REPORT UPON THE BACTERIOLOGICAL EXAMINATION OF ONE THOUSAND SOLDIERS CONVALESCENT FROM DISEASES OF THE DYSENTERY AND ENTERIC GROUPS.

BY CAPTAIN WILLIAM FLETCHER,
Royal Army Medical Corps.

From the Laboratory of the University War Hospital, Southampton.

(Continued from p. 559.)

Prophylactic Inoculations and Agglutinin-Content of Serum in Carriers of B. paratyphosus A.—Five of the six carriers of B. paratyphosus A had been inoculated with a typhoid vaccine by the T.V. 2 method, and one (No. 656) with a mixed vaccine of typhoid and paratyphoid organisms, by the T.A.B. 2 system, four months before the onset of his illness. In four of the cases the blood-serum contained under fifty standard agglutinin units, per cubic centimetre, for B. paratyphosus A. The average for the six patients was thirty-nine, whereas the average number of standard agglutinin units in the blood of the carriers of B. paratyphosus B was found to be about ten times as great for that bacillus.

All the patients had been inoculated with a typhoid vaccine, and the blood-serum of all of them agglutinated that bacillus. The average number of standard agglutinin units for B. typhosus was twenty-seven.

TABLE SHOWING TYPE OF PROPHYLACTIC INOCULATION AND AGGLUTININ CONTENT OF SERUM IN CARRIERS OF B. paratyphosus A.

<table>
<thead>
<tr>
<th>Patient's laboratory number</th>
<th>Inoculations</th>
<th>Standard agglutinin units in 1 c.c.</th>
</tr>
</thead>
<tbody>
<tr>
<td>197</td>
<td>T.V. 2</td>
<td>Typhoid 31, Para A 27, Para B 0</td>
</tr>
<tr>
<td>310</td>
<td>T.V. 2</td>
<td>12, 61, 0</td>
</tr>
<tr>
<td>666</td>
<td>T.V. 2</td>
<td>43, 120, 0</td>
</tr>
<tr>
<td>656</td>
<td>T.A.B. 2</td>
<td>22, 5, 20</td>
</tr>
<tr>
<td>782</td>
<td>T.V. 2</td>
<td>43, 11, 20</td>
</tr>
<tr>
<td>776</td>
<td>T.V. 2</td>
<td>22, 11, 0</td>
</tr>
</tbody>
</table>

In three cases the blood contained agglutinins for B. paratyphosus B, and in three it did not. In one of the former (No. 666), the presence of these agglutinins was accounted for by the patient being a carrier of B. paratyphosus B, in addition to B. para-.
typhosus A; another (No. 656) had been inoculated by the $\frac{T.A.B.}{4}$ method; in the third case (No. 782) the reason was not determined. The preceding table shows the type of inoculation and number of standard agglutinin units in each case.

Cultural Reactions of Strains isolated.—The cultural reactions of the six strains isolated were all according to type. The organisms were motile, no indol was formed in peptone-water within fourteen days; milk was made acid, but was not clotted. Dulcete, glucose, maltose, mannite, and dextrin were fermented, with the production of acid and a bubble of gas.

Agglutinations of the Strains of B. paratyphosus A isolated.—Three of the strains (Nos. 197, 310, 666) were tested with a specific serum, obtained from the Lister Institute, which had a stated titre of 1/6,000. The first was agglutinated by the serum in a dilution of 1/6,000, the second at 1/10,000, and the third at 1/16,000. The other three strains (Nos. 656, 782, 776) were tested with Royal Army Medical College serum, $A_2$, which had a stated titre of 1/6,000. No. 656 was agglutinated at 1/1,280, No. 782 at 1/6,400, and No. 776 at 1/12,000.

Agglutinating Power of the Patients' Serum with the Paratyphoid Organisms isolated from their Excreta.—In every case the patient's serum agglutinated the paratyphoid organisms isolated from his excreta, but in no instance did it do so in high dilutions. In three cases (Nos. 197, 656, 776), there was no agglutination when the serum was diluted more than 1/20, and in none did it occur at a higher titre than 1/320.

