(Zeiss obj. A. oc. 2). Every colony resembling in its appearance the *B. typhosus* was picked out with a platinum needle and examined in hanging drop with a Zeiss obj. 7 $\frac{1}{2}$ and oc. 6.

V. Those which were found to be short motile bacilli were at once subcultured into milk.

VI. Those milk tubes which became coagulated after incubation were rejected.

VII. The milk tubes which did not become coagulated were subcultured into bouillon for indol and also into glucose gelatine for gas formation or into Theobald Smith's tubes and on to potatoes.

VIII. Pure cultures on agar were then obtained, and the organism examined by Van Ermengen's or Loeffler's method as to the disposition of their flagella, and also as to its reaction with typhoid serum of known strength.

I feel certain that it is a matter of much importance to know exactly how a culture of *B. typhosus* grows on the various media used. There are often slight differences in media prepared at different times by apparently identical methods which alter to some extent the character of the growth. To obviate this it was found important to prepare large batches of the different materials at one time. In the case of potatoes the slices taken from one potato ought to be kept by themselves, and each batch tested as to its reaction with a typical typhoid culture.

CONCLUSIONS FROM THE EXPERIMENTS.

The above experiments were carried out under conditions as natural as could be devised. Experiments carried on with soils in the laboratory were not found to give satisfactory results. The results obtained from the outdoor experiments are very suggestive, and, I think, throw some light on the natural history of *Bacillus typhosus*. They prove that the typhoid organism is capable of growing very rapidly in certain soils, and that apparently under certain conditions the organism can survive from one summer to another. The rains of spring and autumn or the frosts and snows of winter did not kill them off.

What the exact conditions are which caused the organism to live for over twelve months in the one series and not in the other series of soils cannot at this step be definitely stated; but whatever these conditions may have been, there remains the one obvious fact that in the one series the organism was fed while in the other it was not. If this be the real cause of the difference it would appear that very similar conditions exist in the so-called typhoid infected areas. A leaking or defective drain is constantly feeding with organic matters the surrounding soil. If cases of typhoid fever are attributed to this drain and the leak is repaired, it is possible that a similar action will take place to that which occurred in the soils which were not manured.

So also the infected privy would appear to be admirably adapted for the preservation of the typhoid bacillus, owing to its constantly receiving fresh additions of organic matter. Whether all soils will support the healthy growth of the typhoid organism equally well is a subject for further research.

SUNLIGHT.

Many experiments during recent years have gone to prove most conclusively that direct sunlight has a most powerful bactericidal influence on the typhoid organism. The results obtained by the above soil experiments go to indicate (as indeed one would expect) that the effect of sunlight is limited to those organisms actually on the surface. Samples of soil which had been collected by scraping a layer of soil not more than one-sixteenth of an inch in thickness from the surface of patches which had been exposed to abundant sunshine showed the organism to be present. It must be borne in mind, however, that the particles of soil are more or less opaque, and that it was impossible to roughly separate the exposed from the unexposed soil.

SPREAD OF THE TYPHOID ORGANISM IN SOILS.

With the object of ascertaining whether the typhoid bacillus had spread from the original infected area on to the surrounding soil (which happened to be grass land), samples were collected at distances of 1, 3, and 9 feet from two of the patches in July, 1897. No bacilli were found in any of these.

Some experiments on similar soils in the laboratory, with and without grass went to show that vegetation was detrimental to the healthy growth of the organism. These experiments could not be carried as far as was originally intended for reasons already stated. The subject is one of some im-

portance, as it may go to explain why typhoid fever is so much more prevalent in towns than in rural districts. It also may throw some light on the fact that persons employed and living in the neighbourhood of sewage farms do not suffer from typhoid fever to the extent that might have been anticipated.

It has been already stated that cultures of the typhoid organism planted at a depth of 18 inches grew to the surface, so also patches inoculated on the surface showed that at least the organism could grow downwards to a depth of 3 inches. It is possible under the existing conditions that this downward growth may have been assisted by mechanical means, that is, rain or artificial watering.

So far as the results go no lateral spread could be ascertained.

Both in laboratory experiments and in experiments under natural (?) conditions it was abundantly proved that the typhoid organism could grow over moist surfaces of stones, etc. It was attempted in another series of experiments to detach the organism from the stones when dry by causing a current of air to impinge on them; this, however, in each case proved unsuccessful.

