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As is apparent from the study of the Annual Reports for the Army Medical Department during the decennial period 1893 to 1902, Bermuda possessed the unenviable reputation of having the highest enteric fever rate per 1,000 of any Command occupied by British troops. The copy of the table in the Report for the Army Medical Department illustrates this. (See p. 29.)

Except as regards enteric fever, the disease rate among the troops on the Islands was so exceptionally low, that if the former disease could be eradicated, or at any rate kept within bounds, there seemed no reason why Bermuda, as a military station, should not be rendered exceedingly healthy.

On my appointment as the first Sanitary Officer in the Islands, I quickly realised that my obvious duty was to inaugurate a campaign against the only disease of importance then existing. As a preliminary it was necessary to cultivate a thorough acquaintance with the Islands, the military stations and camps, their water supply and conservancy arrangements generally, and, incidentally, on account of the neighbourhood of the civil population, to make a careful study of their habits and the conditions under which they lived. This of necessity required time, as unless the knowledge acquired was thorough, measures which might be formulated were liable to be made abortive by unforeseen circumstances.

Geographical.—The Islands consist of seven large areas, mostly connected by bridges, and of numerous smaller portions, ranging in size from a few acres to mere rocks, the whole being spoken of as the Island of Bermuda. Practically, the seven large islands alone are of importance, as they contain the bulk of the population. The estimated area of the Islands is approximately 19 square miles, and the population numbers about 19,000.

Geological.—The Islands are composed of disintegrated coral in the form of coarse sand, which is cemented together by the deposit-
tion of carbonate of lime dissolved from the upper strata and deposited by water which has percolated through. The rock consequently has a tendency to harden under the action of the water in a manner similar to cement. As a consequence of this porosity no natural sources of water supply occur on the Islands, except where, near the sea, brackish water may be found floating on the surface of the sea water. A red soil, the result of disintegration of the sand, is spread in patches over the Islands. It is exceedingly fertile and is extensively manured, a circumstance which does not tend to improve the character of the ground water.

Metereological.—The average annual temperature is fairly high, although the maximum rarely exceeds 87° F. The excessive humidity renders the climate very trying to Europeans. The annual rainfall
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varies from year to year; with an average of about 54 inches. It is distributed over the whole year, there being no definite rainy season, the dryness of the summer months being broken by periodical heavy downpours and thunderstorms.

Water.—All water supplies are collected from the roofs of houses or from cleared spaces on the hillsides rendered impervious with cement, and are stored in over- or under-ground tanks.

Military Stations.—The Garrison is divided between three permanent stations, Prospect (the headquarters), St. George’s and Boaz. In Prospect are included the musketry camps at Warwick, and an overflow camp at Whale Bay; in St. George’s the forts at St. David’s Island, and in Boaz the forts at Ireland Island and Somerset. There are also three signalling stations at which small detachments are kept; Agar’s Island, the old magazine, is now abandoned.

Civil Population.—The civil population is collected chiefly in the towns of Hamilton and St. George’s and on the Island of Somerset; but owing to the agricultural pursuits of the inhabitants, it is scattered, more or less thickly, over the whole of the islands. It is therefore always in intimate contact with the military garrison. The inhabitants of the islands consist of the descendants of Europeans, practically unmixed with the coloured population. The latter form the majority of the people; they are, with the exception of a few aliens, generally on a higher plane of civilisation than the West Indian populations, and are consequently much more amenable to sanitary influences.

Civil Sanitary Organisation.—Sanitary matters are presided over by a Central Sanitary Board, of which the Principal Medical Officer of the Military Forces and the Senior Naval Medical Officer stationed on the Island are ex-officio members. There is also a Medical Officer of Health who devotes his whole time to the work and is a member of, and acts as sanitary adviser to, the central authority.

Each parish has its own Sanitary Committee, which carries out the work of the parish under the supervision of the Medical Officer of Health. The sanitary organisation, therefore, of the Islands is complete, but the efficiency of control is hampered by the comparative poverty of the majority of the population and by conditions similar to those which exist in most of the rural and urban districts in Great Britain.

