CONSERVANCY METHODS AND ENTERIC FEVER INCIDENCE IN INDIA.

By Capt. J. M. Buist.
Royal Army Medical Corps.

In his excellent report on "Enteric Fever amongst the British Troops in India," published as an appendix to the Army Medical Department Report for 1900, Major McCulloch, R.A.M.C., states that "the causation of enteric fever is the question of the day for the army sanitarian"—a statement which will be emphatically endorsed by all who have watched the ravages of this disease in India and in Africa. It is a very remarkable fact that the methods which have been so conspicuously successful in stamping out cholera amongst British troops in India have met with as conspicuous failure in the case of enteric fever. Major McCulloch's report shows that the general improvement in sanitation in India, particularly in the direction of improved water supply, has been followed by little, if any, corresponding reduction in the prevalence of enteric fever. On the contrary, some of the cantonments which have the best and most carefully protected water supplies have an unenviable notoriety as hotbeds of enteric fever. The balance of evidence goes to prove that, in India, direct pollution of the water supply by specifically contaminated discharges is not of common occurrence, and that the cause of the bulk of the cases of enteric fever must be sought for elsewhere. It is practically certain that enteric fever cannot originate de novo, and every fresh case must therefore be derived directly or indirectly from a pre-existing case. As the specific bacilli are voided only in the faces and urine, and, according to Wasdin, occasionally in the sputum, it follows that the safe disposal of these discharges is of the first importance to prophylaxis. If these discharges could in every case be rendered innocuous, enteric fever must of necessity die out, and the problem of its prophylaxis is thus inseparably bound up with that of conservancy.

Though the discharges of all cases among British troops admitted to hospital are mixed with sawdust and burnt, this is by no means an efficient protection to the community, for the specific bacilli may still, in a variety of ways, gain access to man, notably in
cantonments where the general excreta is not burnt, but disposed of on the shallow trench dry earth system, known in India as the Allahabad method. The general excreta may be specifically polluted by ambulant cases of the disease, by cases of persistent bacilluria discharged from hospital, and by the not uncommon occurrence of the disease among the native population. Once the liability of the general excreta to occasional specific pollution is admitted, its safe disposal becomes nearly as important as that of the known specifically polluted discharges from hospital.

The experiments of Majors Firth and Horrocks, reported in the British Medical Journal, September 27, 1902, prove conclusively that the dry earth system of conservancy in general use in India offers favourable conditions for the survival for long periods of any specific bacilli which may gain access to the excreta. The specific bacilli are thus frequently planted out around cantonments and every surface trench may become a potential focus of the disease from which specific bacilli may pass, in rare cases, directly into water supplies; or, more commonly, may be carried back to cantonments by flies or in the form of infected dust, and so secondarily infect water, milk and food supplies. Most observers of Indian experience will agree that such secondary limited infections of water, milk and food supplies are of much more common occurrence than the general infection of a water supply by direct contamination with specific discharges. The Allahabad system of conservancy, though convenient and cheap, must be regarded as highly dangerous. The excreta disposed of must frequently be specifically contaminated with the bacilli of enteric fever, and as this system favours the survival and dissemination of these bacilli, it must be regarded as one of the chief means by which enteric fever is fostered and spread. The immediate and effective sterilisation of the discharges of every case of enteric fever is the very fountain-head of prevention, but, owing to the impossibility of isolating every case, it is impossible to ensure this by any measure short of the sterilisation of the discharges of the entire community.

The destruction of all specific bacilli while still local is the natural first line of defence, and is in reality an offensive defensive measure. Once the bacilli have passed this line of defence and have become widely disseminated, preventive measures in the direction of the protection of air, water, milk and food supplies, are less certain, more expensive and, as events have shown, com-
Comparatively ineffective. Such measures constitute, in fact, only the second line of defence and are strictly defensive, as they do not aim at the destruction of all specific bacilli, but merely endeavour to ensure that they are not re-introduced into the bodies of susceptible individuals. A third line of defence is the protection conferred by inoculation with Wright's anti-typhoid vaccine. This, too, is a strictly defensive measure, as it aims only at raising the proportion of insusceptible individuals. Hitherto the chief efforts at the prophylaxis of the disease have been in the direction of strengthening these second and third lines of defence. It is surely more rational to strengthen the first line by attacking and destroying the specific germ while it is still local. The practical application of this latter idea involves a consideration of the means at our disposal for sterilising excreta on a large scale. This may be effected (1) by chemical means; (2) by incineration; (3) by boiling.

(1) Chemical means.—These may be briefly dismissed, as hitherto the chemical sterilisation of sewage on a commercial scale has not been a practical success. Further discoveries may, however, again bring these methods into prominence. The use of germicidal solutions will probably be found a useful adjuvant to the method of sterilisation by boiling.

