Clinical and other Notes.

OBSERVATIONS ON THE PATHOGENICITY AND SPECIFIC CHARACTERS OF THE BACILLUS FÆCALIS ALKALIGENES.

By Captain L. F. HIRST.

Royal Army Medical Corps.
Pathologist to No. — General Hospital, Egypt.

The Bacillus fœcalis alkaligenes was described by Petruschky for the first time in 1889 as an organism resembling Bacillus typhosus, which he isolated from a specimen of stale beer and human faeces. At first regarded as a harmless saprophyte, the organism was later considered by its discoverer to be the causative agent of a typhoid-like illness in man. In recent years a few cases of this nature have been described by various observers. A paper containing a summary of the literature on this subject by Lieutenant-Colonel Ledingham has recently appeared.

The paper by Captain Shearman, my predecessor at No. — General Hospital, and Captain Moorhead, our late Consulting Physician, describes eleven cases of bacillæmia associated with a mild disease of the enterica type.

My attention was first directed to the question of the pathogenicity of B. fœcalis alkaligenes while working on enteric carriers at the Military Laboratory, Alexandria, in 1916. I was surprised at the frequency with which this organism is found in the stools of convalescent cases of enteric in Egypt. On taking over from Captain Shearman, I learnt that he had isolated the organism from the blood of a series of cases at No. — General Hospital. Subsequently I also have succeeded in isolating B. fœcalis alkaligenes in a pure culture from the blood of a further series of twelve cases.

During the year 1916, 622 blood cultures have been bacteriologically examined at this hospital. B. fœcalis alkaligenes has been isolated no less than 23 times out of a total of 123 positive cultures, i.e., 18.7 per cent. Included in 123 are 12 pure cultures of B. coli. The remaining 88 are organisms of the enterica group B. typhosus and paratyphoid A and B.

The seasonal distribution of these cases for the year 1916 was as follows: March, 1; May, 9; June, 5; September, 4; October, 2; November, 1; December, 1.

A detailed description of the clinical features of my cases does not fall within the scope of this paper. Captain H. F. Blood, who has observed most of these cases, informs me that the clinical picture is briefly as follows:—
Clinical and other Notes

Onset sudden, evening rise of temperature for about five days, marked remission, but morning temperature not falling quite to normal, then a brief intermission followed by more irregular pyrexia for a few more days. The patient's aspect is pale, and he has a toxic appearance out of proportion to his symptoms, which are usually indefinite. The tongue is coated with a brownish fur, red at edges and moist. The pulse is slow in proportion to the temperature. There are no spots and the spleen is not enlarged.

CASE 9.—B = Blood culture taken.

CASE 11.—B = Blood culture taken.
Clinical and other Notes

Captain T. G. Moorhead's cases reported in the already mentioned paper evidently were very similar, but the intermission in the temperature appears to have been much more pronounced than in our cases.

Clinically, Cases 2, 3, 4, 7 and 8 correspond closely to Captain Blood's description of a typical B. fecalis alkaligenes infection.

In Cases 1, 4, 5 and 8 the course of the infection was much influenced by the complications noted in Table I. The duration of the pyrexial period of Case 5 was abnormally long, but this case was diagnosed on clinical grounds as B. fecalis alkaligenes infection before I isolated the organism from the blood.

Cases 10, 11 and 12 were all blood cultured on account of a suspicion of B. fecalis alkaligenes infection.

There can be no doubt that B. fecalis alkaligenes bacillæmia is associated with definite and distinct clinical signs, though whether this affection can be clearly distinguished clinically from certain varieties of B. coli bacillæmia is yet undecided.

The main facts of pathological interest in connexion with these cases are shown in Table I.

Notes on Three Additional Cases of Systemic Infection by B. fecalis alkaligenes.

Captain H. Wiltshire has recently isolated B. fecalis alkaligenes from the blood of three cases under treatment at another General Hospital in Alexandria. The bacteriological observations were made at the Military Laboratory, Alexandria.

\[\begin{array}{c|c|c|c|c|c|c|c|c|c|c|c|c|c|c}
\text{DATE} & 5 & 6 & 7 & 8 & 9 & 10 & 11 & 12 & 13 & 14 & 15 & 16 & 17 & 18 \\
\hline
\text{F°} & M & E & M & E & M & E & M & E & M & E & M & E & M & E \\
\hline
\text{PULSE} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\end{array}\]

Case 3.—B = Blood culture taken.
Clinical and other Notes

All three were cases with a low irregular pyrexia of short duration with symptoms similar to those already described. They were blood cultured on account of a suspicion of enterica.