Absorption Tests.—These were carried out as follows: Five agar slopes, twenty-four hours old, of each of the six strains under test, also of the type strain ("Schottmiller"), and of a B. coli culture, as a control, were emulsified in salt-solution, as follows: One cubic centimetre of salt-solution was added to a tube of each culture, and the growth emulsified. This emulsion was then pipetted into a second tube of the same culture, which was emulsified in the same fluid, and so on to the third. The resulting thick, creamy emulsion was then taken up in a pipette, and 0.8 cubic centimetre was added to a small tube containing 0.25 cubic centimetre of Royal Army Medical College serum $A_2$ (titre 1/6,000), diluted 1/20. The tubes were incubated at 37° C. for three hours. At the end of this time emulsions were made of the two remaining tubes of each culture, with a little more than 0.5 cubic centimetre of salt solution, and 0.45 cubic centimetre of each
emulsion was added to the corresponding tube of serum and bacilli, mixed three hours before. Altogether 1.25 cubic centimetres of an emulsion of each of the eight cultures was added, severally, to eight tubes, each containing 0.25 cubic centimetre of the specific serum, diluted 1/20, so that the dilution of the serum at this stage was 1/120. The tubes were then incubated for a second period of three hours, at the end of which time they were centrifuged, and the supernatant serum pipetted off. The agglutinating power of this serum was then tested, with equal quantities of emulsions of each of the eight cultures, i.e., in a final dilution of 1/240.

The results are set out below, in tabular form. It will be seen that the agglutinins for the type culture, and for each of the test cultures, were removed by all the organisms, except the control culture of B. coli.

<table>
<thead>
<tr>
<th>Culture</th>
<th>Serum saturated with culture (1)</th>
<th>Do.</th>
<th>Do.</th>
<th>Do.</th>
<th>Do.</th>
<th>Do.</th>
<th>Do.</th>
<th>Do.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Schottmüller</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>(2) 197</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(3) 310</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(4) 666</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(5) 666</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(6) 782</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(7) 776</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(8) B. coli</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

Negative sign = no agglutination. Positive sign = agglutination.

Carriers of B. paratyphosus B.

Thirty-five carriers of B. paratyphosus B were found among the patients convalescent from diseases of the dysentery and enteric groups (i.e., 3.5 per cent). Six of the thirty-five patients had been in the East, the remaining twenty-nine had come from France. Most of them were in early convalescence, and in only nine cases had more than twelve weeks elapsed since the commencement of their illness. The diagnoses on the transfer certificates of these thirty-five convalescents were as follows:—
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17. Paratyphoid B  Nos. 135, 136, 143, 16, 282, 547, 588, 734, 666, 735, 999, 1,116, 1,118, 314, 521, 106, 581

1. Paratyphoid A  No. 511

1. "Paratyphoid"  No. 159

11. Dysentery.  Nos. 61, 518, 527, 551, 565, 1,081, 699, 702, 842, 886, 1,058

1. Typhoid  No. 360

3. "Enteric"  Nos. 73, 888, 1,107

1. "F.U.O."  No. 548

35 Total

The pathogenic organisms were discovered at the first examination in twenty-five cases; at the second in five; at the third in two, and during the incubation stage in three.

The patients are divided by the results of the examination of their excreta into four groups: (1) those from whose excreta paratyphoid bacilli were isolated on one or two occasions only; (2) those from whose excreta paratyphoid bacilli were repeatedly isolated, but disappeared during convalescence or soon after; (3) chronic carriers, including all cases from whom the organisms were isolated, frequently more than three months after the commencement of their illness; (4) precocious carriers, from whose faeces the infecting organisms were isolated during the stage of incubation.

*Group (1): Patients from whose excreta B. paratyphosus B was isolated on one or two occasions only.*—This group comprised 20 patients; in 16 of them B. paratyphosus B was isolated once only (Nos. 135, 73, 136, 159, 61, 143, 16, 282, 360, 511, 547, 548, 588, 734, 1116, 1118). In three of these cases (No. 54, 547, 548) the bacilli were recovered from the urine, in two during the fourth week after the onset of illness, and in one during the seventh week. In the thirteen cases remaining, the pathogenic organisms were found in the faeces. In every instance this was before the tenth week, except in one (No. 61) where they were isolated during the twentieth week, but not again in the course of four examinations made during a period of four weeks.

