theoretically the nutrition of the foot must go wrong, is too horrible to be contemplated. Actual experience has proved that, in many cases, the errors of nutrition which ought in theory to occur do not occur, or, at worst, are not nearly so serious as might be expected.

CONCLUSION.

Surgeons will glean from what has been written that there are many ways in which the disabilities following nerve destruction can be met, and that hardly any case is bad enough to justify a counsel of despair. Our knowledge of what can be done in poliomyelitis will invite us to take a cheerful outlook in traumatic paralyses.

This article is intended not merely to indicate ways in which the ground can be prepared for the operations of nerve suturing, or to point out the value of keeping a paralysed muscle relaxed by opposing the force of gravitation, but to indicate the great and ever-increasing field of usefulness that is opened up by utilizing tendon, whether that of an active or a hopelessly paralysed muscle, for the restoration of movement or the correction of deformity, thereby restoring to a greater or less extent the economic efficiency of an individual who will otherwise sink into the position of a non-productive and dependent member of the community.

THE IMPORTANCE OF METHOD IN THE ISOLATION OF PATHOGENIC ORGANISMS OF THE TYPHOID GROUP FROM FAECES.

A FURTHER NOTE ON THE VALUE OF TELLURIC ACID COMBINED WITH BRILLIANT GREEN.

BY

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THE employment of brilliant green in fluid medium as a means of isolating typhoid and paratyphoid bacilli from faeces, which was originally suggested by Browning, Gilmour and Mackie, and independently by Torrey, for paratyphoid organisms, has now found wide acceptance (Clarke and Stokes, Dreyer, Tidy, as well as other workers whose results are not yet published). The general experience has been that, when used in conjunction with the ordinary direct plating of the faeces on a differential medium like MacConkey's or Endo's, a substantial increase in the number of positive results has been obtained as compared with the latter method alone. As Clarke and Stokes note, however, this statistical result

leaves out of the picture the relative ease of the two methods so far as finding the colonies is concerned. The balance from this point of view is strongly in favour of the brilliant green method, in which it was common to get a practically pure plate of the typhoid group organism.

Accordingly our statement is confirmed that when these specific organisms are found they usually occur in abundance in the subcultures from the brilliant green medium, thus saving much of the time which is taken up in testing a variety of "likely" colonies from the direct plates.

As regards the procedure which has been followed by other workers who have employed brilliant green, it is to be noted that for the most part they have cut down the series of tubes of peptone water containing varying amounts of the dye, which we originally recommended. Thus a single tube containing 0.4 to 0.5 c.cm. of brilliant green 1 in 10,000 in 10 c.cm. of peptone water has been generally employed as representing the optimum concentration. The adjuvant procedure in the form of a further series of tubes containing telluric acid along with brilliant green, in addition to green alone, which was suggested by Browning, Mackie, and Smith, does not appear to have been extensively tested by other investigators. It is, of course, recognized that exigencies of work set a limit to the time which can be devoted to such examinations; but as the paramount importance of leaving no carriers undetected is now generally recognized, it seems desirable that methods should be adopted which will expose the maximum number of cases. The results of others have shown that the use of a single tube of

brilliant green medium will contribute a large proportion of the extra positives detectable by means of this reagent; but in view of the epidemiological significance of carriers it would be an unwise economy of time to rest content with the detection of those carriers which could be found by abbreviated methods and to neglect the further number of cases which could be discovered by suitable means, and which, if overlooked, are probably quite as likely as the rest to constitute foci of infection later on. Thus, provided that there is a definite prospect of adding to the number of positive results, a moderate increase in the amount of attention devoted to the examination of the faeces beyond the inoculation of one direct plate and one tube of brilliant green medium is highly advisable.

The question is, What extension of procedure is likely to yield the best return of further positives? On the basis of our own routine investigations of suspected typhoid-group infections in a large general hospital we would submit that of the means at present available, in addition to direct plating, the employment of a series of tubes of fluid medium containing varying amounts of brilliant green along with a series containing green and telluric acid will probably afford the largest yield of positive results.

As has already been emphasized in these pages (Browning and Thornton), we believe that the employment of a series of doses of the differential reagent in the medium is of the greatest importance. It is obviously a difficult task to arrange such conditions that scanty specific bacteria in a mixture with a large number of biologically similar organisms may undergo selective proliferation so as to enable the former to be isolated in pure culture. The method of making very large surface inoculations on a solid differential medium direct from the faeces, as was done some years ago by Harvey in his important work on the detection of carriers in the army in India,* involves the use of much agar and the search among large numbers of likely colonies, a serious matter where coliform bacilli, which do not produce typical appearances on the differential medium (for example, pale growth on MacConkey's agar), are present. Therefore the use of a simple fluid medium containing differential antiseptics probably yields the best return for the time spent.