(2) Incineration.—Large incinerators are already in use in many hill stations where the conformation of the ground does not admit of trenching. Unfortunately, the perfect incinerator has not yet been invented and those now in use can only be described as modified successes. Carefully conducted experiments have shown that this method is from four to nine times as expensive as superficial soil burial. On a small scale incineration is carried out in every garrison hospital where the dejecta of all cases of enteric fever are mixed with sawdust and burnt in a small brick and iron incinerator. These "chulas" cost from 7 to 30 rupees, are quite effective and cause no nuisance. I have seen incineration on this small scale very effectively carried out, without nuisance, in an ordinary kerosine oil-tin provided with a lid. In some few hospitals special destructors are in use. In one of these patent destructors (Donaldson's) the air which feeds the fire is drawn over the pail contents, the effluvium from which is thus carried through the fire and so deodorised. Now this system of local incineration, which has proved a practical success in hospitals, could be easily
extended to all existing latrines in barracks and bazaars, a small "chula" being built in the immediate vicinity of each latrine. The great advantage of this local incineration is that it kills all germs at the earliest possible moment before they have had time to become disseminated, and it obviates the necessity for a preliminary collection of excreta with its attendant risks, such as is required when large incinerators are in use. Its disadvantages are that it is difficult to deal with the urine on this system and the urine would have to be separately heated; the system is, moreover, somewhat unnecessarily costly, as the heat required to complete incineration is far more than sufficient to kill the specific germs. Difficulty might be experienced in obtaining a sufficient supply of sawdust or other combustible material to mix with the excreta. In many hill stations fir cones and pine shoots in large quantity are to be had for the small cost of collection, and these, where available, might be used to replace sawdust. There are many stations at which such a scheme would be found practicable, and there is no reason why it should prove more costly than incineration in large incinerators.

(3) Boiling.—This involves the introduction of a limited water carriage system. All existing latrines could be easily converted into trough closets, the water supply of which need be but very small in amount—only just sufficient to keep the trough clean and prevent nuisance. Twice a day the contents of the troughs could be syphoned off into a boiler placed at the end of each latrine, and, after the urine from the urinals had been added, the whole could be boiled and subsequently safely disposed of on to land. Major Cummins, R.A.M.C., has devised an apparatus for sterilising excreta by boiling which is effective and is stated to cause no nuisance.

The principle of the Donaldson Destructor could be easily adapted to any boiler and would effectively prevent nuisance. The addition of some cheap germicide to the sewage would lower the temperature necessary for sterilisation and so would lower the cost of this method. It may be urged that the expense of such a scheme would be prohibitive. In many stations the drinking water for the troops is boiled and the expense of this is not considered prohibitive. The amount of fuel which would boil two pints of drinking water (the amount allowed to each man) would suffice to sterilise by boiling the excreta of several individuals, and if this were effectively done the necessity for boiling drinking water would
disappear. Such a scheme disposes of the urine as well as the
solid excreta, and kills the germ at the earliest possible moment.
There is every prospect that it would be found quite practicable
and decidedly cheaper in the long run than incineration, though
the initial cost would be greater.

One of the conclusions arrived at by Majors Firth and Horrocks
was, that there is no evidence that the enteric bacillus in soil could
increase or grow in different directions. This conclusion at once
raises the question whether a reversion to deep trenching would
solve the problem of the safe disposal of specifically infected excreta.
Deep trenching is open to the objection that it permits of the survival
of the specific bacilli and does not obviate the risk of their direct
percolation into a water supply. This risk is, however, a slight one,
as trenches are never placed near water supplies. The advantages
of deep trenching are that it is no more costly than the
Allahabad system, and it would afford protection from wind-borne
germs. The great objection to this system, however, is its failure
to destroy the specific germ.

I have endeavoured to show (1) that the methods of prophylaxis
which allow the specific bacilli to survive and become disseminated
and which aim only at the prevention of its introduction into the
bodies of susceptible individuals, have met with conspicuous failure
in India; (2) that it is more rational and quite practicable to attack
and kill the germ while it is still local. The practical application
of this latter idea involves a radical change in conservancy in India.
Though in the light of Majors Firth and Horrocks' experiments,
the superficial burial in earth, or Allahabad system, stands con­
demned, it cannot be swept away until some practicable, better and
safer system can be substituted. Such a system can only be arrived
at after extended experiment, and in view of the importance of
the subject a beginning should be made without delay. I would
suggest that the initial experiments might usefully take the follow­
ing form:—

(1) In view of the increased importance of incineration, let
Government offer a really valuable prize for the best incinerator.

(2) Select some station which, under present conditions, may
be relied on to furnish annually a considerable number of cases of
enteric fever. The selected station should not have too large a
bazaar population. In this selected station abolish entirely the
dry earth system in hospitals, barracks, bazaars and private bunga-
lows, and substitute either local incineration or local boiling of all liquid and solid excreta. The abolition of the dry earth system in the selected station must be absolute. The effect of such radical measures on the prevalence of enteric fever could thus be watched and much valuable information gained. An experiment of this magnitude is no new departure. At the instance of the Commissioners of the Royal Society, the Indian Government is now conducting a very costly experiment in the prophylaxis of malaria at Mian Mir, the importance of which lies not in the prevention of a little malaria at Mian Mir, but in the fact that Mian Mir is being made a test case, and in the event of success there, the measures which have proved successful will no doubt be extended all over India. It is surely as feasible and no less important to conduct a similar experiment in the prophylaxis of enteric fever.

(3) Deep trenching, though falling short of the theoretical requirements of a perfect system, might be given a trial at a selected station.

The whole sanitary environment of the soldier is the subject of the most assiduous, constant and intelligent care, and is more carefully supervised than that of any other community, yet enteric fever—theoretically an entirely preventable disease and one whose etiology is comparatively well understood—exacts a very heavy toll from the soldier in cantonments and in the field. This state of affairs is a constant reproach to every officer of our corps, and as the fault does not lie in want of sanitary supervision, it can only be due to wrongly directed or faulty methods of prophylaxis. Majors Firth and Horrocks have performed a great service in directing attention to the grave dangers of the Allahabad system of conservancy. To devise a safe and practical substitute for this dangerous system is of the most pressing importance. The problem is one of very great difficulty, but until it is solved there is little hope of any large reduction in the incidence of enteric fever.