In eleven of the above sixteen cases, paratyphoid bacilli were isolated from the first specimen examined (Nos. 73, 159, 143, 360, 511, 547, 548, 588, 734, 1116, 1118); in three they were isolated during the examination of the second specimen (Nos. 135, 136, 282), and, in the two remaining cases, at the examination of the third.

The number of examinations made in the above cases was as follows:—

One patient (No. 159) was examined once, two (Nos. 282, 143)
were examined twice, and two (Nos. 16, 73) on three occasions. In these five cases, further specimens were not available, because the patients were transferred to other hospitals. The remaining nine cases were examined repeatedly during a period of four weeks after being found "positive"; the average number of examinations in each case being nine.

In four cases (Nos. 314, 518, 527, 888), *B. paratyphosus* B was recovered on two occasions only; in one instance it was found in the feces (No. 314), and in three it was found in the urine (Nos. 518, 527, 888). Patient No. 314, the fecal carrier, was examined twice, during the fifth week, with positive results on both occasions. He was then transferred elsewhere without further examination.

From the three urinary cases in which the bacillus was found on two occasions, it was isolated at the first and second examinations in two (Nos. 518, 527), and at the second and sixth in one (No. 888). These patients were subsequently examined during a period of four to eight weeks, and from ten to twenty examinations were made, in each case, with negative results.

The temperature of all the twenty patients included in Group (1), from whose excreta *B. paratyphosus* B was isolated on one or two occasions only, had fallen to normal before admission to this hospital. Most of them were in early convalescence from mild attacks, several having been up and walking about for more than a week. In short, Group (1) consisted of twenty patients from whose excreta the pathogenic bacilli were isolated at the end of a mild attack of paratyphoid fever.

Group (2): *Patients from whose excreta B. paratyphosus B was isolated repeatedly, but where the Bacilli subsequently disappeared.*

—This group includes seven cases. In three of them *B. paratyphosus* B was recovered from the urine (Nos. 521, 551, 565), and in four from the feces (Nos. 1081, 1107, 699, 702). Pathogenic bacilli were not found in the excreta of any of these cases later than the ninth week, except in one instance, patient No. 565, who was dangerously ill with subtertian malaria, and in whose urine *B. paratyphosus* B was present up to the fifteenth week.

These six cases will be considered briefly in detail.

(Ordinal numbers as applied to the weeks indicate the number of weeks which had elapsed since the commencement of the patient's illness).

No. 521. This patient was in a debilitated condition after a rather severe illness. *B. paratyphosus* B was isolated from the urine during the ninth week, on the first and three following
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examinations. Fourteen subsequent examinations extending over a period of four weeks were negative.

No. 551. At the time of this patient's admission, five weeks after he was taken ill, he had a very slight relapse and B. paratyphosus B was found in the urine at the first three examinations. Ten subsequent examinations made during the next five weeks were all negative.

No. 565. When admitted to this hospital, in the tenth week, this patient was very anaemic, and he nearly died from an attack of subtertian malaria. Forty-seven examinations of his urine were made between December 5, 1916, and February 6, 1917. B. paratyphosus B was found at the first, fourth, seventh, tenth and fifteenth examinations on December 5, 14, 22, 29 and January 8, respectively. In this case the infection was probably prolonged by the debility and anaemia caused by the malaria.

No. 1081. This patient was also in a weak state when admitted in the sixth week. He had a history of a mixed infection of dysentery and enteric. Paratyphoid bacilli were recovered from his feaces at the first three examinations, fifteen subsequent examinations proved negative.

No. 1107. This patient was admitted with healing gunshot wounds of the shoulder and knee; he had an irregular temperature which had just come down to normal, after having been raised for two weeks. B. paratyphosus B was isolated from his feaces at the first and six subsequent examinations, the last occasion being in the sixth week.