Summary of the Cases of Enteric Fever which occurred during the Years 1904, 1905, and 1906.—On arrival at Bermuda in March,
1904, it was found that a few cases of enteric fever had occurred in Warwick Camp, among the men of a regiment which left the island by the same troopship. The regiment was replaced at Warwick and Boaz by the 3rd Battalion of the King’s Royal Rifle Corps.

At Warwick cases of enteric fever began to appear among the men of this battalion in September and continued till the end of the year, some seventeen cases in all being admitted. From Whale Bay Camp four cases were admitted from the same battalion. On the return of some of the companies to Boaz the epidemic continued there, nine cases in all being admitted, making a total of thirty cases in all.

Among the men of the 3rd Battalion of the Royal Fusiliers and of the Royal Engineers, stationed at Prospect, no cases occurred till September, when three men of the latter corps were admitted with the disease, followed after an interval by twenty-four men of the Royal Fusiliers, the epidemic ceasing about the middle of December.

At St. George’s only one case occurred during the year, and this was traceable to outside sources.

During 1905 no cases were admitted from Whale Bay Camp, and only one case occurred at St. George’s.

At Prospect seven cases occurred. At Boaz, the 3rd Battalion of the King’s Royal Rifles suffered severely, twenty cases occurring, while among the rest of the regiment, stationed at Warwick, no cases occurred.

During 1906 there were four cases at Prospect, one at Warwick, one at Boaz, and four at St. George’s.

Water Supplies for the Use of Troops.—The water supplies were naturally first brought under review, as being the most likely agents for the dissemination of enteric fever; and during the three years constant investigation as to their condition was carried out, both by chemical and bacteriological methods, and by constant personal inspection of every tank and water-catchment area in the Islands, belonging to the War Department.

The number of military tanks on the Islands is very large; and although in some cases the tanks are in communication by means of their overflows, it may be taken that no common water supply for the troops exists, except perhaps at Warwick Camp, where one catchment and tank supplies the North Camp and one the South. Only in these camps was it possible to watch the effect of the water on the health of the troops, and, except for the slight outbreak of diarrhoea, which may not have had anything to do with the water, no ill-effects were ever observed.
Chemical examination of the water was soon given up, being useless, as it was practically distilled water to which organisms had been added, while bacteriological supervision was also impossible on account of the very large number of separate tanks and the change in composition of their contents after every rain.

Dust from manured land was constantly present on the roofs and catchment areas, being washed into the tanks every shower, no separators being provided. Coliform organisms might thus be expected to abound in all the water supplies, and this was amply borne out by the results of such bacteriological analyses as were made. Repeated attempts were made to see if it was possible to isolate Bacillus typhosus from water, but, as might be expected, without success; and no evidence was ever discoverable which could be held to point to the water supplies as agents in the conveyance of enteric fever. Failing chemical and bacteriological supervision, inspection of all tanks and their surroundings was the only practical method of safeguarding the waste supplies.

Conservancy.—Two systems of sewage removal existed side by side in the military stations in the Island. In St. George’s, Boaz and Prospect the water-carriage system was installed; while in Warwick and Whale Bay Camps, and in all the isolated quarters at all stations, where the distance was too great to connect up with the sewer, the dry-earth system survived.

At Boaz and St. George’s the flushing water was provided by the pumping of sea water; but at Prospect, 180 feet above sea-level, the fresh-water stores had to be utilised for this purpose. This supply was inadequate to the needs of the large number of troops stationed at the post during the whole year, and a recommendation was put forward for the increase of the catchment areas and tanks, to meet the demand. As, however, the garrison of the Island was reduced to one battalion the following year, the scheme was abandoned, the quantity available approximating more nearly to the needs of the reduced garrison. In the event of fire, however, the barrack fire hydrants, which also depended on the fresh-water tanks for their supply, would soon exhaust the available water.

