

do not cause diphtheria cannot be spoken of as diphtheria bacilli until it is shown that they are *potential* diphtheria bacilli, that by passage, &c., they can be made to produce ectotoxins. Until this has been done they must be treated as distinct. In every other respect they are not distinguishable from *B. diphtheriæ*.

*B. xerosis* forms on blood serum agar whitish or colourless colonies, dry and adherent, growing not very actively, and consisting of large rather thick individuals with clear-cut segmentations. Neisser's granules large and irregular. Common upon the conjunctiva. Does not ferment lactose or dextrine. There has been considerable confusion regarding forms described under this heading. Mellon, from the study of one strain only, describes it as negative to saccharose, while Hamilton includes a maltose fermenter under this name which Mellon would class as *B. flavidus*. That here given is the more commonly accepted sugar formula, though acid is produced so slowly with dextrose that earlier observers reported the fermentation to be negative. Eyre isolated a form from cases of chalazion which he found pathogenic for guinea-pigs, causing local oedema on inoculation. Other observers find it devoid of virulence, and it does not produce ectotoxins.

*B. flavidus*.—Morphologically and culturally very similar to the preceding, save that with age the colonies become pale yellow. Dry adherent growths on blood and serum media. Neisser's granules large and irregular. While not producing ectotoxins, Hamilton found it pathogenic for guinea-pigs (four out of seven strains). Mellon would give this name to organisms "similar in most respects to the Klebs-Loeffler bacillus, but lacking the specific toxin formation of the latter." Morse lays stress on the fact that, unlike *B. diphtheriæ*, it is a weak fermenter, and that "usually" saccharose, maltose and glycerine are not fermented.

The observations of Captain Adams at Folkestone that the strains isolated there, while giving the sugar formula of *B. xerosis*, nevertheless assumed the yellowish colour which is associated with *B. flavidus*, suggest strongly that Hamilton is correct in admitting a considerable variation in the fermentative activities of the former. But in that case *B. flavidus* as such becomes non-existent, save as a variant of the earlier named *B. xerosis*, and all come under the one heading of *B. xerosis*. We are not prepared to make a decisive ruling on this point, and hence, provisionally, record both forms, although registering an opinion that *B. xerosis*, *B. flavidus* and *B. hoagii* form a closely allied series of forms.

*B. hoagii*.—Under this heading it appears proper to include a very widely distributed group of non-pathogenic diphtheroids growing actively on blood media, and giving abundant moist confluent growths which take on a salmon-pink or tawny colour, becoming buff with age. They vary in their fermentative activities; in general ferment saccharose actively, and do not ferment lactose and dextrine. Maltose at times fermented, at times not. Individual bacilli of medium size smaller than the members of the two preceding species, but larger than *B. hofmanni*, thick, solid, barred, or wedged-shaped. Neisser's granules abundant but small.

We are of the opinion that Benham's organism\* which he obtained from cases of common cold belonged to this group, and not, as Mellon regards it, to the *B. enzymicus* series, and that therefore, by the laws of priority, his name *B. septus* (1906) should be applied to this sub-group, but both Benham and Graham Smith identified their organisms with Cautley's *B. coryzæ segmentosus*, and doing this report fermentative activities so divergent as to create confusion. Hine's skin and urethral diphtheroids are here apparently to be included, the latter fermenting dextrine, the former not.

*B. ruedigeri*.—Ruediger isolated this organism in 1903. It grows heavily on agar and various media, and causes diffuse clouding of broth. It ferments none of the "sugars," although it decolorizes litmus milk, but this without the production of acid (reduction process). It produces an ectotoxin fatal to guinea-pigs, which is not neutralized by diphtheria antitoxin. Rare.

*B. hofmanni*.—Small, solid, wedge-shaped forms, smaller than *B. diphtheriæ*. No Neisser's granules. Growths colourless. Ferments none of the sugars. Non-toxic.

This table and these descriptions are, we admit, pro-

visional. More has still to be accomplished in the matter of reciprocal agglutination and complement fixation tests before the relationships by these various sub-groups is clearly determined. We give the table tentatively in the hope that it may be of service to others and form the basis for further work.

Comparing this with the table already given of our results, it will be seen that our Wound Diphtheroids (I) come under the category of *B. enzymicus*, our Wound Diphtheroids (II) are *B. hoagii*, and our Wound Diphtheroids (III) are *B. xerosis*.

#### CONCLUSIONS.

(1) Morphologically and, in the early stages, culturally, diphtheroid bacilli from wounds are, many of them, indistinguishable from *B. diphtheriæ*.

(2) Harmless, non-toxic bacilli may be present in wounds affording cultures possessing the same sugar formula as regards dextrose, lactose, saccharose and dextrine, as does the true virulent Klebs-Loeffler bacillus.

(3) It is not justifiable, therefore, to make a diagnosis of diphtherial infection of wounds, either from smears alone or from stained preparations and cultural characteristics.\* The demonstration that the bacilli produce toxins—ectotoxins—i.e., the result of inoculation of broth cultures, is alone capable of proving the presence of infection by the true virulent *B. diphtheriæ*.

(4) By the staining, cultural and fermentation tests, four cases of apparent diphtherial infection have been detected in a careful bacteriological study of 306 cases of open wounds. By the decisive test of inoculation these are reduced to two.

(5) There is a large body of evidence showing that even isolated cases of diphtherial infection of wounds are distinctly uncommon among the wounded overseas, and complete absence of any evidence in Great Britain that these isolated cases have acted as foci for the spread of the infection to other wounded men. No evidence of a widespread infection of open wounds by diphtheria bacilli has been discovered in Canadian hospitals overseas in Great Britain.

(6) Diphtheroid bacilli of various orders, while not common, are, as might be expected, more frequent in open wounds. There is no evidence that these have exerted deleterious effects.

(7) There is a certain amount of evidence that particular species of diphtheroid bacilli characterize particular hospitals.

### CHRONIC HYPERTROPHIC PULMONARY OSTEO-ARTHRITIS FOLLOWING BRONCHIECTASIS.

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THE comparative rarity of the clinical picture presented by the following case seems to justify its being recorded.

Private S. R., Regimental No. 865298, 44th Canadian Battalion, single, aged 21, was admitted to No. 16 Canadian General (Ontario) Military Hospital, Orpington, November 15, 1917, complaining of cough and profuse expectoration and weakness.

The family history was unimportant, and no other member has been similarly affected.

The patient had diphtheria at 4 years of age. He states that since 7 years of age he has, at intervals, had a slight cough, but it never gave him any special trouble until the onset of his present illness.

He enlisted in Canada in March, 1916. In June of the same year, while at Camp Hughes, between Winnipeg and Brandon, he contracted a left-sided pneumonia, for which he was confined to bed for six weeks. Seven weeks after the onset of the pneumonia he began to have an annoying cough

\* E.g., advice has been received from Canada that a bacteriological examination of the wounds of returned invalids at the time of their leaving the hospital ship on January 10, 1918, before any of the wounds had been dressed on shore, revealed the presence of "bacteria similar to diphtheria bacilli" in fourteen cases. Further information is promised regarding these cases. The wording of the information indicates that inoculation tests had not at that time been performed.