No. 699. When in France, this patient had suffered from diarrhœa, and had passed blood and slime in his stools. His temperature was normal when he was admitted during the fourth week of his illness, and, on his papers, it was stated that it had never risen above normal. Like the other patients in this group, he was in a weak condition and unable to walk about. B. paratyphosus B was isolated at the first examination of his feaces, which was made the day after his admission, and in nine examinations out of thirty made subsequently. No paratyphoid bacilli were isolated after the seventh week.

No. 702. This patient had suffered from dysentery in France and he had still a little diarrhœa when he was admitted to this hospital, on January 8, in the middle of the third week. In this case, as in the last, it had been noted that the temperature did not rise above normal. Fifteen examinations of his feaces were made between January 10 and February 22. Paratyphoid bacilli were
found at the second and the six following examinations but not subsequently. This patient was suffering from a mixed infection; paratyphoid organisms and dysentery bacilli of the mannite fermenting group were present in his faeces together.

The cases in this group differ from those comprised in the first series, where the patients had just recovered from mild attacks. In this second group the patients had suffered from severe illnesses; all of them were "cot cases," and several of them were still ill when they were admitted to this hospital.

Group (3): Patients who were chronic Carriers of B. paratyphosus B.—This group comprises five patients (Nos. 106, 581, 666, 735, 999). Three of them (Nos. 106, 581, 666) had been in the Eastern Mediterranean. They were all faecal carriers.

The term "chronic" is here applied to those cases who were still carriers after more than twelve weeks had elapsed since the commencement of their illness and from whose faeces the pathogenic organisms showed no tendency to disappear.

No. 106 was admitted to this hospital from the Mediterranean. He had a thrombosed vein in one leg, but was otherwise in good health. His excreta were examined six times with positive results upon each occasion, between the twentieth and twenty-second weeks, after which he was transferred elsewhere.

No. 681 was admitted, convalescent, at the beginning of the eighth week. His faeces were examined on forty-six occasions between December 8, 1916, and March 12, 1917, that is, up to the twenty-second week after the commencement of his illness. B. paratyphosus B was isolated at the first examination and on twenty-one subsequent occasions. He was in good health except for occasional attacks of diarrhoea. His faeces were not constantly "positive"; at times, no pathogenic bacilli were found for several days; then he would have a slight attack of diarrhoea and paratyphoid bacilli would become abundant in his faeces once more.

No. 666 was admitted to this hospital from the Eastern Mediterranean on December 22, 1916, in the seventeenth week after he was taken ill. Ninety-seven examinations of his faeces were made between January 2 and May 5 (thirty-five weeks after the beginning of his illness) and pathogenic bacilli were found on every occasion. This case will be more fully dealt with under the head of "Carriers of mixed infections," for, in addition to B. paratyphosus B, B. paratyphosus A was also constantly present. This patient was apparently in perfect health; he never suffered from fever, pains in the stomach, or looseness of the bowels; in fact, he seemed to be
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quite immune to paratyphoid bacilli, which lead a purely saprophytic existence within him.

No. 735. This patient was taken ill in France, and admitted to this hospital in the seventh week, when his temperature was normal. A few days after his admission, he was up and walking about the hospital. Thirty-two examinations of his faeces were made between the seventh and fifteenth weeks and on each occasion B. paratyphosus B was present in large numbers. He was then transferred to another hospital. He appeared to be in good health and he said, himself, that he was as well as he had been before his illness.

No. 999 was taken ill on January 27; his temperature came down to normal on February 2. He was admitted to this hospital on March 12, in the seventh week, and he had a slight rise of temperature on the following day. Between March 13 and May 23, fifty-two examinations of his faeces were made, with positive results on each occasion. It is now sixteen weeks since the commencement of his illness and every sample of his faeces contains paratyphoid bacilli in large numbers.

Group (4): Precocious Carriers.—From time to time cases have been reported where the infecting organisms have been isolated during the incubation period of typhoid fever. While the evidence that such cases actually occur has been disputed by some, others have accepted it, and Sacquépéé has classified such carriers as "Porteurs précoces."