The Jennings trough pattern latrine was in general use by the troops, and may be regarded as quite unsuited to the needs of Bermuda. In a trough full of water, and in which, on account of the scarcity of water, flushing can only be carried out two or three times a day, faecal material accumulates and floats, affording, with the soiled paper, a good foothold for flies. Consequently, in a country where flies abound these latrines should be flushed seven
or eight times a day, or wash-down water-closets should be used. The comparative immunity of St. George’s from the disease at a time when Prospect was suffering severely can only be attributed to the fact that there was a plentiful supply of sea water available at the former place, while at the latter, owing to the drought and to the excessive number of troops using them, the latrines could not be kept properly flushed. In 1905 the access of flies to the troughs was prevented by the provision of covers to the openings in the seats of the latrines, ventilated by the insertion of a piece of perforated zinc in the centre and so constructed that they fell into position the moment the seat was vacated.

The dry-earth system of removal was carried out by local contractors and was performed in a manner usual in enervating climates, requiring constant supervision. Still it was found that, when once the local conditions were understood, and the service was carried out properly, less enteric fever occurred where the dry-earth system was in use than where water carriage was installed. In Warwick camp, when the defects in the system were remedied, no further cases of enteric fever occurred; and in the isolated quarters, where the system was almost universally installed, no cases occurred in the three years under review. The inference, therefore, is not that the dry-earth system is preferable, but that, if properly carried out, it is infinitely less dangerous than an inadequate water carriage system.

As regards comestibles meat was supplied to the troops by a contractor who imported cattle and practically monopolised the wholesale trade of the Island. The slaughter-houses were kept under strict supervision and were invariably in a clean and sanitary condition. The same contractor supplied all the ice as a part of the cold storage business. As all water for making ice has to be boiled to expel air in order to ensure a clean ice, no danger could be traced to this source. There were several mineral water manufactories from which mineral waters were obtained for the use of the troops. These were kept under strict supervision and defects pointed out. As a rule, suggestions were well received by the manufacturers and, if feasible, carried out. No cases of disease were ever traced to the products of any of the supervised factories.

The general conditions under which the troops lived having been investigated, it became necessary to sift the evidence afforded by the way in which the disease arose, with a view to obtain clues to the causation of the disease. The incidence of the cases in the various camps seemed to give a hint as to the probable origin of
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the epidemics, but in the case of each camp the indications differed, according to the varying conditions which prevailed.

From the summary of the history of the outbreaks already given, it will be seen that in Warwick Camp there was a probability that the camp was infected by the regiment which left the Island in 1904, or that the conditions which facilitated the spread of the disease were still in existence. As, however, no cases occurred among the fresh troops until six months after their departure, the theory of direct infection seems doubtful.

The conditions which might assist in starting and spreading the disease may be summarised as follows:

(1) A defective or infected water supply.
(2) Insanitary conditions in the camp itself.
(3) Infection from the civilian population.
(4) Other causes not indicated directly by the facts available.

Taking the first of these conditions, the water supply of the two sections of the camp was collected in a large tank, in each from a catchment area immediately above it. This area was liable to contamination with dust from the camps, but it scarcely seems probable that *B. typhosus* would be able to survive the exposure to the sun's rays to which it must be subjected on a whitewashed area of bare rock, but thinly sprinkled with dust, until a shower should wash it into the tank.

As no interference with the tank or any part of the apparatus attached to it was allowed, there seems no reason to suppose direct infection by the troops was possible. The immunity of the troops during the dustiest part of the year, when occasional heavy showers prevailed, seems to absolve the water supplies of complicity. The fact that for the two following years, after other defects had been remedied, no cases of enteric fever occurred, the water supply not having been interfered with, seems to decide the matter.