Case 1.—Aged 34, T.V. 2, September, 1914. Patient's serum agglutinated the homologous strain of B. facalis alkaligenes up to a dilution of 1 in 50. His pyrexia began after nine days' treatment in hospital for a surgical affection of the feet.

Case 2.—Aged 29, T.V. 2, September, 1915. Admitted on account of a staphylococcc abscess of the leg. Pyrexia persisted without apparent cause after abscess was treated. Widal reaction negative to T.A.B.

Case 3.—Aged 38, T.V. 2, September, 1915. Admitted on account of "headache." His serum agglutinated B. typhosus up to a dilution of 1 in 200. B. paratyphoid A and B negative.

There was apparently no direct association with inflammatory infection of the bowel in these cases.

Characters of the Various Strains of B. facalis alkaligenes.

Petruschky's original description was written before introduction of modern methods of differentiating bacterial species. The specific name of B. facalis alkaligenes was subsequently given by various observers to a number of organisms, some of which are clearly distinct species.

Berghaus compared a number of strains from various sources. He found that the pure cultures agreed generally with Petruschky's original description, save that the flagellae were polar and not peritrichal. He came to the conclusion that B. facalis alkaligenes was a pure saprophyte, and identified it with B. fluorescens non-liquefaciens and B. fluorescens putidus (Flügge) which had lost the power of producing a fluorescent pigment.

Much confusion has been caused by working on impure cultures of B. facalis alkaligenes.

Klimenko in 1907 collected fifteen strains designated B. facalis alkaligenes from various laboratories in Russia and Germany and carefully compared them with seven strains of his own, isolated from a water supply in Petrograd, and with strains of B. fluorescens non-liquefaciens and B. fluorescens putidus.

He shows clearly that these latter organisms are saprophytes with an optimum temperature of 20° C., and having distinct characters from B. facalis alkaligenes. Four of this collection of laboratory strains turned out to be identical with these saprophytes.

Several of Klimenko's strains formed acid with glycerine, levulose, and galactose. The organisms in Klimenko's sub-group I. of B. facalis alkaligenes include two of Petruschky's strains. The various organisms could be split up into a number of sub-groups by their action on carbohydrates, and by the use of agglutinating sera prepared by injection of typical strains into animals.
I have carefully compared the descriptions given in such literature as I could find in Alexandria of strains isolated by various observers with the characters of my own strains isolated by hemoculture, and from the urine and faeces of patients in No. — General Hospital.

Table II. shows the principal characters given by these observers contrasted with those of my principal group of blood strains. Petruschky's strains No. 1 and 2, as described by Kliimenko, may be regarded as the type species of B. faecalis alkaligenes.

Some of the difference in these descriptions, such as the arrangement of the flagellae, the liquefaction of gelatine and the action on carbohydrates are of specific importance. Castellani's organism is quite distinct from the type species.

The strains isolated from human blood in Alexandria differ from those previously isolated by hemoculture by Rochaix and Marotte, and by Straub and Krais mainly in respect of their lower agglutinability to the patient's serum and their more variable motility.

Strain 2 of Straub and Krais closely agreed with the laboratory strain of B. faecalis alkaligenes (Schottmüller) with which it was compared.

The strain from the pleural effusion of Case No. 8 was isolated by Captain J. G. Thomson. I am responsible for the isolation of all the other strains isolated at No. — General Hospital since September 1, 1916.

My twelve strains isolated by hemoculture fall into two groups, the first comprising the bacilli isolated from the first nine, and the second from the last three cases. No appreciable difference could be detected between the individual members of either group.

Each organism before testing its characters was replated to ensure purity.

Group I.—Morphology.

All the nine strains were pleomorphic, especially after repeated subculture on agar. For example, the strain of Case 8 showed only short and coccoid forms and was non-motile when first isolated, but became actively motile with long filaments by the sixth sub-culture on agar, the biochemical characters remaining the same as before.

I am indebted to Captain J. G. Thomson for the following measurements from a film from a twenty-four hours' culture on agar. Length: maximum, 4 microns; minimum, 1-5 microns; average about 2-5 microns. Breadth: maximum, 1 micron; minimum, 0-5 micron; average about 0-75 micron. The organism thus shows long and coccoid forms. It is broader than B: typhosus. It is rounded at the ends. It sometimes grows end to end in long chains.

