authority. Who can as yet control the atmosphere? The wind bloweth where it listeth.

In conclusion I hope, by a simple device in a year or so, to be able to contrast the frequency of typhoid with the comparative prevalence of flies, and also with the average amount of dust blown through a given vertical area.

I am collecting evidence on the subject of typhoid fever and the variations in the condition of the water supply, but as yet it is too soon to publish the results I have obtained.

AIRBORNE TYPHOID.

BY LIEUTENANT-COLONEL R. H. QUILL, R.A.M.C.,
Senior Medical Officer, Ceylon.

AT the late meeting of our Association, Dr. Leigh Canney read a very interesting paper on the Etiology of Typhoid Fever, in which, while strenuously supporting the proposition that epidemics of typhoid fever are always waterborne, he vigorously denounced those who ventured to believe that such epidemics could sometimes be traced to an airborne origin.

I should like to say, at the outset of the remarks I have to offer on Dr. Canney's proposition, that I, in common, as I believe, with the officers of the R.A.M.C. as a body, hold that epidemics of typhoid fever are chiefly waterborne, and it is to the water supply we first turn our attention when investigating the origin of typhoid cases, occurring sporadically or epidemically. But I am entirely at issue with Dr. Canney when he lays down the hard and fast proposition that typhoid epidemics are invariably waterborne—never airborne.

The subject is one of far-reaching importance, well deserving of full discussion. I will therefore, as briefly as possible, adduce evidence to prove that the waterborne theory will not *always* account for the occurrence of a typhoid epidemic. My facts will be drawn from our experience in connexion with the large camp in this island where Boer prisoners of war are confined.

In August, 1900, a large camp was formed at Diyatalawa, in the hills of Ceylon, for the Boer prisoners of war. The first batch of prisoners arrived on August 9th, and succeeding batches quickly followed, until by the end of December 96 officers and some 5,000 men were under confinement.

On September 21st, 1900, one of the prisoners who had arrived on September 5th reported sick. He was found to be suffering from typhoid fever of probably ten or more days duration. This was the commencement of an epidemic of typhoid among the prisoners, which soon assumed formidable proportions. By the end of December 600 cases had been diagnosed as typhoid fever, and during the same period some 200 cases of simple continued fever occurred, many of which, it is highly probable, were mild cases of typhoid.

We fully satisfied ourselves that this epidemic of typhoid among the prisoners had been imported from South Africa, but in that connexion I refrain from further remarks, as it has nothing to do with the proposition I have set myself to prove.

It is here necessary for my argument that I should briefly describe the relationship which exists between the prisoners' camp and that of the surrounding camp, where is located the military guard.

The prisoners' camp, situated on an undulating slope, is surrounded with a strong fence of barbed wire; outside that fence are inner and outer military guard lines. The "inner guard" consists of a number of sentry boxes at intervals of 100 yards, and placed only some 20 yards from the barbed wire fence. The "outer guard" consists of guard huts occupied by strong guards, placed on rising ground some 200 yards further back. The latrines, urinals, washhouses, and hospitals for the prisoners are all situated close to the barbed wire fence which surrounds the prisoners' camp as a whole.

The guard for the prisoners was formed by the 2nd Battalion King's Royal Rifles, who were a fine healthy body of men. No suspicious fever of any kind, prior to the outbreak among the prisoners, existed among them. The battalion remained in a thoroughly satisfactory healthy condition until October 18th, 1900—that is, for over two months after its arrival at Diyatalawa, and for a month after the first case of typhoid occurred among the prisoners.

On October 18th a man reported sick; he was found to be suffering from fever, which quickly proved to be typhoid. From that date admissions for typhoid among the battalion occurred at short intervals, until by the end of December there had been altogether 24 admissions and 5 deaths.

Now, in attempting to account for this outbreak of typhoid fever among the military guard at Diyatalawa Camp, I commence by advancing the following evidence against the outbreak having been in any sense waterborne.

1. The water supply was obtained from a mountain stream some three miles distant, and was brought into camp by underground iron pipes. The intake in the hills was so isolated that its pollution was, indeed, very remote. On the arrival in camp of the main iron pipes, smaller ones passed directly into four large Pasteur tank filters disposed about the camp in suitable positions, while in each barrack hut portable Pasteur or Berkefeld filters were placed and kept under careful supervision; thus all water used in the camp before its distribution invariably passed through a thoroughly reliable filtering medium. The water prior to filtration was subjected to a weekly chemical analysis, and the report always gave the water a high character; a similar verdict followed frequent bacteriological examinations. There has been no alteration in the water supply or filtering arrangements since the camp was opened, and no case of typhoid fever has occurred among the troops since December, 1900—that is, since the practical cessation of the epidemic among the prisoners of war.