Taking the condition of the camp itself, it was soon discovered that it was in a far from satisfactory condition. The camp was divided into the so-called old and new camps, separated from one another by a field some 200 yards across, with several high hedges of oleanders. The 3rd King’s Royal Rifles occupied the old, or windward camp, while a detachment of the 3rd Royal Fusiliers occupied the new camp. All the cases, with one exception, occurred in the old camp, and this at once pointed to some condition prevailing in one camp and not in the other. The number of troops in the old camp was greatly in excess of that in the
new, despite the fact that the area of the latter was much greater than that of the former. The latrines were also of a bad pattern, the seats were insufficient in number for the troops present, and the use of dry earth to cover faecal matter was neglected. As a result, the pails were full to overflowing early in the morning and were exposed to flies for the rest of the day, since by the law of the Island they were only allowed to be emptied at night. The resultant condition of things can be well imagined; and of the possibilities of food contamination there could be no doubt. In the new camp, owing to the smaller number of troops, matters were not so urgent, and the greater distance of the latrines from the tents prevented the carriage of infection.

The danger of civilian infection was undoubted, as on one or two occasions the commencement of an attack was directly traceable to the drinking of water, from native houses, by men carrying out field-training. This, however, though accounting possibly for the introduction of the disease into the camp, could not be blamed for its continuance.

As regards other factors tending to the spread of the disease, the questions of food and drink have already been disposed of. The practice of eating and keeping food in the tents must be blamed for, at anyrate, affording facilities for the spread of the disease by attracting flies which had but lately arrived from the latrines. The dangers of infected dust were also accentuated by this practice.

The precautionary measures necessary, therefore, resolved themselves into a campaign against flies. The number of latrines was doubled and they were altered to a more sanitary pattern. All were built on a concrete base, so arranged that all spillings, either by the men or by the contractor who emptied the buckets, were retained on it, and were prevented from soiling the ground. These bases were washed down twice a day, the soiled water flowing into a channel and from thence to a covered soakage pit, from which disconnection was secured by a trap. The urine from the urinals, instead of remaining in buckets all day, was also conducted into these pits. The porous nature of the soil ensured the prompt removal of all such liquids. The use of dry earth, in a manner which left nothing of interest to the fly, was insisted on, suitable earth-boxes and scoops being provided. While the extra latrines were under construction leave was obtained from the Medical Officer of Health for the emptying of the buckets twice daily, doubling at once the capacity of the latrines. The doors and windows of kitchens and of all places where food was kept were fitted
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with perforated zinc in frames, and these were made self-closing. The destruction of chance flies was arranged for by fly-papers. All food sold in the canteens was covered with gauze, stretched on wooden frames, so arranged that the gauze could easily be detached and washed. Kitchen refuse and soiled water were also disposed of in a manner which prevented the access of flies. Chloride of lime was issued for the purpose of discouraging flies, and was found of great use. A large hut was set apart for the men to have their meals in, and arrangements were made for the storage of all bread or other food in boxes made fly-proof with gauze. On account of the dangers of ice-cream, as made locally, an apparatus was purchased by the regiment and the cream sold in the canteen.

In addition to these measures lectures were given to the troops to accentuate the importance of the observance of sanitary rules. Careful supervision of all native and other hawkers was also arranged for; but owing to the camp being surrounded by woods this was difficult to carry out, and the fact that the men would be at liberty to purchase any kind of unsupervised article, when walking out, rendered the supervision of little use.

As will be noticed from the short history given previously, the result of these measures was the complete disappearance of enteric fever from the camps for the next two years.

While on the subject of the dry-earth system, it may be well to consider the defects discovered in the management of it throughout the Island and the measures taken to remedy them. It was found that the contractors for the removal of night-soil all over the Islands failed to cleanse the buckets properly before returning them, thus providing a foul surface covering the inside and outside of the buckets, for flies to crawl on. By the contract, which had not been altered since the whole of the troops had been served by this system, the contractor was supposed to wash the buckets on the spot, water being supplied near the latrines for this purpose, and the soiled water being emptied into the carts carrying the night-soil. This method was considered inadvisable for the following reasons:

1. The carts provided by the contractors, having to be of light construction to surmount the steep gradients to the various quarters, were never water-tight.
2. With native workmen it seemed much more likely that most of the soiled water would be thrown on the surrounding ground.
3. Water from the tank supplying the house with drinking water was only available in limited quantity at detached quarters,
and it was not considered advisable that the workman should be
allowed to soil the pump-handle with material gathered from the
soiled pails.