Kliimenko's strains were mostly short thick bacilli with rounded ends. He describes a type with long motile filaments and sharp cut ends.

All the strains of Group I were non-motile in the primary culture.
Strains became actively motile on sub-culture and several of the others sluggishly motile.

All the strains showed flagella when stained by the method of Nicolle and Morax, the typical arrangement being two at each end, but sometimes there is a leash of six flagella at the end. This agrees closely with the type species.

Staining.—Most of the strains show Neisser granules in the protoplasm of a large proportion of the bacilli, but this is not a constant character. There are no spores. None of my strains stained by Gram’s method. No growth took place in one week in broth cultures incubated anaerobically. No indol was found in peptone broth after one week’s incubation at 37° C. None of the strains liquefied gelatine in one month. There was no sign of clarification of milk after one month at 37° C. (six strains).

Effect on Carbohydrates.—No acid nor gas was formed by any strain in lactose, glucose, saccharose, maltose, mannite, dulcitol, and dextrine, one per cent peptone broth. Four strains tested with galactose, arabinose, levulose, and glycerine, also proved negative. There was usually marked alkali production in these media.

Growth in Bouillon.—A marked pellicle was usually formed rapidly. The pellicle formation is especially rapid in broth containing carbohydrates. A somewhat granular deposit formed at the bottom of the tube.

Reducing Power.—The colour of neutral red (Grübler) was rapidly changed to light yellow on MacConkey’s medium containing glucose or lactose. Neutral red peptone water showed only the usual alkaline change. Some of the strains reduced the colour of litmus after prolonged incubation in litmus tinctured media.

Pigment Formation.—The growth on potato was light brown. The growth on old agar cultures sometimes became slightly brownish. There was never any colouration of the medium.

Pathogenicity.—Emulsions in salt solutions of a few loopfuls of two recently isolated strains were injected intraperitoneally into guinea-pigs without producing any visible effect on the health of the animals.

Specific Agglutination Test.—The macroscopic method was used in a few observations of this kind made. It is often difficult to prepare a suitable emulsion of the organism. On the whole it would appear that the agglutination test is not of much value in the diagnosis of the Near Eastern strain of B. faecalis alkaligenes.

Group II.—Haemoculture Strains.

This group isolated from similar cases gives similar reactions to the tests applied. Morphologically the strains were coccoid with only a few bacillary forms. I did not succeed in demonstrating flagella. No motility developed after repeated sub-culture in young cultures. Litmus
was more rapidly reduced and neutral red more rapidly decolorized than by the first group. Milk showed distinct clarification after fourteen days. These strains had the other characters of the first group.

Strains from Feces and Urine.—These closely conformed to Group I, but many strains were actively motile when first isolated. Several strains gave a viscous pellicle on broth. Six strains only were put through all the above tests. Usually I think it sufficient to identify an organism as *B. faecalis alkaligenes* to apply the following tests: Motility in hanging drop, Gram's stain with counter stain, litmus milk, gelatine, agar slope, peptone bouillon and lactose, and glucose one per cent litmus peptone water. The use of the agar slope avoids confusion with *B. pyocyaneus* and other pigment producers.

The discrete colonies on MacConkey's lactose bile salt agar are fairly characteristic, being large, transparent, with irregular edge and surface, and surrounded by a marked zone of yellow.

There is a fairly close agreement between the characters of most of my strains and Klimenko's Sub-group I. They are almost certainly the same species. Three strains isolated from Cases 10, 11, and 12, possibly belong to a distinct species.

Most of the organisms in my series were isolated by means of a technique and culture medium similar to that employed by Captain Shearman. Since November, owing to difficulties in obtaining suitable ingredients for this medium, a modified MacConkey's medium was used with beef broth as a base, and azolitmin as an indicator, our stock of Grübler's neutral red being almost exhausted.

The blue colonies of *B. faecalis alkaligenes* show up well on such a medium, if they are sufficiently discrete from the *B. coli*.

Most of the fecal strains were isolated on this medium. If a special search for *B. faecalis alkaligenes* is being made, it is best to include all the principal carbohydrates in the same medium, instead of using only lactose.

**Pathogenicity of *B. faecalis alkaligenes* to Man.**

In addition to the question whether the term *B. faecalis alkaligenes* is being applied to a single variable species or to a group of closely related species, the question also arises as to whether *B. faecalis alkaligenes* is a true pathogenic organism or only a secondary invader from the bowel.

