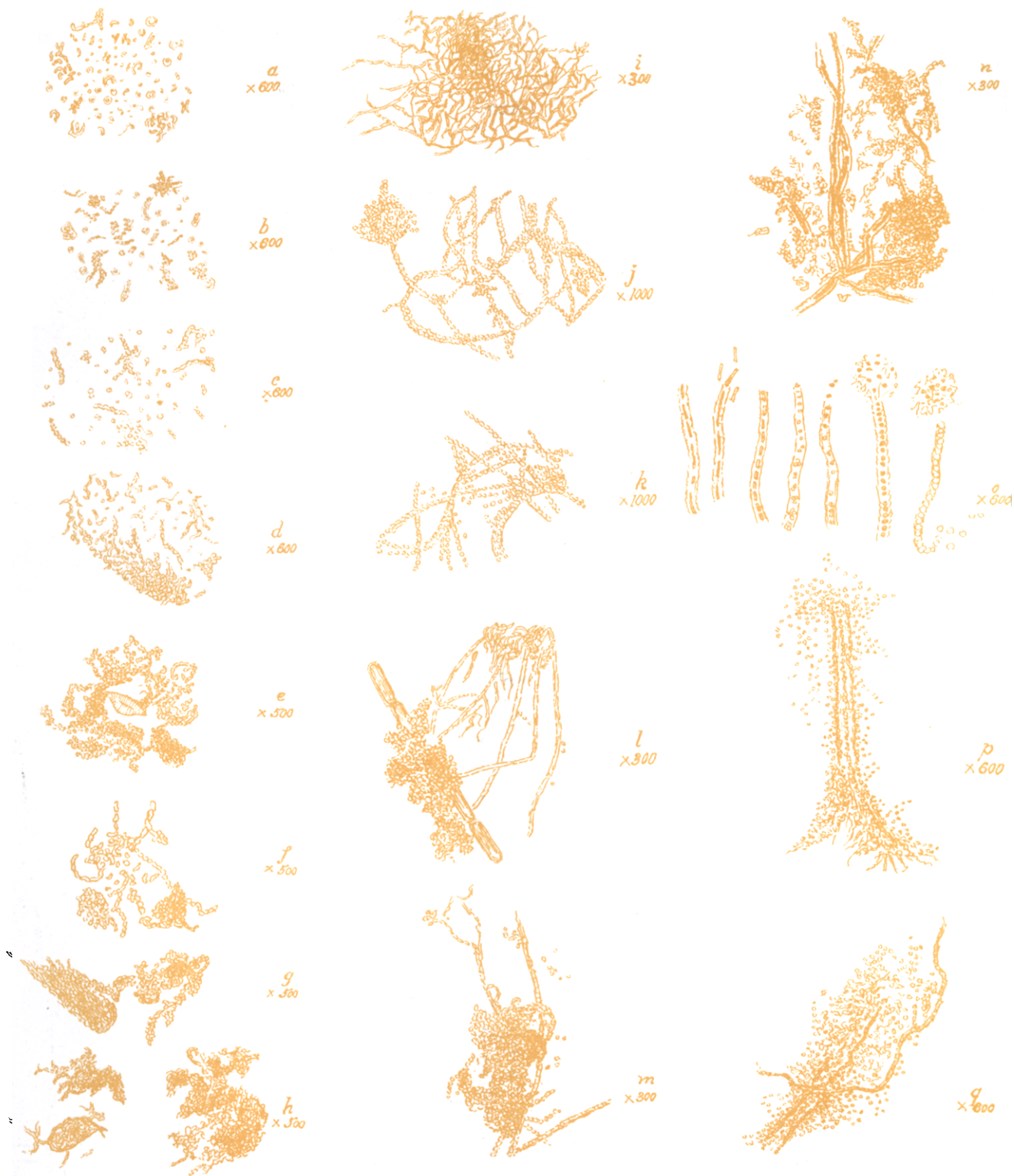
The two Bennetts were notified to me with typhoid fever on August 14th, and Mr. Field August 15th. On Saturday, August 1st, or Friday evening before (July 31st), Mr. T. Bennett gave a relative, Mr. T. Stearn, two dozen. He ate them off the shell for supper, and at twelve midnight he was seized with vomiting and purging, up to six a.m. He felt queer for a day or two, but had no further symptoms.

These are the bare facts of the case. Dr. Thresh, Dr. Cook, and myself are further investigating the matter.

DR. THRESH'S REPORT.

Dr. Thresh, the Medical Officer of Health for the County of Essex, reported to his sanitary authority that he had visited Brightlingsea, and ascertained that the incriminated oysters were taken from a "laying" situated at the end of one of the sewer outfalls, and that early in the year a case of typhoid fever had occurred in a house connected with this sewer. The oysters are Portuguese, which are brought from Portugal in the spring, and laid down on the foreshore to fatten. They are dredged up as required during the season, and either sent direct to the consumers, or placed in pits on the beach. These pits, if not properly protected, and if not freely supplied with water, become bacteriologically very foul.