After consultation with the contractors it was found that they
were willing to allow the insertion in the contract papers of the
words "in the sea," after those "properly washed." This at once
settled the whole difficulty, no objection being raised by the local
sanitary authorities, and where access to the sea was difficult or
dangerous, platforms were built from which the bucket contents
could be thrown into deep water, and pumps were provided to
enable the buckets to be washed out. As night-soil itself has a
certain manurial value, the disposal of it in the sea was not insisted
on, burial being allowed at a distance of not less than half a mile
from all military buildings, and in accordance with the require­
ments of the civil authorities. Care was also taken that the fresh
earth supplied to the quarters was virgin soil and had not recently
had excreta deposited in or on it.

Moule's pattern closets were almost universally used in married
quarters. These closets work in a satisfactory manner as long as
the earth supplied is dry, but choke at once with wet earth or
stones. They require a small amount of care to keep them
in proper working order, which, it is to be regretted, they did not
often receive.

**Enteric Fever in Prospect Camp.**

The course followed by an outbreak of enteric fever in Bermuda
was usually as follows: (1) Introduction of the disease into a station
from another station or from the civil population; (2) infection of
the troops, from the first case, or from "carriers": by personal
contact; by flies from the latrines; by the use of infected
vessels, &c.

The sequence of events was as follows: (1) The admission of a
man to hospital with symptoms pointing to gastric disturbances
and a slight rise of temperature; (2) the admission of a case or
two from the same room, often with undoubted symptoms of enteric
fever; (3) the admission of men from all over the barracks with
the disease.

The outbreak in 1904 succeeded in obtaining a firm hold before
the conditions governing it were appreciated. A Royal Engineer
was admitted from the Engineers' block on September 3rd, and two
other cases from the same room on the 12th and 13th respectively.
As the work of these men took them all over the Island they had
many more opportunities for contact with the civil population than other soldiers, and hence the probable infection. The Royal Engineers' latrine was in the immediate rear of the cookhouse, and as the first man used this, the way in which the other men were infected was not difficult to imagine. From this latrine it was possible for flies to reach the regimental cookhouse, some fifteen yards away, and also the barrack blocks close by. As a result a cook from this cookhouse was admitted to hospital with the disease on the 24th. From the barrack block next to the Royal Engineers block three cases were admitted on the 22nd, 24th, and 26th, which might have been due to food infection or to the Royal Engineers' latrine, which, being close by, they probably used. A small outbreak also occurred in the band block, at the other end of the barracks, which may have been due to the fact that the adjacent latrine, in addition to being cracked at that time, was also the worst supplied with water in the whole station. Two other cases, a man working in the butcher's shop and a pioneer, whose occupations kept them in the vicinity all day, may have been due to the same cause, as they used the same latrine. As regards the later progress of the disease, several men were found to be ambulant cases. They had been sent to hospital early in the outbreak, but their symptoms subsiding rapidly, they were discharged to duty. They were either admitted to hospital with definite attacks of the disease later, or were placed in the isolation camp.

As the water supply was practically a common one, being, on account of the shortage, brought to the cookhouse in carts and thence distributed to the men, it cannot be regarded as the source of the infection.

From this outbreak the following deductions were made: (1) That the disease had been introduced into the camp, probably from the civil population; (2) that the cause of the spread was the infected latrine, through the agency of flies, &c.; (3) that the generalisation of the disease in the barracks was due to ambulant cases and to infection left by the men already admitted to hospital.

The establishment of an isolation camp for the segregation of ambulant cases, carriers, or convalescents, brought about a rapid cessation of the epidemic.