It is now well established that intestinal *B. coli* do not invade the system through healthy mucous membrane, but are not uncommon as secondary causes of bacillæmia in cases of dysentery, enterica, and other inflammatory conditions of the coat of the intestine.

*B. coli* bacillæmia is well known all over Europe. As already mentioned we have records of twelve cases during 1916 at this hospital.
With a view to shedding more light on the question, I have carefully examined 100 consecutive stools of enteric convalescent and dysentery patients received in the laboratory since November 25, 1916, and also the stools of fifty patients in the general wards and venereal compound who gave no definite history of diarrhoea, enterica or dysentery during the two months before admission. They all received a preliminary purge before taking a sample. The results are as follows:

<table>
<thead>
<tr>
<th>Abnormal stools</th>
<th>Total</th>
<th>B. faecalis alkaligenes found</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enteric convalescents</td>
<td>43</td>
<td>16</td>
</tr>
<tr>
<td>Dysentery convalescents</td>
<td>57</td>
<td>29</td>
</tr>
<tr>
<td>Normal stools</td>
<td>50</td>
<td>Nil</td>
</tr>
</tbody>
</table>

The colonies of B. faecalis alkaligenes when present, were often very numerous.

The B. paratyphosus A was found also in one of the convalescent enterica stools. Two B. dysenteriae (Flexner) and one B. dysenteriae (Shiga) were isolated from the dysentery stools.

This result is very striking and strongly suggests to my mind that B. faecalis alkaligenes multiplies in certain abnormal states of the bowel, but is present in small numbers, if at all, in normal individuals in this country.

Nevertheless reference to Table I shows that I have been unable to trace any direct association with bowel complaints in some of the cases. Cases 1, 6, 8, 10, and 11, exhibit such associations clearly. Various forms of dysentery and diarrhoea are very prevalent in Egypt. Mild infections with dysentery bacilli may cause very few symptoms and the occasional passage of a small amount of blood and mucus is apt to be disregarded by the men.

I may mention that Captain J. G. Thomson has found that lesions due to Entamoeba histolytica and other pathogenic protozoa are more frequently present and may cause less obvious symptoms than is generally believed. I understand that isolated amebic ulcers were commonly found post mortem in the bowels of men killed in action on the Gallipoli Peninsula, who had not reported sick. The normal cases were all examined quite recently, when the dysentery season was practically over.

My own view is that B. faecalis alkaligenes is an organism of low virulence to man, perhaps commoner here than in most other localities, which is capable of multiplying in the bowel in certain favourable conditions, and occasionally gains access to the blood-stream through a more or less damaged mucous membrane, thereby producing a mild enteric-like infection.

B. faecalis alkaligenes may be regarded as intermediate in its pathogenicity to man between the B. coli group and the true enterica group.
**TABLE I.**

<table>
<thead>
<tr>
<th>Case number</th>
<th>Probably infected in</th>
<th>Leading features</th>
<th>Complications</th>
<th>Association with dysentery and enteric</th>
<th>Laboratory findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Serjt. P., aged 25</td>
<td>Sidi-Bishr Camp</td>
<td>Mixed infection, <em>B. typhosus</em> and <em>B. fecalis alkaligenes</em>, commenced as ordinary attack of typhoid. In hospital from 8.7.16 to 18.11.16 (dated invalidated to England); <em>B. fecalis alkaligenes</em> attack fifteen days, 8.9.16 to 23.9.16</td>
<td>Typhoid pyonephrosis, operations, nephrotomy. Left kidney not enlarged.</td>
<td>Ten days after second attack 8.7.16. <em>B. typhosus</em>, blood</td>
<td>T.A.B. 2</td>
</tr>
<tr>
<td>(4) Drvr. P., aged 22</td>
<td>Salonika</td>
<td>Irregular pyrexia seven days, 18.9.16 to 22.9.16. Did not react properly to quinine. 18.9.16 to 24.9.16</td>
<td>Benign tertian malaria</td>
<td>No history of dysentery or enteric</td>
<td>T.A.B. 2</td>
</tr>
<tr>
<td>(5) Pte. F., aged 26</td>
<td>Sidi-Bishr</td>
<td>Pyrexia six days. Complications insufficiently acute to explain temperature</td>
<td>Gonorrhoeal epididymitis. 'Malaria?'</td>
<td>No history of dysentery or enteric</td>
<td>T.A.B. 2</td>
</tr>
<tr>
<td>(6) Pte. B., aged 25</td>
<td>India</td>
<td>Irregular pyrexia forty days, 5.10.16 to 14.11.16</td>
<td>Nil</td>
<td>History of chronic dyspepsia</td>
<td>T. 2</td>
</tr>
<tr>
<td>(7) Gnr. B., aged 21</td>
<td>Salonika</td>
<td>Irregular pyrexia thirty-six days, 3.10.16 to 8.11.16. Quinine no effect on temperature. Spleen not enlarged. Clinically typical case</td>
<td>Nil</td>
<td>B. <em>fecoalis alkaligenes</em> attack possibly preceded by <em>B. paratypoid A</em> infection</td>
<td>T.V. 2 Feb., 1915</td>
</tr>
<tr>
<td>(8) Drvr. T., aged 22</td>
<td>Salonika</td>
<td>Irregular, pyrexia thirty-one days, 1.11.16 to 1.12.16. Probably began illness with <em>B. typhosus</em> infection, followed by <em>B. fecalis alkaligenes</em> attack</td>
<td>Pleurisy with effusion. Benign tertian malarial parasites found at Salonika</td>
<td>No history of dysentery</td>
<td>T.V. 2 Sept., 1914</td>
</tr>
</tbody>
</table>