2. No fresh milk was allowed within the camp precincts. When milk was required condensed milk (Milkmaid Brand) was used.

3. All aërated waters used in camp came from the Ceylon Brewery at Newera Eliza, and were identical with those used at that sanatorium. There has been no enteric fever at Newera Eliza.

4. No uncooked food or uncooked vegetables were used in camp.

5. No native hawkers of any kind were allowed to enter the camp.

6. Within the camp there were five or six native shops; these were under strict military supervision. No native drinks of any kind were sold in them. The aërated water sold in them were invariably procured from the Ceylon Brewery at Newera Eliza.

7. All men leaving the camp for purposes of duty or pleasure were obliged to take with them a water bottle filled with filtered water.

8. It is to be remembered that for obvious military reasons the camp was situated in an isolated position in the hills far removed from habitations of any kind.

As the foregoing considerations, in my judgment, completely put out of court a waterborne cause as being responsible for the typhoid outbreak in the military camp, I was driven to the conclusion that the infection was airborne, being derived from the adjoining prisoners-of-war camp, where at the time an epidemic of typhoid fever was raging.

In support of that opinion I submit the following observations:

1. Guard huts, accommodating strong guards, surround the prisoners' lines, and are close to them. This for military reasons is unavoidable.

2. The men on sentry duty are during day and night posted at short intervals almost immediately outside the barbed wire enclosure which separates the prisoners from the military camp. Thus those on sentry duty (a numerous body of men) are in close contact not only with the prisoners, but with their latrines, urinals, and washhouses, all of which, as I have already stated, are situated close to the barbed wire fence. The undesirability on health grounds of the line of sentries being placed so close to the prisoners' camp was fully recognised, but for military reasons it was not found possible to alter the arrangement. From the foregoing remarks it will be obvious that those on duty in the guard huts and sentry boxes must be to a very appreciable extent exposed to the emanations arising from the latrines used by the prisoners of war, especially during the time when the latrines are emptied—a frequent necessity. Now assuming that such emanations contained typhoid organisms—not a very far-fetched hypo-

thesis when we remember that at the time typhoid fever was very rife in the prisoners' camp, and further assuming that typhoid infection can be airborne—the possibility, nay the probability, of the infection being thus conveyed from the prisoners' camp to the military guards appears to be well founded.

3. But in addition to the assumption that the emanations from the prisoners' latrines may have conveyed infection to the military guard, it has to be recorded that the soil of the prisoners' camp gave peculiar facilities for the spread of the infection. The rank grass which originally covered the slope upon which the previous camp was arranged very soon disappeared, giving place to a reddish soil, so friable that dust was much in evidence, notwithstanding that it was the rainy season of the year. Now it is not unreasonable to reject as pure the dust of a camp in which at the time a formidable epidemic of typhoid fever was prevailing.

4. Lastly, the possibility of the infection being conveyed to some extent by flies must be considered. During the whole period that typhoid fever was prevailing in the prisoners' camp, flies in that camp amounted almost to a plague, the military camp being also infested, but to a lesser extent. Now flies being well adapted for the carriage of infection it is plain that, under the conditions existing in the prisoners' camp, there would be nothing to prevent flies laden with typhoid bacilli migrating from the prisoners' to the military camp, and thereby conveying to the latter camp the poison they carried.

I have endeavoured in this paper to review dispassionately the evidence bearing on the causation of the typhoid outbreak which occurred among the military guard at Diyatalawa Camp, Ceylon, during the closing months of 1900. I submit that I have shown—

(*a*) That all water avenues through which typhoid fever could have been conveyed to the military camp at Diyatalawa, were efficiently guarded, and therefore that a waterborne origin must be abandoned.

(*b*) That the infection was airborne, resulting from emanations from specifically infected latrines, infected dust, or bacilli-laden flies.

SO-CALLED "REMITTENT" OR "PRETORIA" FEVER.

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A GREAT many soldiers who stay for any length of time in Pretoria or its neighbourhood suffer from attacks of fever of a remittent type which is of short duration, and for want of a better name and a good deal from want of any accurate knowledge of its nature is returned either as "remittent," "malarial remittent," sometimes "simple continued" fever, and has even been given the special name "Pretoria" fever. To ally the complaint with malaria, however, is distinctly wrong, as it has no connexion whatever with it.