Years 1905 and 1906.—Owing to the following out of the plan of campaign to be described shortly, there were very few cases of enteric fever in Prospect during the years 1905 and 1906. Usually the patient gave a history of contact with the civil population of a low class, or he came from a room in which a previous case had
occurred. The occupations of the men, mess waiters, officers' servants in outlying quarters, and the alcoholic tendencies of at least one, amply accounted for the way in which the disease was contracted.

The measures taken were as follows:

1. All sick at Prospect were seen by the sanitary officer, and any man suffering from headache, a rise of temperature, diarrhoea, and foul tongue, was at once sent to hospital for observation.

2. The belongings of such men—kits, bedding, &c.—were sent to hospital for disinfection. This was insured by the words "kit and bedding to hospital," being written against the man's name across the sick report, which was sent to his company officer. The whole of these articles (leather, of course, excluded) were placed in the Thresh disinfecter.

3. The men of the barrack-room to which the patient belonged were confined to camp, not allowed to use the regimental institutes, and were made to use a special latrine which was carefully supervised. A Soyers' stove was kept full of boiling water, and into it all utensils used for food or drink were placed, before being allowed to go to the cookhouse again. Beer and minerals from the canteen were allowed to be consumed in the barrack-room, but all glasses, &c., were boiled before being returned.

4. The men under observation attended all drills, &c., but went on guard together, and took their own blankets and bedding with them.

5. They were inspected daily for thirteen days, or until the man in hospital was pronounced not to be suffering from enteric fever. By this means the disease was usually limited to the first case.

**ENTERIC FEVER AMONG THE CIVIL POPULATION.**

As the blame for the introduction of the disease into the military stations is constantly being laid on the civil population, it may be well to justify this here. There seems no reason to doubt the fact that enteric fever in a mild form exists among the coloured population much more than is generally thought or acknowledged. When it is considered that the drinking water supplied has for centuries been drawn from tanks connected with the roofs, and that the standard of sanitation has been, and still is, low, there is little reason to doubt that enteric fever must also have existed for long periods. As in Cuba, where the inhabitants have acquired an immunity from yellow fever, and consequently only suffer from mild forms of the
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Disease, so it is conceivable that in Bermuda an immunity from enteric fever has been acquired in a similar manner. Newcomers in both islands are liable to attacks of the disease in no way differing from the typical attack.

During certain periods of the year mild fevers are prevalent in Bermuda which are not malarial, as the parasite has never been discovered and the necessary mosquito does not exist, and there seems no reason to doubt that these fevers are mild attacks of enteric fever. No specific fever, except enteric, has ever appeared among the troops; the inference being that no others occur on the island. (Since writing this a few cases of beri beri have occurred.)

As we know that the protective influence of one attack of enteric fever wears off gradually, the mild attacks may be due to the immunity being insufficient to ward off the attack, but like vaccination, being able to mitigate its virulence. It should also be noticed that the disease is increasing considerably among the whites; whether owing to better diagnostic methods or to the influx of non-immunes it is hard to say.

That many cases of enteric fever among the civil population escaped diagnosis or were not reported is well known to Service medical men, and considering the poverty of the coloured element, the inferior knowledge of the native medical men who attend them, if called in, and the difficulty, even when equipped with the best knowledge on the subject, and with an up-to-date laboratory, of being certain of the origin of a mild fever, it is not surprising that many more cases should exist than are brought to notice.

Boaz.—The outbreak which occurred in 1904 was, undoubtedly, a continuation of the epidemic at Warwick Camp, as has been stated before, and died out as soon as the infecting persons were removed to the convalescent camp at Fort Hamilton.