In the case of *B. paratyphosus* B the disparity in behaviour between the specific organism and most of the accompanying coliform bacilli is such that brilliant green by itself, in the proportion of 0.5 c.cm. 1 in 10,000 per 10 c.cm. of peptone water, seems to constitute usually a highly suitable medium for isolation. But where one has to deal with smaller differences between the specific organism and the concomitants, as is especially the case with *B. typhosus*, a single concentration of green does not yield the best results (as Clarke and Stokes's figures indicate), and a finer adjustment of the medium becomes necessary. Hence appears the value of using a series of amounts of the differentiating reagent (brilliant green) in the culture of a single specimen of faeces, as the optimum concentration of the dye depends on factors which vary from case to case. Torrey, in employing brilliant green for the isolation of paratyphoid bacilli from faeces, also recognized the importance of the quantitative factor; thus he adopted a fixed concentration of green in glucose bouillon, but added varying amounts of faeces to a series of tubes; subcultures were then made after twenty-four hours' incubation at 37° C. He found that

if the paratyphoid or enteritidis bacilli are fairly numerous in the faeces, pure or nearly pure cultures will develop in all of these tubes. If, however, they are present in very small numbers, the specific growth occurs rather more often in the lightly than in the heavily seeded tubes.

We also employed a relatively light inoculation and found that positive results might be obtained in subcultures from the fluid medium after forty-eight hours' incubation, although the subcultures at twenty-four hours had been negative. Clarke and Stokes, on the other hand, made much heavier inoculations, and found it advisable to subculture earlier (after nine hours).

Here, again, the optimum conditions cannot be determined beforehand, hence the advisability of employing a series of concentrations of the reagent so as to afford a range within which the optimum is likely to lie.

* Harvey used three 9-in. plates of Conradi's medium for each sample of faeces. Each plate required approximately 30 c.cm. of medium, and every likely colony was picked off and investigated.

Further, it has already been pointed out that typhoid bacilli may be isolated from faeces by means of a series of doses of brilliant green and telluric acid, where direct plating, as well as the use of varying amounts of brilliant green alone, both fail to detect their presence (Browning, Mackie, and Smith). The following instance, which recently came under our observation, furnishes a fresh illustration of this latter highly important point. We are indebted to Dr. Pasteur for permission to use the clinical notes of the case.

Woman, aged 34. History of sixteen days' illness; pains in the head and abdomen, with slight abdominal tenderness, vertigo, and profound weakness. The faeces throughout have been firm and well formed. "Rose spots" present; also slight splenic enlargement (maximum recorded temperature 103.4° F.). Previous to the onset of illness the patient had for five weeks nursed a case said to be suffering from typhoid fever. Widal reaction (by the macroscopic method, using Dreyer's emulsion) shows marked agglutination of *B. typhosus* up to 1 in 200 serum dilution after two hours at 55° C. Specimen of faeces (solid, obtained by enema)—one loopful emulsified in 5 c.cm. normal saline; then one large loopful of emulsion added to each tube of medium (1 per cent. peptone water, neutral to litmus; two series—(a) containing brilliant green, and (b) brilliant green plus telluric acid).

10 c.cm. Peptone Water containing		Resulting Growth, after Incubation for 24 hours at 37° C., plated on MacConkey's Medium.
Telluric Acid 1 per cent.	Brilliant Green 1:10,000.	
0 ...	0.1 c.cm.	Coliform bacilli.
	0.2 "	" "
	0.35 "	" "
	0.5 "	Coliform bacilli which did not ferment inositol.
0.04 c.cm. in each tube	0.1 c.cm.	Coliform bacilli.
	0.2 "	" "
	0.35 "	" "
	0.5 "	<i>B. typhosus</i> in pure culture.

Plate of MacConkey's medium inoculated directly with the faeces showed nothing resembling *B. typhosus* present in more than 100 colonies.

The amount of faeces used was less than that commonly employed by us. As a rule, in the case of very fluid faeces a large loop (up to 1 in. diameter) is employed for inoculation; solid faeces are emulsified by rubbing up with several volumes of sterile water, and then one loopful is used to inoculate each tube.