How far the typhoid organism can be given off from decomposing masses of semiliquid filth was also examined into. For this purpose sterile plates of agar or gelatine plated were inverted over masses of semisolid excrement, which had been largely contaminated with a culture of the typhoid bacillus. Such plates when kept at the ordinary temperature remained sterile for a period of nearly three months. Those that were kept at 37° C., and which presumably were exposed to a very actively decomposing mass, soon showed growth of various organisms. In no case did the typhoid organism appear among the growths. These plates were distant 1 $\frac{1}{2}$ and 4 inches from the decomposing faecal matter, and at both distances apparently equal contamination took place.

NOTE ON THE SPECIFIC ACTION OF NORMAL HUMAN SERUM UPON THE BACILLUS COLI COMMUNIS.

By S. R. CHRISTOPHERS, M.B. VICT.

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THE application of the serum diagnosis to the differentiation of the typhoid bacillus from the various varieties of the *Bacillus coli communis* has not hitherto been as satisfactory in its results as might have been anticipated.

Peckham gives a table showing the action of typhoid human serum upon seventy cultures of typhoid and coli bacilli obtained from various sources, and lays stress upon the anomalous results obtained by her application of this test to the differentiation of the two forms. In her list the majority of cultures giving the biological characters of coli were undoubtedly agglutinated by human typhoid serum; one in particular she mentions as giving the reaction as fully, that is, clumping, and almost entire cessation of movement, as did any of the typhoid cultures.

Ziemke states that whilst using cultures of coli as controls in the performance of the Widal's test, he frequently found that they were agglutinated by typhoid human serum.

Bensaude also states that the agglutinins of typhoid serum act upon the *B. coli*, though in a less degree, than upon the typhoid bacillus, and explain this action as being due to the close biological relationship of the two organisms.

Such marked action of typhoid serum upon the *B. coli* would naturally invalidate the strict specific nature of the reaction between typhoid serum and the typhoid bacilli. There is, however, a source of error, which I have not seen mentioned, which may be to a large extent responsible for these puzzling results. It is that many have used as the differentiating test the blood of human typhoids. Now in the following table it will be seen that normal human serum has in the great majority of cases as specific an action upon the *Bacillus coli communis* as has the serum of a typhoid patient upon the *Bacillus typhosus*; that, in fact, the serum of typhoid patient probably has two distinct specific actions, one upon the typhoid bacillus due to infection by that organism, and one upon the *B. coli*, an action which is present alike in typhoid and non-typhoid sera.

Table I shows the action of a number of non-typhoid and typhoid sera upon the *B. coli*, with the amount of dilution with which the reaction could be obtained. The coli organism used was one which gave in a marked degree the characters of the *B. coli*, such as indol formation, coagulation of milk, gas formation, marked growth on potato, etc.

TABLE I.

	Typhoid.	Cholera.	Coli.
Non-typhoid	Normal... ..	Not 1 to 5	1 to 30
	Normal... ..	"	1 to 120
	Normal... ..	"	1 to 60
	Phthisis... ..	"	1 to 30
	Diabetes... ..	Signs 1 to 5	"
	Lead poisoning... ..	Not 1 to 5	"
	Empyema... ..	"	1 to 20
	Pleural effusion... ..	"	1 to 60
	Atheroma... ..	Not 1 to 5	1 to 60
	Hemiplegia... ..	"	1 to 30
Typhoid	Normal... ..	Signs 1 to 5	1 to 120
	Perityphilitis... ..	Not 1 to 5	1 to 120
	Leucocythæmia... ..	1 to 10	1 to 200
	Normal... ..	Not 1 to 5	Not 1 to 20
	Normal... ..	1 to 10	1 to 60
	Fourth day... ..	Not 1 to 5	1 to 30
	Sixth day... ..	1 to 60	"
	Sixth day... ..	1 to 30	"
	Seventh day... ..	"	1 to 20
	Eighth day... ..	1 to 120	1 to 30
	Tenth day... ..	Not 1 to 5	1 to 30
	Thirteenth day... ..	1 to 120	1 to 120

At the dilutions given the action was not pronounced negative until after two hours. At such small dilutions as 1 to 20 the coli organism was agglutinated within twenty minutes with precisely similar appearances to those seen in the agglutination of the typhoid bacillus.