Three cases (Nos. 1058, 886 and 842) have been met with in this hospital where organisms of the "B" type have been isolated from the excreta during the incubation stage of paratyphoid fever.

These three men had been under observation for several weeks, during which their excreta were examined many times. They had all suffered from dysentery. From the stools of one (No. 1058) a mannite-fermenting dysentery organism was cultivated on several occasions; the second (No. 886) was a carrier of B. dysenteriae of the Shiga type; the third (No. 842) suffered from chronic diarrhoea, the result of an old infection with Shiga's bacillus.

On April 13, 1917, B. paratyphosus B was isolated from the fourteenth specimen of the faeces of No. 1058. On April 14, the thirty-ninth sample of the faeces of No. 886 was examined and the same organism was isolated. On April 15, B. paratyphosus B was isolated from the ninth sample of the faeces of Case 842.

The following table shows the dates upon which specimens of the excreta of these men were examined, and the results:
**CASE 1058.**

<table>
<thead>
<tr>
<th>Date of sample</th>
<th>Result of examination</th>
<th>Date of sample</th>
<th>Result of examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 26</td>
<td>+ (B. dysenteriae)</td>
<td>April 21</td>
<td>-</td>
</tr>
<tr>
<td>28</td>
<td>-</td>
<td>22</td>
<td>-</td>
</tr>
<tr>
<td>30</td>
<td>-</td>
<td>23</td>
<td>-</td>
</tr>
<tr>
<td>31</td>
<td>-</td>
<td>24</td>
<td>-</td>
</tr>
<tr>
<td>April 2</td>
<td>+ (B. dysenteriae)</td>
<td>25</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>+</td>
<td>26</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>+</td>
<td>27</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>+</td>
<td>28</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
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</tr>
<tr>
<td>9</td>
<td>+</td>
<td>30</td>
<td>+ (B. paratyphosus B)</td>
</tr>
<tr>
<td>10</td>
<td>+ (B. dysenteriae)</td>
<td>May 1</td>
<td>+</td>
</tr>
<tr>
<td>11</td>
<td>-</td>
<td>2</td>
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</tr>
<tr>
<td>12</td>
<td>-</td>
<td>3</td>
<td>+ (B. paratyphosus B)</td>
</tr>
<tr>
<td>13</td>
<td>+ (B. paratyphosus B)</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td>+</td>
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<td>+</td>
</tr>
<tr>
<td>16</td>
<td>-</td>
<td>7</td>
<td>+</td>
</tr>
<tr>
<td>17</td>
<td>+ (B. paratyphosus B)</td>
<td>9</td>
<td>+ (B. paratyphosus B)</td>
</tr>
<tr>
<td>18</td>
<td>+</td>
<td>14</td>
<td>+</td>
</tr>
<tr>
<td>19</td>
<td>+ (B. paratyphosus B)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>+</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(No pathogenic organisms were recovered in twelve subsequent examinations)

**CASE 886.**

<table>
<thead>
<tr>
<th>Date of sample</th>
<th>Result of examination</th>
<th>Date of sample</th>
<th>Result of examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb. 23</td>
<td>+ (B. dysenteriae; Shiga)</td>
<td>April 21</td>
<td>+ (B. dysenteriae)</td>
</tr>
<tr>
<td>March 1</td>
<td>-</td>
<td>22</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td>23</td>
<td>+ (B. dysenteriae)</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>24</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td>25</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>+ (B. dysenteriae)</td>
<td>26</td>
<td>+ (B. paratyphosus B)</td>
</tr>
<tr>
<td>7</td>
<td>-</td>
<td>27</td>
<td>+</td>
</tr>
<tr>
<td>8</td>
<td>-</td>
<td>28</td>
<td>+</td>
</tr>
<tr>
<td>9</td>
<td>+ (B. dysenteric constanly present except three occasions</td>
<td>30</td>
<td>+</td>
</tr>
<tr>
<td>March 9 to</td>
<td>(B. dysenteriae and</td>
<td>May 1</td>
<td>+</td>
</tr>
<tr>
<td>April 13</td>
<td>(B. dysenteric and</td>
<td>2</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>(B. paratyphosus B))</td>
<td>3</td>
<td>+</td>
</tr>
<tr>
<td>14</td>
<td>+ (B. paratyphosus B)</td>
<td>4</td>
<td>+ (B. dysenteriae)</td>
</tr>
<tr>
<td>16</td>
<td>+ (B. dysenteriae)</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>17</td>
<td>+ (B. paratyphosus B)</td>
<td>6</td>
<td>+ (B. dysenteriae)</td>
</tr>
<tr>
<td>18</td>
<td>+ (B. paratyphosus B)</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>19</td>
<td>+ (B. dysenteriae)</td>
<td>8</td>
<td>+ (B. dysenteriae)</td>
</tr>
<tr>
<td>20</td>
<td>+</td>
<td>9</td>
<td>+ (B. dysenteriae)</td>
</tr>
</tbody>
</table>