An isolated case, however, which occurred earlier in the year, illustrated the danger to the troops owing to the propinquity of the civilian population at Somerset. The man was a sapper, who was employed on work around the Island. He was in the habit of having his tea in a small restaurant in Somerset. As soon as the occurrence of the case was notified enquiries were made as to the man's movements, and this restaurant was examined. It was found that, while attending to the shop and dispensing the food, the proprietor was attending her daughter who was suffering from enteric fever in the rooms above. She also acknowledged that she was in the habit of leaving a bedpan containing her daughter's
stools in the verandah, immediately over the shop, all day or until she could dispose of them in the dry-earth latrine. No covering was used, and there was nothing to prevent the access of flies which, in a shop where pastry was kept, would be very numerous. The tank, from which all water was drawn for the house, was situated under the floor of the shop, which formed its roof. The jointing of the floor was by no means tight, and dust from the floor could find access to the tank. The latrine and urinal were at the back of the house, against the cliff, and on a slightly higher level than the water in the tank, so that material which did not fall into the buckets in either place could be washed into the tank by heavy rains, the porous sandstone walls of the house or tank being no obstruction. The daughter was attended by a native medical man, who, if he had diagnosed the case, did not notify it to the Medical Officer of Health till the investigations commenced, and who took no trouble to safeguard others against infection, either by giving the mother instructions or by disinfecting stools, &c. As a result, the sapper contracted enteric fever and died, while the woman's own son, who was in the Navy, was admitted into the naval hospital with the disease, but recovered. How many cases occurred among the civilians as a result of
this case it is impossible to say, but there is no doubt that such a focus of infection would be responsible for more than the two cases recorded. This case is given in detail to indicate the conditions which cannot be regarded as existing in this house only, and which amply justify the accusation made against the civil population of being the *fons et origo* of enteric fever in the Islands.

The outbreak which occurred in 1905 is discussed in detail, as it seems to furnish proof of the fact that the disease is conveyed by personal contact from one man to another. On June 14th, 1905, a soldier, employed as waiter in the officers' mess, was admitted to hospital suffering from a mild attack of the disease, confirmed by Widal's method. He first felt ill on May 24th, after a bicycle ride to and from Warwick Camp, where there were no cases of enteric; having had, as he stated, something to drink in Somerset. On June 26th the colonel of the regiment, who was living in the mess, was admitted with the disease, having been unwell for some time previously. Next day, and on the next day following, two other officers were attacked, one of whom had been living in the colonel's house. On the 27th the mess serjeant was also found to be suffering from the disease, having been ill for a week. A further case, a soldier, who had been employed casually in the mess as a waiter since June 14th, was also admitted on July 7th. There thus appears to be a regular sequence of cases, all traceable to a first case, and in such a manner that only contact with food and utensils handled by the first case could account for a number of persons in such different ranks being attacked. Following this other cases occurred, scattered about the barracks, but in such a manner that no cause could be traced, except that the men all messed together on the restaurant system.

In 1906 only two cases occurred. The first was a coloured militiaman, who had contracted the disease in civil life, and the second was the Royal Army Medical Corps orderly who nursed him.

*St. George's.*—One case only occurred each year at St. George's. In 1906 four cases occurred, two of which were men of the Royal Garrison Artillery, who had recently returned from Ireland Island, where a number of cases had occurred among the sailors of the Royal Navy. One case occurred in the band of the Hampshire Regiment, and the Royal Army Medical Corps orderly who nursed him also contracted the disease.
GENERAL SCHEME OF PRECAUTIONARY MEASURES TAKEN TO PREVENT THE SPREAD OF THE DISEASE.

The precautions with regard to the water supply have been already indicated. The manifest impossibility of maintaining a bacteriological or chemical supervision of all the water-tanks rendered visual methods the only ones applicable. That efficient supervision was able to prevent contamination of the water is shown by the fact that in no case was it possible to trace disease to it. The danger of introduction of the disease from civil sources has been already discussed, and further proof on the subject seems superfluous. It was, however, necessary to discover the avenues by which the disease could be introduced, and to devise means to stop them. As it was impossible to prevent men from leaving their stations, there seemed a possibility of safeguarding them when in contact with the civilians, by ascertaining the condition of the public-houses and small restaurants they were in the habit of frequenting, and of having the defects in sanitation remedied. With this view the assistance of the medical officer of health was obtained, as the measures proposed would encroach on his preserves, and a scheme was prepared by which, under the orders of the Commander-in-Chief, all public- and eating-houses, which at a certain date did not possess a certificate from the medical officer of health or the sanitary officer, stating they were in a reasonably good sanitary condition, and were not likely to be prejudicial to the health of the troops visiting them, were placed out of bounds for the visiting troops.