**Laboratory findings**: Inoculations

- *B. typhosus* positive, 1/800 Widal
- *B. fecalis alkaligenes*, pleurisy with effusion 11.16
- *B. typhosus* positive, 1/200 Widal
- *B. fecalis alkaligenes* negative 1/25
- *B. typhosus* positive, 1/200 Widal
- *B. fecalis alkaligenes* negative 1/25
- *B. typhosus* positive, 1/200 Widal
- *B. fecalis alkaligenes* negative 1/25
<table>
<thead>
<tr>
<th>Case</th>
<th>Surname</th>
<th>Age</th>
<th>Symptoms</th>
<th>Diagnosis</th>
<th>Treatment</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Rfmmn. S.</td>
<td>47</td>
<td>Irregular pyrexia eleven days, 4.1.17 to 16.1.17. Clinically typical of <em>B. fecalis alkaligenes</em> infection</td>
<td>Stricture of urethra, 10.12.16</td>
<td>No previous history of enteric or dysentery</td>
<td>T.V. India</td>
</tr>
<tr>
<td>10</td>
<td>Capt. H.</td>
<td>41</td>
<td>Pyrexia four days, 25.1.17 to 28.1.17. Sudden onset with rigor. Dysentery second day</td>
<td>Bacillary dysentery</td>
<td>Contracted dysentery of <em>B. dysenteriae</em> (Flexner) isolated in England</td>
<td>T. 1911</td>
</tr>
<tr>
<td></td>
<td>R.A.M.C.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No T.A.B.</td>
</tr>
<tr>
<td>11</td>
<td>Pte. G</td>
<td>32</td>
<td>Pyrexia five days, 29.1.17 to 2.2.17. Sudden onset with rigor. Laboratory- orderly</td>
<td><em>Nil. B. fecalis alkaligenes</em> infection during convalescence from attack of dysentery</td>
<td>Admitted hospital with dysentery 22.1.17</td>
<td>T.A.B. 1916</td>
</tr>
<tr>
<td>12</td>
<td>Gnr. H.</td>
<td>52</td>
<td>Pyrexia four days after admission, 31.1.17 to 3.2.17. Sudden onset</td>
<td>Said to be convalescent from malaria</td>
<td>No history of dysentery</td>
<td>No malarial parasites found in India</td>
</tr>
</tbody>
</table>

Case 4 was the only one giving a marked diazo reaction. The spleen could be felt in Cases 4 and 5. The enlargement in Case 4 was clearly due to malaria and possibly in Case 5 also.

Case 4 has the very unusual complication of a pyonephrosis due to the *B. typhosum*. It is likely that the patient had a hydronephrosis before his illness, which became infected with *B. typhosum* in the bacillorea stage of this infection. The specific organism was isolated on pure culture from the pus of the nephrotomy wound.

The *B. pyocyaneus* was isolated from the urine and faces of Case 9. Many cases of bacillœmia due to this organism have been reported from tropical countries, where it is often omnipresent.

*B. pyocyaneus* has been shown to be only capable of invading the system through damaged mucous membrane.

