ENTERITIS DUE TO *B. DYSENTERIAE* SONNE

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In recent years outbreaks of dysentery and enteritis have been found, on occasion, to be due to late lactose fermenting organisms allied to the Flexner dysentery group. Sonne (1915) found that the main cause of dysentery in Copenhagen was a late lactose fermenting bacillus. D'Herelle (1916) in France and Øhnell (1918) in Sweden also found this atypical organism to be associated with cases of dysentery. Andrewes (1918) suggested the name *B. dispar* for lactose fermenting members of the dysentery group, which he obtained from cases of suspected dysentery and from convalescents. Thjøtta (1919) in Norway while investigating cases of dysentery obtained 40 strains of Flexner dysentery bacilli (Thjøtta group II) and 25 strains of the Sonne type (Thjøtta group III). He explained that the less frequent finding of the Sonne type was due to the fact that this organism often caused a mild diarrhoea that was not sufficiently serious to necessitate the services of a physician, with the result that the cases were not subjected to bacteriological investigation. He showed that the Sonne bacilli had the following characteristics, viz.: Large irregular crenated colonies grew on litmus lactose agar plates; acid was produced in maltose and glucose, and occasionally in lactose; no indol was produced; and serologically the group showed no relationship to the other groups of dysentery bacilli (Flexner and Shiga).

In Japan Mita (1921) isolated from children who clinically were suffering from dysentery, bacilli similar in their cultural characteristics to the type described by Sonne. These strains he called para-dysentery bacilli. In a further paper Thjøtta and Sundt (1921) showed that the Sonne bacillus produced both an endotoxin and an exotoxin. The endotoxin was the most marked in effect and produced intestinal symptoms in rabbits and mice. The exotoxin was mild in its action as compared with the exotoxin of *B. dysenteriae* Shiga and produced paresis in rabbits while mice reacted non-specifically to it. In Australia, Paterson and Williams (1922) recovered the Sonne bacillus from patients suffering from enterocolitis, dysentery, and summer diarrhoea. They found that this organism produced acid in lactose peptone water in from seven to ten days but after repeated sub-culture the acid production occurred earlier. The bacilli were agglutinated in low dilution by a monovalent serum prepared from the X strain of Flexner dysentery bacilli of Andrewes and Inman (1919) but the absorption test showed that the homologous agglutinins were not removed. More recently Bamforth (1924) has described a small outbreak of dysentery due to a late lactose fermenting type. The serological relationship of the causative organism to the Sonne bacillus was not established.

Clinical Features of Cases. In December 1923 a small outbreak of enteritis occurred in a ward of the City Hospital, involving within a period of 24 hours four infants whose ages ranged from 5 to 15 months.

The first case occurred on the evening of 28th December and the remaining three in the course of the next day. Attention was drawn to the condition by an elevation of temperature accompanied by a corresponding acceleration of the pulse rate. The maximum temperature was attained within 24 hours and varied from 100·4° to 101·8°. Abdominal distension and subsequent passage of mucus were common features, while two of the cases showed traces of blood in the stools. Abdominal pain was not a noticeable symptom, nor was diarrhoea a prominent feature. The symptoms lasted from 36 hours to $4\frac{1}{2}$ days and recovery took place in every case, only one patient showing loss of weight as a result.

Bacteriological Findings. From the faeces of two out of the four cases non-lactose fermenting colonies were obtained on McConkey plates at the first examination. The colonies were not numerous, two colonies being obtained on one plate and one on another. The colonies were larger than those of the true dysentery bacilli and when the strains were replated on agar showed markedly crenated edges. Growth on an agar slope showed no special characteristics. The two strains, tested immediately after isolation, gave the following fermentation reactions:

	Allan strain			Hendry strain		
Day of incubation	1	8	10	1	8	10
Lactose	0	S.A.	A.	0	S.A.	A.
Mannite	A.	A.	A.	A.	A.	A.
Glucose	A.	A.	A.	A.	A.	A.
Dulcite	0	0	0	0	0	0
Saccharose	0	0	0	0	0	0
Sorbite	0	0	0	0	0	0
Salicin	0	0	0	0	0	0
Milk	A.	A.	A.	A.	A.	A.

A. = Acid. S.A. = Slight acid. 0 = No change.

The organisms were found to be non-motile. They did not produce indol, and did not liquefy gelatin. Lead acetate medium showed definite blackening and both strains were capable of reducing nitrates to nitrites.

