

bacillus. Upon inoculation into guinea-pigs both were found non-virulent, like results being obtained on repeating the test. The other case (No. 77), with a granulating ulcer on the leg, gave virulent diphtheria bacilli, 1'0 c.c. of the broth culture causing death within forty-eight hours, with oedema at the site of injection and bright red suprarenals. Regarding this case, it is interesting to note that further inquiries elicited that the man had been isolated when coming out of the trenches in France as a case of suspected diphtheria. The strains of wound diphtheroids isolated were almost entirely of the *B. xerosis* type, one alone affording the sugar reactions characteristic of *B. hofmanni*.

Captain Adams reports at a later date "the cultures that gave the proper sugar reactions for true diphtheria kept on sub-culture their small colonies, characteristic morphology and staining for at least two months. On the other hand the diphtheroids, after a week or two, changed their character. The colonies originally too robust for true diphtheria became still bigger, and many of the strains developed a creamy or pink colour. The bacilli also shortened, and many strains lost their granules."

(2) Orpington.

Captain Imrie's report from Orpington is strikingly similar, both as regards the immediate and the late results. Here also two strains were isolated which, until inoculation tests were made, appeared both to be the genuine Klebs-Loeffler bacilli; upon inoculation one of the two was found to be non-virulent. The other diphtheroids were of the usual wound diphtheroid type (negative to dextrine) with one exception. He likewise calls attention to the coarser, more confluent growth of the diphtheroids isolated by him, and their assumption of a yellowish colour.

(3) Taplow.

The results at Taplow are curious and interesting. Captain Fleming had prior to the War made yearly for the Toronto Board of Health several thousand examinations, microscopical and cultural, in cases of diphtheria and suspected diphtheria. Add to this that for months he had been engaged upon the routine study of wound bacteriology at Taplow, particularly in connection with the progress of wounds subjected to the Carrel-Dakin treatment. Prior to taking up this particular investigation he had never encountered diphtheria-like bacilli at No. 15 Military Hospital. For the purpose of this examination he and Captain R. M. Janes studied approximately 100 wounds by the routine laid down (they forward sixty detailed negative reports and offered to make out the remainder if desired). An analysis of the sixty reports forwarded shows that swabs were made from open wounds of various orders and varying duration from two weeks to twenty-two months, subjected to various orders of treatment, drainage (nine cases), Dakin's (thirteen), fomentations (five), saline (twenty-one), &c. These results varied so widely from those obtained at Folkestone and Orpington that the two observers offered to engage in another series, when both were transferred elsewhere. Captain Farquharson, who succeeded, undertook this additional investigation some two months later, and now in a series of twenty-five cases encountered diphtheroids nine times. Of these nine only one was the commoner type of wound diphtheroid negative to dextrine, five were of the rarer type fermenting dextrine, two were of the xerosis type, and one *B. hofmanni*.

Combining these results into a table we find the following:—

Dextrose	Lactose	Saccharose	Dextrine		Folkestone	Orpington	Taplow	Total number of diphtheroids
+	+	+	+	Wound diphtheroids (type I)...	0	1	5	6
+	+	+	-	" " (,, II) ...	0	5	1	6
+	+	-	+	<i>B. diphtheria</i> , virulent ...	1	1	0	2
+	+	-	+	" non-virulent ...	1	1	0	2
+	-	+	-	Wound diphtheroids (III), xerosis type	21	0	2	23
-	-	-	-	<i>B. hofmanni</i>	1	0	1	2

Taking these two tables it will be observed that the results obtained are strikingly at variance with those reported by Majors Fitzgerald and Robertson. In place of forty out of sixty-seven cases, or practically 60 per cent. of open wounds affording cultures of true virulent Klebs-Loeffler bacillus, we find two out of (approximately) 306, or under 0'6 per cent. Even if we accept the non-virulent bacilli of Klebs-Loeffler

type as true diphtheria bacilli, the figure is raised only to a little over 1'0 per cent. The total number of diphtheroid strains isolated affords a percentage far below that of the *B. diphtheria* isolated by the Toronto observers.

DISCUSSION.

In a careful bacteriological study of open wounds made at three important Canadian medical centres in England there is complete absence of widespread infection of wounds by *B. diphtheria*. The Toronto epidemic of such infection is, we believe, the first recorded among the soldiers of the Allied Powers during the course of this War.

It is well recognized to-day that non-pathogenic diphtheroids are widely spread. Even these, while commoner, are not frequent inhabitants of wounds.

Thanks more particularly to the introduction of the newer methods of antiseptic treatment of wounds, never has there been so extensive and intensive a study of the bacteriology of wounds as during the present War. For the establishment and control of these newer methods repeated cultures have come into vogue, and had diphtherial infection been common in Europe, numerous observers would before this have called attention to the fact. We find, on the contrary, no reports upon the epidemic spread of diphtherial infection. That individual cases occur our own observations clearly demonstrate. What is more, in addition to the two cases here reported, two other cases have been notified as occurring at No. 5 Canadian General Hospital, Liverpool. But upon further inquiry into these cases we learn that in the earlier of the two (Pte. P—228808) this was recorded by the Pathological Department of the Thompson-Yates Laboratories of the University of Liverpool as yielding a free growth of staphylococci and "a few apparently typical diphtheria bacilli." With regard to the second case, that from Sergeant W—38385, this was one of eight swabs received, and was returned as positive. In neither case were tests made for pathogenicity. The officer in charge of the 1st Western General Laboratory, who reports these facts, states further that owing to the cost of guinea-pigs pathogenicity tests are not made as a routine; occasionally attention is drawn to the fact that diphtheria-like bacilli are not necessarily pathogenic, and he adds: "Only recently an assistant in a neighbouring laboratory had diphtheria-like bacilli present in the throat which, however, were negative to the pathogenicity test." It will be seen thus that diagnosis in these two cases was made simply from the appearance of the mixed cultures obtained from swabs, and that this being the case, the evidence that these two patients showed genuine and virulent diphtheria bacilli in their wounds is far from complete.

That epidemic spread of diphtherial infection of wounds might under circumstances manifest itself is freely admitted. In Major Fitzgerald and Robertson's account of the nurse with the infected finger we have an excellent instance of how this may be brought about. We are, however, of the opinion that the widespread use of eusol, Dakin's mixture, flavine, and other antiseptic solutions in Canadian hospitals in England has reduced the danger of such spread to a negligible amount. As regards the non-pathogenic diphtheroids, indeed, our figures indicate, we consider, the existence of a low grade of local or endemic prevalence. Thus it is deserving of note that wound diphtheroid (I) was the commoner form at Taplow, wound diphtheroid (II) at Orpington, while bacilli of the xerosis type predominated in

the Folkestone area. We would not, however, lay too great a stress upon these findings.

ON THE CLASSIFICATION OF THE DIPHTHEROIDS.

It may be asked by those who have not followed the literature: What is the nature of these wound diphtheroids? In 1888 von Hofmann-Wellenhof of Graz, in Austria, called