In order to see to what extent this action would hold good with different varieties of colon bacillus, I tried the action of normal and typhoid sera in dilution upon 16 cultures of supposed coli organisms taken from different sources. Three of these were acting pathogenically, 4 were from sewage, 4 from milk, 3 from mussels, and 1 from cheese.

It will be seen that the majority of these were agglutinated by human serum, independently of the fact whether it was from a typhoid patient or not. In fact, had any of these been suspected typhoid organisms, and the action of human typhoid serum been tried upon them, they might very easily have been returned as typhoid bacilli.

TABLE II.

	Pathogenic.				Sewage.				Milk.				Mussels.				Cheese.
	Typhoid from Spleen.	Lab. Coli.	Coli from Appendix.	Coli from Cystitis.	Coli from Diarrhoea.	C ₁	C ₂	C ₃	C ₄	C ₁	C ₂	C ₃	C ₄	C ₁	C ₂	C ₃	C
Coagulation of milk ..	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Gas formation	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Indol	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Marked growth on potato	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Human typhoid serum at dil. 1-20	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Human normal serum at dil. 1-20	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Normal rabbit serum at dil. of 1-40	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Serum of typhoid injected rabbit at dil. of 1-40	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Serum of coli injected rabbit at dil. of 1-40	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

In face of these results I think that in the use of human typhoid serum for diagnosing suspected typhoid bacilli found in water, milk, etc., the equally specific action of the serum upon *B. coli* must also be borne in mind.

In the examination of a number of rabbits' sera, I found that in the majority of cases dilution to the extent of 1 in 20 did away with all agglutinating action upon both the typhoid and colon bacillus. Such animals injected with typhoid cultures ought (supposing a strict specific action) to give a serum agglutinating the typhoid bacillus and not the colon bacillus.

In Table II it will be seen that on none of the coli-like organisms had the serum of a typhoid rabbit (in dilution) any action, whilst it had a marked action on typhoid bacilli. So that presumably the results of those observers who have used the sera of injected animals as the differentiating agent have escaped the above-mentioned error.

However, even if injected animals be used, the serum ought to be proved to have no action upon the colon bacillus in the dilution at which it is proposed to use it as a differentiating test.

PRACTICAL SUGGESTIONS

ON THE

TREATMENT OF STRICTURE OF THE URETHRA.*

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STRICTURE of the urethra may occur at any age from tuberculous disease or injury, but in a vast proportion of cases gonorrhoea is the primary cause. Living in the midst of a large seafaring population, we have abundant opportunities of treating every variety of urethral disorder. Sailors, as a class, live careless lives, and the diseases which they contract are too often treated by ignorant and unqualified persons. Injections are employed in all stages of specific urethral inflammation without any precautions at all, and their careless application, together with the neglect of local cleanliness, promotes the extension of the disease along the mucous surface of the canal.

During the last few years my views on the treatment of urethral stricture have undergone very considerable modification. I have long given up all attempts at forcible rupture, and likewise the operation of internal urethrotomy. Before the latter operation can be practised the strictured part must be dilated to admit the cutting instrument, and a sound equivalent to a No. 2 or 3 catheter must be successfully passed along the canal. Apart, therefore, from all other objections to this method, I am confident there are very few cases which cannot be cured by dilatation whenever an instrument of this size has been introduced into the bladder.

DILATATION UNDER AN ANÆSTHETIC.

It is my experience that the tightest and thickest strictures in any part of the canal can generally be cured by simple intermittent dilatation; and for the practice of this operation many kinds of instruments have been introduced from time to time, so that it would be a difficult task to develop any very startling improvement.

The special instruments which I employ are tapering catheters, with bulbous points and solid flexible beaks. The orifice of the tube is placed at the base of the beak, and the point of the straight stilette exactly fits the bore of the instrument (Fig. 1).

A tapering metallic instrument presents many advantages in the treatment by dilatation: (1) It enables the surgeon to rapidly pass several sizes of dilators at one sitting; (2) the flexible beak is serviceable in changing the direction of the point, which is a little manoeuvre often of great advantage in penetrating a tortuous stricture; (3) the bulbous extremity assists the operator in determining that penetration has been successfully accomplished.

It is always a good plan to delay the operation of dilatation until the patient has been prepared by rest, regular and un-

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