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A NOTE ON THE INTER-CLASSIFICATION OF THE GAERTNER GROUP.

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THE bacteria which may be included together as the Gaertner Group are of considerable importance, comprising as they do most of the bacteria found in outbreaks of food poisoning and in paratyphoid fever, while they are etiologically concerned with a number of diseases in animals both domesticated and wild.

The arrangement of bacteria into groups is very convenient and has been extensively practised. The Gaertner group itself is really a sub-group of the large coli-typhoid group, the members standing in their cultural characters between the chemically active coli group and the chemically rather inactive typhoid group.

The differentiating characters of the Gaertner group are chiefly cultural and may be stated as follows:

Short sporeless bacilli with rounded ends usually exhibiting marked motility. Grow as a white or translucent growth upon gelatine without any liquefaction. Produce at first some acid in litmus milk, then after a few days (the exact time shows considerable variation) marked production of alkali. The milk is never clotted. Indol is not produced. Glucose and mannite are fermented with production of acid and gas, while lactose and saccharose are not fermented.

The bacilli found in nature with these characters may be conveniently divided into two sub-groups:

Sub-group A. True Gaertner bacilli.
„ „ B. Para-gaertner bacilli.

True Gaertner bacilli. These bacilli are all culturally indistinguishable, and in addition to the above group characters they ferment dulcite,

maltose, galactose and laevulose, while they do not ferment salicin, raffinose or glycerine. In glycerine they may produce a little acid, but never gas.

While culturally indistinguishable these bacilli can be differentiated, by means of agglutination and other serological tests, into several organisms. Apparently at least four can be distinguished, *i.e. B. enteritidis* Gaertner, *B. suipestifer*, *B. paratyphosus* β and *B. morbificans bovis*. *B. paratyphosus* α cannot be considered a member of the sub-group.

The Gaertner organisms isolated from outbreaks of food poisoning were shown by Durham, and also independently by De Nobele, to be sharply separated by means of their agglutination properties into two groups. The one group of bacilli are identical with *B. enteritidis* Gaertner, the other are identical with *B. aertrycke*.

Most investigators are now in agreement that the food poisoning bacilli of the aertrycke type are indistinguishable from *B. suipestifer* and that they are the same bacilli (Boycott, Savage and Bainbridge in England, Kutscher and Meinicke, Bock, etc. in Germany).

B. suipestifer is the organism isolated from most cases of swine-fever or hog-cholera. At one time supposed to be the cause of this disease it is now known to play only a secondary part and not to be the real cause.

B. paratyphosus β is the cause of the majority of cases of paratyphoid fever. There is a decided difference of opinion as to whether this organism is identical with *B. suipestifer*. In Germany, Kutscher and Meinicke carried out an extended series of investigations and came to the conclusion that these two bacilli were identical. They did not however carry out absorption tests. Their results have been confirmed by Sobernheim and Seligmann and other German investigators, and it may be said that, with but very few exceptions, the German view is that these two strains are identical. Bock, however, using absorption tests, found a distinction between these two organisms.

On the other hand English investigators have found differences, *e.g.* Boycott, Bainbridge and Savage. Bainbridge and O'Brien have quite recently published an extended series of absorption tests which show clearly that these two organisms can be differentiated.

I am decidedly of opinion that *B. paratyphosus* β is not identical with *B. suipestifer*.

Rat Gaertner bacilli. A number of Gaertner bacilli have been isolated from rats and used to exterminate these rodents. Bainbridge, from agglutination and absorption tests, concluded that the Raticide

bacillus was identical with *B. suipestifer* and that the others were identical with *B. enteritidis*.

B. typhi murium. From the different investigations it is clear that this is not a separate entity but that some of the organisms so labelled are *B. enteritidis* and others *B. suipestifer*.

B. septicus vitulorum. From my investigations it is a *B. enteritidis* strain. This organism was isolated by Thomassen in 1897 in cases of fatal septicaemia in calves. Similar bacilli have been isolated by later investigators.

The position of *B. psittacosis* is not quite clear, but Böhme concluded that it belonged to the *B. suipestifer* group.

B. morbificans bovis. Isolated by Basenau from the organs of an emergency slaughtered cow. It does not seem possible to place this organism as identical with any of the above. Sobernheim and Seligmann found that it was not agglutinated by either Gaertner or paratyphoid serum. This also is my experience.

In view of these facts the following classification may be adopted.

Gaertner group.

Sub-group A. *Gaertner-verus.* All culturally identical.

1. *B. enteritidis.* Includes not only many of the Gaertner bacilli isolated from food poisoning outbreaks but also *B. danysz* and most of the other rat viruses, some of the strains of *B. typhi murium* and probably *B. septicus vitulorum.* Some of the bacilli causing spontaneous outbreaks of disease in mice and guinea-pigs are identical with *B. enteritidis.*

2. *B. suipestifer.* Includes *B. suipestifer* itself, organisms isolated from supposed healthy pigs, all the food poisoning bacilli of aertrycke type, some of the *B. typhi murium* strains, probably *B. psittacosis* and some of the bacilli causing outbreaks of disease amongst mice and guinea-pigs.

3. *B. paratyphosus β.* The organism causing paratyphoid fever; also found in the human intestine in carrier cases.

4. *B. morbificans bovis.*

Sub-group B. *Para-gaertner.*

Sub-group C. *B. paratyphosus α.*

Para-gaertner bacilli. The bacilli which are included in this sub-group are a number of organisms, for the most part unnamed, which appear to be not very uncommon in the healthy animal and human intestine and, which from their close resemblance to true Gaertner bacilli

are of great interest. I first drew attention to their presence in a series of reports to the Local Government Board (1906–07, 1907–08, 1908–09), finding them present in small numbers in the healthy animal intestine and in even smaller numbers in the human intestine.

They possess the general Gaertner group characters described above but can be culturally distinguished when an extended series of tests is employed. Of these additional tests the fermentation of dulcite, salicin and glycerine are the most valuable in my experience. True Gaertner bacilli ferment the first but not the other two substances.

As an illustration of their prevalence it may be mentioned that from the intestinal contents of 31 animals specially investigated for Gaertner bacilli 11 organisms of this sub-group were isolated. Of these all but one could be distinguished by the dulcite and salicin tests, since eight fermented salicin and the other two failed to ferment dulcite. The remaining bacillus, isolated from horse dung, resembled true Gaertner bacilli very closely as regards its cultural characters, the only difference being that it fermented glycerine within 24 hours with the production of a large amount of gas.

In addition to these cultural differences all the para-gaertner bacilli which I have isolated failed to be appreciably agglutinated by sera obtained by immunizing animals with any of the members of the true Gaertner sub-group. They are also for the most part non-pathogenic.

In investigations upon the distribution in nature of Gaertner bacilli steps must be taken to differentiate these para-gaertner bacilli, otherwise Gaertner bacilli will be recorded as being much more widely distributed in nature than is actually the case. Failure to do this is probably the chief cause of the discrepancy of recorded results on this subject.