(Transferred to another hospital)
**Bacteriological Examination of Soldiers**

**CASE 842.**

<table>
<thead>
<tr>
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<th>Result of examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan. 1</td>
<td>-</td>
<td>April 21</td>
<td>+ (B. paratyphosus B)</td>
</tr>
<tr>
<td>Feb. 2</td>
<td>-</td>
<td>22</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>23</td>
<td>+</td>
</tr>
<tr>
<td>March 2</td>
<td>-</td>
<td>24</td>
<td>+</td>
</tr>
<tr>
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<td>-</td>
<td>25</td>
<td>+</td>
</tr>
<tr>
<td>14</td>
<td>-</td>
<td>26</td>
<td>+</td>
</tr>
<tr>
<td>15</td>
<td>-</td>
<td>27</td>
<td>+ (B. paratyphosus B)</td>
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<tr>
<td>16</td>
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<td>17</td>
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<td>19</td>
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<tr>
<td>April 15</td>
<td>+ (B. paratyphosus B)</td>
<td>May 1</td>
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(No pathogenic organisms were isolated after May 10, in 20 subsequent examinations)

(N.B.—In all the above tables a positive sign signifies the presence of pathogenic organisms in the samples. A negative sign indicates that no pathogenic organisms were isolated.)

When paratyphoid bacilli were first isolated from the faeces of these three men, they were all in their usual health and there was no change in their temperature or pulse-rate. Blood-cultures were made, with negative results in each case. The blood serum of none of them contained agglutinins for *B. paratyphosus* B, nor did it, in any instance, agglutinate the bacillus isolated from the faeces; later on, however, specific agglutinins developed in all the three cases.

To take the cases in more detail:—

No. 1058, the first patient, was taken ill on the night of April 16, four days after the collection of the first specimen in which paratyphoid bacilli were found; his temperature and pulse-rate then began to rise, and he entered upon a typical attack of paratyphoid fever. As mentioned above, when paratyphoid bacilli were first isolated from his faeces, no organisms were found in his blood, but on the second day of his illness another specimen was taken, and, on this occasion *B. paratyphosus* B was cultivated from it.

The curve of the agglutinin content of his serum followed the usual course; on April 15, three days after *B. paratyphosus* B was first isolated from his faeces, his blood contained no agglutinins for that bacillus. On April 24, which was the ninth day of his illness, it was found to contain no fewer than 1,071 standard agglutinin
units; on April 28 it contained 1,420 units; on May 5, 5,429 units, and on May 18, 32,000.

As shown in the accompanying table, *B. paratyphosus* B was repeatedly isolated from his excreta during the course of his illness up to the end of the fourth week, but not afterwards.

**CHART OF PRECOCIOUS CARRIER.** No. 1058.

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</table>

D = *B. dysenteria* isolated from feces. B = *B. paratyphosus* B isolated from feces. X° = No agglutinins. X'071 = 1071 agglutinin units, etc. Dotted line = Curve of agglutinin content.

*Case 886.*—This patient was none the worse for his infection with paratyphoid; in fact, he declared that he was "better," and his weight increased by five pounds during the first week.