Cases 11 and 12 were in hospital together. Clinically they resembled one another very closely. The symptoms were similar to the earlier cases, but the pyrexial period was very short. No connexion between them could be traced. As will appear later, the organisms isolated from the blood had exactly similar characters and differed distinctly from the other nine strains.
Clinical and other Notes

of bacteria. Both clinically and pathogenically *B. fæcalis alkaligenes* infections seem more nearly related to disease conditions due to the coli group of organisms than to the true enterica group. *B. fæcalis alkaligenes* infection seems widely distributed in Egypt. Captain Wilmore tells me that he has recently discovered several cases of *B. fæcalis alkaligenes* bacillæmia at Suez.

*B. fæcalis alkaligenes* has been isolated from dust and from contaminated water supplies by several bacteriologists in Egypt. This is only natural in view of its great prevalence in diarrhoeal stools in this country. As an indication of pollution of a water supply, I would attach more significance to its presence than to ordinary *B. coli*, but its occasional presence in small numbers need not cause alarm.

I agree with Captain Shearman that with the diminution in the incidence of the ordinary enterica infections as the result of inoculation, obscure febrile diseases due to *B. coli*, *B. fæcalis alkaligenes* and *B. pyocyaneus* and their allies, are likely to come into increased prominence as a cause of sickness among troops living under insanitary conditions.

Many cases of this type running a short course must occur which are never admitted to hospitals provided with laboratory facilities.

I am much indebted to Captain H. Wiltshire for the notes on his cases, and to Captain J. G. Thomson, R.A.M.C., for assistance in the preparation of the paper, and also to the medical officers in charge of the wards in the Hospital, particularly Captains Blood and Bradley, for procuring specimens and clinical notes, and to Colonel Sandwith and Dr. Grendiroupolo for kind help in getting together the available literature.

REFERENCES.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Petruschky (Sub-Group I)</th>
<th>Straubo Krais. (Strain 1)</th>
<th>Straubo Krais. (Strain 2)</th>
<th>Rochaix and Marotte</th>
<th>Castellani</th>
<th>Shearman</th>
<th>Hirst</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MOBILITY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perifichal</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td>Variable</td>
<td>Variable</td>
<td></td>
</tr>
<tr>
<td><strong>GELATINE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Polar</td>
<td>Polar</td>
<td></td>
</tr>
<tr>
<td>Not liquefied</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not liquefied</td>
<td>Not liquefied</td>
<td></td>
</tr>
<tr>
<td>Turbid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>General turbidity, Floccal pellicle.</td>
<td>General turbidity, Pellicle.</td>
<td></td>
</tr>
<tr>
<td><strong>CARBOHYDRATES</strong></td>
<td>Not fermented</td>
<td>Not fermented</td>
<td>Not fermented</td>
<td></td>
<td>Not fermented</td>
<td>Not fermented</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>General turbidity, Pellicle.</td>
<td>General turbidity, Pellicle.</td>
<td></td>
</tr>
<tr>
<td><strong>LITMUS MILK</strong></td>
<td>Very blue</td>
<td>Blue</td>
<td>Blue</td>
<td></td>
<td>Very blue</td>
<td>Blue</td>
<td></td>
</tr>
<tr>
<td><strong>MILK</strong></td>
<td></td>
<td>Slow clarification</td>
<td>Clariification</td>
<td></td>
<td>Clarification</td>
<td>Clarification</td>
<td></td>
</tr>
<tr>
<td><strong>INDOL</strong></td>
<td>Negative</td>
<td>Negative</td>
<td>Negative</td>
<td></td>
<td>Negative</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Browning of potato</td>
<td>Light brown on potato</td>
<td>Nil</td>
<td>Nil</td>
<td></td>
<td>Nil</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td><strong>PATHOGENICITY</strong></td>
<td>For guinea pigs</td>
<td>Not pathogenic to guinea-pigs, white mice and rats</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>INTRAPEPTONAL INFECTION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>AGGLUTINATION BY PATIENT'S SERUM</strong></td>
<td>From description given in Flügge's Text-book</td>
<td>Characters of seven strains from various sources including Petruschky I and II</td>
<td>Strain isolated from blood of a case giving history of dysentery followed by irregular pyrexia</td>
<td></td>
<td>Characters tabulated in Chalmers and Castellani's Text-book</td>
<td>General characters of 11 strains isolated from blood</td>
<td></td>
</tr>
<tr>
<td><strong>REMARKS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: The table details various characteristics and experiments performed on different bacterial strains isolated by various authors.*