***Grenothrix polyspora* var. *Cheltonensis*.**



A B C D Spore Cocci
I J K L M N Filamentous Developments

E F G H Cells in Zooglææ
O P Q Production of Spore Cells by Filaments

Dr. Thresh had several oysters dredged up from the bed, and has made a bacteriological examination of the mud on the shells, the liquid in the pallial cavity, and in the substance of the oyster. By cultivating in phenolated broth, and by growth on gelatine plates, he isolated organisms which resemble in many respects the bacillus coli and the bacillus typhosus, but which could not be absolutely identified with either. The organisms referred to grow in phenolated broth, curdle milk, produce air bubbles in gelatine, but do not give a distinct indol reaction. The pollution of the foreshore at Brightlingsea has been referred to several times by Dr. Cook, the Medical Officer of Health to the district, and it is hoped that this outbreak will cause the sanitary authority to take immediate steps to remedy a condition of things which is not only a danger to the inhabitants, but also to the visitors and others who consume the oysters fattened under such objectionable conditions.

CRENOTHRIX POLYSPORA (VAR.) CHELTONENSIS.

A HISTORY OF THE REDDENING AND CONTAMINATION OF A WATER SUPPLY, AND OF THE ORGANISM WHICH CAUSED IT; WITH GENERAL REMARKS UPON THE COLOURATION AND POLLUTION OF WATER BY OTHER ALGÆ.

BY

J. H. GARRETT, M.D., D.P.H., F.L.S., Medical Officer of Health, Cheltenham.

THE water supply in question constitutes at the present time the chief supply to Cheltenham. It comes from the Dowdeswell Reservoir which is filled from the head waters of the little river Chelt, and which holds when full 100,000,000 gallons. The two chief streams unite before entering a settling pool placed at the head of the main reservoir, and separated from it by a dam of masonry, whilst some minor streams which rise in springs not very far away run straight into the main reservoir. The steep slope on one side of it is covered with a thick wood, and several small springs rising in boggy ground in this wood send down their water to join the main supply. In some places on the wood side of the reservoir, and in the banks of the upper pool, there are small springs of water surcharged with ferrous carbonate, the presence of which is made evident by the ochreous deposit in the course of the streamlet. A trace of iron may always be found in the water as delivered to the town, the quantity being however, too little to make it worthy of special note from an analytical, or sanitary point of view. The water of the chief springs forming the fountain heads of the Chelt is thrown out from the oolitic limestone, the escarpment of which rises some hundreds of feet above the lias clay, and partly

surrounds the reservoir. A considerable portion of the water collected, however, is from the surrounding upland surfaces of cultivated ground, and the whole of the water consequently requires to be submitted to filtration before being supplied to the town. The water is alkaline to an equivalent of some 15 parts of calcium carbonate in 100,000, and normally contains about 2 parts of chlorine and .5 of nitric acid per 100,000. The supply of water during the winter months is usually more than sufficient to fill the reservoir, so that by the early spring of each year there is an overflow, and for some weeks at least a considerable stream passes through the reservoir over and above that which is utilised to supply the town. An exception to this rule occurred last winter, when, owing to the diminished rainfall, there was not sufficient water to fill the reservoir, and there was consequently no overflow in the spring of this year, as there had been in every previous year since the reservoir was made ten years ago. This fact affected the quality of the water to some extent, and may have been the cause of the phenomenon, which was never before observed.

Complaints arose, in the spring of this year, of an odour and turbidity in the water supplied to the town; the odour was observed particularly by those who used hot water for baths. On March 1st a swimming bath belonging to a large boys' school was filled for the first time this year, when it was noticed to be rather red and turbid. It happens that the three or four other swimming baths in the town are filled with water derived from other sources, and in these the water was of normal appearance. The possibility of an accumulation of iron rust having occurred in the boiler and pipes connected with the bath since last it was used was a suggested cause. Complaint was not made in regard to it until some weeks later, when, upon refilling the bath after a holiday interval, the water was found to be much worse in appearance, and so turbid that the bottom of the bath could only just be seen at a depth of $3\frac{1}{2}$ feet. A little later it was discovered that the whole bulk of the water contained in the reservoir had assumed a red colour. At a visit on April 20th, the water in the reservoir was of a brown-red colour, and turbid. At this time the gauge marked a depth of 28 feet 11 inches of water, which is equivalent to over 84,000,000 gallons. The water in the upper settling-pool, into which the Chelt first flows, had the normal green colour which usually characterises it, and offered a striking contrast to that contained in the main reservoir, from which it was simply divided by the dam. The reason of the upper pool not being affected in the same way as the reservoir evidently lay in the fact of the constant flow through it of a large quantity of fresh water, whilst the lower pool, being of infinitely greater size, was in a condition of comparative stagnation. It was at once divined that