Below I only refer to the fever of the Pretoria neighbourhood. I do not include the simple continued fever so common at the beginning of the war amongst soldiers, especially in Cape Colony. This fever was more often of an intermittent type. True malaria does not, so far as I can ascertain, exist in Pretoria and its neighbourhood among the soldiers, except cases imported from Komati Poort and its surrounding districts.

I am informed, however, that amongst the poorer class of Dutch living on the low-lying ground near the river in Pretoria a low form of fever occurs, but I have seen no cases of a malarial nature amongst soldiers living near. I am also informed that about Penaar's River an intermittent fever occurs among the soldiers; the temperature rarely rises over 100°, and is unaffected by quinine. Personally I have neither heard of nor seen a single case of remittent fever, originating in this district, in which plasmodia have been found in the blood. Captain Beveridge, R.A.M.C., Analyst to the Army in South Africa, who has examined the blood of many of these cases, has not met with a single instance.

The onset of fever is, as a rule, sudden; the patient has been feeling out of sorts probably for a day or two previously but not sufficiently so as to cease work. The attack commences with acute frontal headache, pains in the back and legs; sometimes acute pain in the lower part of the occipital region, which occasionally occurs in enteric fever and is rather a characteristic symptom when present; sensations of "cold water being poured down the back"; often vomiting; loss of appetite and *malaise*. In 24 hours the temperature may reach 104°, rarely higher. A history of diarrhoea previous to admission to hospital is often given.

When admitted generally after about twenty-four hours' fever, the patient's condition is usually as follows: Headache as above, also about this time slight abdominal pain located, as a rule, by the patient above the umbilicus, and passing from right to left, slightly griping in nature (an almost constant symptom). Vomiting, if present, rarely lasts more than twenty-four hours after admission. Diarrhoea is fairly common for the first day, sometimes longer, but occasionally the patient is constipated. He is heavy and languid, with flushed face. The temperature variable, between 100° and 104° as a rule. The tongue is generally thickly coated with white or yellow fur, sometimes inclined to be dry, sometimes quite moist; occasionally quite clean, even raw-looking and moist. No enlargement of the spleen can be felt, but as a rule there is tenderness over this region (below the costal margin), and sometimes over the liver. On the whole, the condition on admission is generally much more characteristic of an intestinal lesion than of malaria.

The temperature generally descends gradually, dropping one or two degrees in the morning, rising half to one and a-half in the night. The time of descent is variable, two days or much longer, but remittent in character. The symptoms rapidly ameliorate; the headache disappears within two or three days, and even though the patient has a temperature of 101° or 102° at night, he may be quite indignant at being kept in bed and on a light diet. Spots resembling enteric only occurred in one case of mine (at the sixth day), but not more that 20 per cent. of the enterics out here have characteristic spots.

The stools are rarely typically enteric. The pulse is slow and quite out of proportion to the temperature. In one or two cases it was markedly dicrotic, even when the temperature had become normal. In one case with a normal temperature and dicrotic pulse, a typical enteric "relapse" occurred.

The tongue may clean rapidly, but often the coat persists for several days after the temperature is normal. This generally prognosticates a relapse with all the features of true enteric fever.

In contrast with malaria sweating is not at all a constant feature towards the termination of the fever, and is not profuse when present. The duration of the fever is from five days upwards, if beyond twelve days the diagnosis has to be altered to enteric fever.

NATURE OF THE FEVER.

Personally I have had very many, I may say hundreds of cases of the above type, and the conclusion I came to some time ago was that they were almost invariably abortive attacks of enteric fever. The proofs of this seem fairly conclusive.

1. These short fever attacks more often occur in men who have been some time in the country, generally well over six months. For instance, in about one month, out of 11 successive cases of "remittent" fever (under thirteen days fever), 1 patient had been out five months (see list at end—he had a relapse), one 7, one 10, and the rest all over a year, three-quarters of them over eighteen months. The reason is that most of these old-service men are, under ordinary circumstances, immune to enteric fever. In the first six months out here many men if they get run down will get true enteric fever not "remittent." The remainder after six months are more or less immune, that is, their powers of resistance are very high; but even these—after prolonged exertion, bad food, etc., have their resistance broken down and fall victims to fever. So soon as they get rest and proper feeding the resistance reaches its former high level and the attack aborts; they have had "remittent" fever (otherwise abortive enteric).