The results obtained here show (1) that along with a negative result by direct culture on MacConkey's medium—the number of typhoid bacilli present in the faeces constituting probably much less than 1 per cent. of the total viable organisms—(2) no amount of brilliant green up to high doses enabled *B. typhosus* to flourish so as to permit it to be recovered in subcultures, but (3) the mixture of telluric acid and brilliant green yielded in this case a pure growth of *B. typhosus* in the tube containing the highest amount of green, whereas no typhoid bacilli were found in subcultures from any other tubes of the series. We shall not attempt to analyse the multiplicity of factors which may operate in such cases; but the practical issues are clear—namely, that (a) for the successful isolation of *B. typhosus* from faeces varying amounts of the differential reagents may be necessary, and (b) the use of telluric acid along with brilliant green may be essential in order to secure a positive result.

Summary.

1. In the examination of faeces for typhoid and paratyphoid bacilli, the value of a simple fluid medium containing brilliant green, in addition to direct plating, as a means of increasing the number of positive results, has been confirmed by a number of workers.

2. A single fixed concentration of brilliant green (0.5 c.cm. of green 1 to 10,000 per 10 c.cm. of peptone water) seems to leave little to be desired as a medium for the isolation of *B. paratyphosus* B; but this fixed medium does not yield so good results with *B. typhosus*, for which a series of doses of green are required in order to secure the optimum concentration, which depends on a number of variables.

3. In the examination of faeces for *B. typhosus* a series of varying amounts of brilliant green along with telluric acid may be essential in order to isolate this organism in cases where both direct plating and brilliant green alone fail.

* MacConkey's agar has been employed, since we have not found that, as prepared here, it compared disadvantageously with Endo's as a medium for the growth of *B. typhosus*.

4. The importance of detecting carriers for the prophylaxis of epidemics should justify the time spent in this extension of the "one-tube" method. Even in its unabbreviated form the procedure compares favourably, as regards consumption both of time and materials, with the old method of spreading a number of large plates directly with the faeces. The fact that the successful subcultures from the fluid medium frequently yield practically pure growths of the pathogenic organism is an important advantage of the method.

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EXAMINATION OF FIFTY DYSENTERY CONVALESCENTS FOR CARRIERS.

BY

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The fifty men examined had all suffered from dysentery contracted on service, and with one exception gave a history of passing blood and slime for periods varying from three days to nine weeks. In four cases a history was also obtained of an illness resembling enteric fever. The convalescents were not selected, but were the first fifty examinations completed in the course of search for carriers in a convalescent camp.

The date of onset of the original illness ranged from May, 1915, to January, 1916, but all except two cases first showed symptoms of dysentery before the end of November, 1915. The examination began on February 16th, and ended on March 24th, 1916.

In every case, therefore, except two the illness began more than two months before the investigation here recorded. The examination of faeces was made in each case on three occasions, an interval of two or three, or occasionally more, days elapsing between the separate observations. The specimens of faeces reached the laboratory within half an hour of being passed. The examination consisted of: (1) Microscopic search for protozoa; (2) plating on MacConkey's neutral red bile-salt lactose agar, and subsequent examination of colourless colonies by means of carbohydrate media and agglutinating serums; (3) a specimen of blood was taken from each man on one occasion and its agglutinating power tested against stock emulsions.

Table showing the Results Obtained by Microscopic Examination and Culture.

<i>Entamoeba histolytica</i> was found in ...	9 men
<i>E. coli</i> was found in ...	25 "
<i>Lambia intestinalis</i> was found in ...	15 "
<i>B. dysenteriae</i> (Shiga) was found in ...	2 "
<i>B. dysenteriae</i> (Y) was found in ...	0 "
<i>B. typhosus</i> , <i>B. paratyphosus</i> A or B was found in ...	0 "
Negative results (neither protozoa nor bacteria) ...	14 "

Trichomonas intestinalis was noted in two cases, but was not looked for, especially on account of the need for rapid work. In all the cases in which *Entamoeba histolytica* was recognized tetragena cysts were observed, and large or small vegetative forms were also observed in some of these.

Further Analysis of the Results of Microscopic Examination.

<i>Entamoeba</i> was found alone in ...	6 men
<i>Entamoeba coli</i> was found alone in ...	12 "
<i>Lambia intestinalis</i> was found alone in ...	4 "
<i>E. histolytica</i> and <i>Lambia</i> were found in ...	1 man
<i>E. histolytica</i> and <i>E. coli</i> were found in ...	2 men
<i>E. histolytica</i> and <i>Trichomonas</i> were found in ...	1 man
Negative ...	14 men.

Total ... 50