When *B. paratyphosus* B was first isolated from his feces, his
blood contained no paratyphoid agglutinins. Their subsequent appearance shows that a general infection occurred, though, for all practical purposes, this patient was a healthy carrier.

*B. paratyphosus* B was first isolated from his faeces on April 14. His blood was examined on the following day and was found to contain no agglutinins for a standard emulsion of *B. paratyphosus* B or for an emulsion of the bacillus isolated from his faeces. Blood cultures remained sterile. Ten days later, on April 25, his blood contained 141 paratyphoid agglutinin units; on May 1 this number had declined to seventy-one, and on May 5 it had not altered. He was, then, transferred to another hospital.

**Case 842.—**The third patient had been ill for many months, suffering from "colitis" which had followed an attack of dysentery. He had been under treatment here since the beginning of the year.
when, on April 15, *B. paratyphosus* B was isolated from his faeces. At that time he was in better health than usual. His blood serum contained no paratyphoid agglutinins nor could paratyphoid bacilli be cultivated from it. He remained in the same condition, eating well, sleeping well and getting up a little every day, until April 24, nine days later, when his temperature, which often rose to 99° F. in the evening, went up to 100.5° F. and a mild attack of paratyphoid fever commenced.

**Chart of Precocious Carrier. No. 842.**

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**APRIL.**

- **B** = *B. paratyphosus* B isolated from faeces. **X** = No agglutinins. **X07** = 357 agglutinin units, etc. Dotted line = Curve of agglutinin content.

On April 14, there were no paratyphoid agglutinins in his serum. On April 25 it contained 357 units; on May 1, 71 units, and on May 18, 14 units. Between April 15 and May 10 *B. para-
typhosus B was isolated from nineteen samples of his faeces, but the organism was not found again in a large number of examinations made subsequently.

It was established, without a doubt, that these three men had become infected by a chronic carrier of B. paratyphosus B with whom they had come in contact.

The cultural reactions of the three strains isolated, were according to type. They were all agglutinated by a specific serum in dilutions as high as 1/10,000 (the serum employed was Royal Army Medical College B₂ titre 1/10,000) and all three strains absorbed the specific agglutinins from that serum.

The results of the investigation of these cases show clearly that people in the incubation stage of paratyphoid fever may be carriers of infection. It is only by an accident that such persons come to be examined, so that they are but rarely detected. It may be that it is the rule, and not the exception, for persons in the incubation stage of fevers of the enteric group to be carriers of the pathogenic organisms which have multiplied in their intestine and are being passed in their excreta.

Prophylactic Inoculations and Agglutinin Content of Serum in Carriers of B. paratyphosus B.—In thirteen of the thirty-five cases from which B. paratyphosus B was isolated, there was documentary evidence of the men having received prophylactic inoculations of a mixed typhoid and paratyphoid vaccine. In one case (No. 518) the inoculation was given only two weeks before the onset of illness, and in four other cases within two months of the attack (125, 136, 16, 551). The other eight cases had been inoculated within a year of their illness.

None of the patients in the third group (which comprised the five chronic carriers) had been inoculated with a paratyphoid vaccine.

The blood of three of the patients (73, 61, 360) in Group (1), from whose faeces B. paratyphosus was isolated once only, contained no agglutinins for that bacillus.

In Group (2) and Group (3) the serum of all the patients agglutinated B. paratyphosus B except that of No. 565, from whose urine the bacillus was isolated five times in five weeks. He was very ill and very anaemic from subtertian malaria when his blood was taken for examination, and this may account for the absence of agglutinins.

The serum of the "precocious carriers" in Group 4 when first examined contained no paratyphoid agglutinins, but, as already mentioned, they developed later. The figures in the table give the
results of the examinations made when \textit{B. paratyphosus} B was first discovered in the excreta of these men.

The above table shows the type of prophylactic inoculations and the number of standard agglutinin units for typhoid and paratyphoid emulsions in the serums of the thirty-five carriers of \textit{B. paratyphosus} B.

In some of the earlier cases, the agglutinations were not carried beyond a dilution of 1/250.

\textit{(To be continued.)}