Two months after the Allan and Hendry strains had been isolated, *B. dysenteriae* Sonne (No. 268) was obtained from the National Collection of Type Cultures and the three strains were retested against an extended series of sugars. The strains were incubated for 14 days and the summarised results of the fermentation tests are as follows:

A. *Monosaccharides.*

1. Hexoses.
   Dextrose, laevulose, galactose, mannose.
   All strains produced acid in 24 hours.
2. Pentoses.
   Arabinose, xylose.
   All strains produced acid in 24 hours in arabinose, but no change occurred in xylose.

3. Methyl Pentose.

Rhamnose.

All strains produced acid in 24 hours.

B. *Disaccharides.*

1. Maltose.

All strains produced acid in 24 hours.

2. Lactose.

B. dysenteriae Sonne No. 268 produced slight acid on the third day and very definite acidity after five days' incubation. The Allan and Hendry strains produced a slight acid change on the second day and the medium was markedly acid on the third day.

3. Saccharose.

Acid was produced by all strains in 24 hours. At the first test the Allan and Hendry strains produced no acid in 10 days.

4. Trehalose.

All strains produced acid in 24 hours.

C. *Trisaccharides.*

1. Raffinose and Melezitose.

No acid production occurred with melezitose but *B. dysenteriae* Sonne No. 268 produced acid in raffinose in 24 hours. The other strains did not cause any change in 14 days.

D. *Polysaccharides.*

1. Dextrin.

All strains produced slight acid after 24 hours' incubation but the medium became definitely alkaline in three days.

2. Starch and Inulin.

No change occurred.

E. *Alcohols.*

Mannitol, Glycerol, Dulcitol, Sorbitol.

All strains produced acid in mannitol in 24 hours, and all strains produced slight acid in glycerol on the third day and definite acidity by the fifth day. The media containing dulcitol and sorbitol were unaffected by any of the strains.

F. *Glucosides.*

Salicin and Inosite.

No change occurred.

After isolation the Allan and Hendry strains were found to be pathogenic for rabbits. One-fifth of an agar slope culture when given intravenously killed rabbits in 24 hours and 2 c.c. of a killed broth culture also produced this effect. The result of intraperitoneal inoculation of guinea pigs and mice was uncertain, some of the animals surviving.

Blood was obtained from all four patients ten days after the commencement of the illness. The serum of one patient, from whom the bacillus was not

isolated, but who was ill for 4½ days agglutinated the Allan and Hendry strains to 1 in 240 and 1 in 480 respectively. The serum from the patient Hendry agglutinated the Hendry and Allan strains in a dilution of 1 in 30. Ten normal sera gave no agglutination against the Allan and Hendry strains in a dilution of 1 in 30. The sera from the patients were tested against the V, W, X, Y and Z strains of Flexner bacilli and against *B. dysenteriae* Shiga but no agglutination was obtained in a dilution of 1 in 60.

Agglutinating sera were prepared for *B. dysenteriae* Sonne No. 268 and for the Allan and Hendry strains. The serum for *B. dysenteriae* Sonne agglutinated the Allan and Hendry strains to titre (1 in 1500), the Allan serum agglutinated strains No. 268 and Hendry to titre (1 in 1000), and the Hendry serum agglutinated strains No. 268 and Allan to titre (1 in 2000).

Absorption of agglutinins showed the following:

Serum	Titre	Titre after absorption with Strain No. 268	Titre after absorption with Strain Allan	Titre after absorption with Strain Hendry
No. 268	1500	nil.	nil.	nil.
Allan	1000	nil.	nil.	nil.
Hendry	2000	nil.	nil.	nil.

The strains were tested against monovalent sera prepared from *B. dysenteriae* Flexner V, W, X, Y, and Z, and *B. dysenteriae* Shiga. The V serum which had a titre of 1 in 20,000 agglutinated all the strains (No. 268, Allan and Hendry) to a titre of 1 in 400 but the absorption agglutinin tests showed that the homologous agglutinins were not removed Agglutinating sera prepared against *B. typhosus*, *B. paratyphosus* A, *B. paratyphosus* B, and *B. enteritidis* Gaertner had no action on any of the strains.

The effort to trace the source of infection was unsuccessful, the faeces of the other patients in the ward and of the nursing staff in charge of the children being examined with negative results.

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