As the chief support of the public-houses was afforded by the troops, the placing of a house out of bounds meant a very serious loss to the proprietor, and was a powerful lever in inducing him to remedy any defects which were pointed out. In order to render the blockade effectual, the system was applied in the first place to Hamilton, and an extra force of police was drafted in to ensure bounds being kept. St. George's and Somerset were dealt with in succession in a similar manner.

It was found that practically all such public-houses had carried out recommendations made within a few months from the issue of these orders, to the great benefit of the civil as well as the military population.

All certified houses were inspected every two months to ensure the maintenance of the standard; and, further, the proprietors of such houses were directed to report, at once, for investigation, any cases of illness occurring on their premises. All places where
articles of food and drink were prepared, which might be supplied to the soldiers, were also supervised. Thus the mineral water factories were constantly inspected and defects remedied. In the case of any opposition being encountered, it was found possible to make the person see the error of his ways as, although he might not supply the troops direct, he did so through some of the public-houses over which the orders previously referred to gave a hold. The civil population of the Island, also, had sufficient regard for their health to be shy of mineral waters from a factory which did not meet with the approval of the civil or military sanitary authorities. Stringent rules were drawn up for the regulation of ice-cream making. As the cream must be boiled before freezing, it is liable to contamination only while cooling or when stored. It was therefore considered that if these processes could be properly conducted there would be little danger of infection. The regulations were framed to ensure this, and only those persons who had premises which were in good order and who seemed likely, from their habits and intelligence, to carry out the instructions, were allowed to supply the troops in any way. Lectures were constantly given to the men, pointing out the risk they ran if the rules were evaded, and also to enable them to exercise an intelligent supervision over their own health. The moral of the lectures was supplied by the eight deaths from enteric fever which occurred in 1904.

LABORATORY WORK.

The laboratory material was not available till the year 1905; consequently the valuable work which might have been done during the epidemic of the previous year was lost. Besides the water supplies, the milk for the hospitals was examined every month, and the dairies were supervised.

Pure cultures of *B. typhosus* were isolated from the spleens of men who died of enteric fever, and in a few cases from the blood and stools of the living. These, with a culture obtained from the Royal Army Medical Corps laboratories, and one from New York, were the strains used. It was found that the strain isolated one year did not react well the next year, but that every year a fresh culture had to be isolated. The English and New York strains also did not give Widal’s reaction till they had been in the Islands for a year. This seems to indicate that there was a slight difference between the strains causing the disease at home and in Bermuda, and also between those producing the disease each year.
Widal's reaction was relied on to back up the clinical symptoms in cases of suspected enteric fever, and several presumed carriers were discovered during the first year. It was thought to be fairly conclusive proof of the necessity for isolation if Widal's reaction was persistently given by a suspect, when all other causes of acquired immunity were excluded.

The opportunities for research, however, tended to disappear as the results of the sanitary precautions began to make themselves felt, the cases of 1905 and 1906 being too few and too sporadic to enable any sequence of events to be established.

**Conclusions.**

From the facts already given it may be assumed that:

1. The chief source of infection with *B. typhosus* in the garrison in Bermuda is the contact of the military and civil populations, and that until this source can be eliminated, cases of enteric fever will constantly arise among the troops.

2. That it is possible, by rigorous sanitary precautions and by the co-operation of all branches of the Service, to limit cases of enteric fever to those introduced from local sources.

3. That the danger of personal contact exceeds that from properly supervised water supplies and conservancy systems, and that this danger is aggravated by the mild form which the disease seems to assume in Bermuda.