

## **Typhoid : a destroyer of armies, and its abolition / by Leigh Canney.**

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TYPHOID  
THE DESTROYER OF ARMIES, AND  
ITS ABOLITION.

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*Lecture delivered at the Royal United Service Institution,*

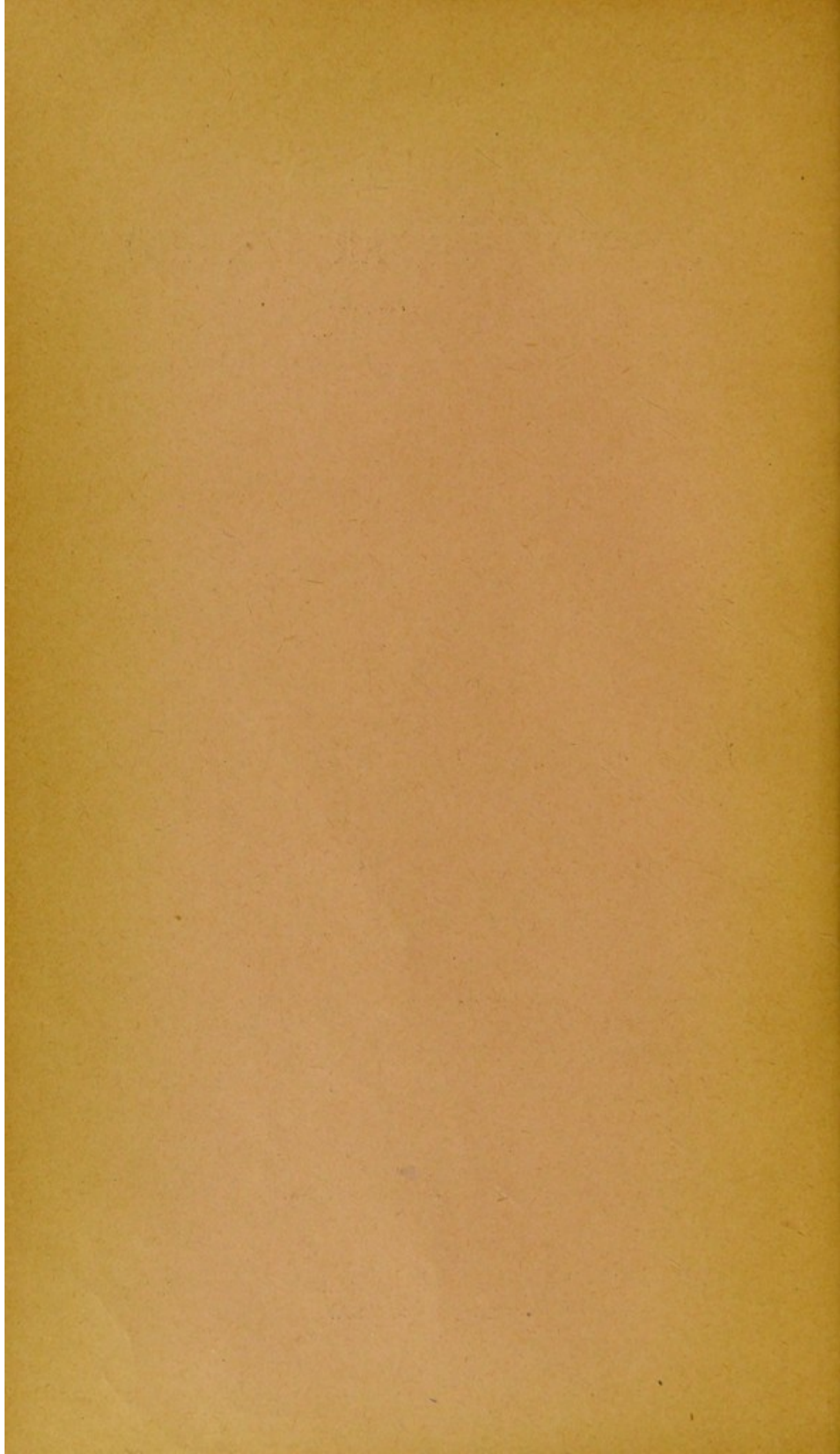
BY

LEIGH CANNEY, M.D. (LOND)

ON TUESDAY, 12TH NOVEMBER, 1901.

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## TYPHOID, THE DESTROYER OF ARMIES, AND ITS ABOLITION.

By *LEIGH CANNEY, M.D. (Lond.)*

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Tuesday, 12th November, 1901.

Sir WILLIAM H. BROADBENT, Bart., K.C.V.O., M.D., F.R.C.P., F.R.S.,  
in the Chair.

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IN asking your consideration to-day of a scheme which I have proposed for the prevention of one of the greatest evils in war, I am encouraged to address this meeting of experts, feeling confident that you have assembled here in the public interest, with a desire by your counsel to assist the nation to avoid in the future the recurrence of those evils it has lately suffered and may shortly be again called upon to face. I feel confident that, if you are of the opinion that the scheme I shall propose is likely to lead to a marked reduction of these evils and the disasters that have often accompanied them in the past, and if you regard the organisation and effort involved to prevent the same as reasonable and practicable, you will not allow yourselves to be moved from the resolution that in the public interest this scheme in its essential principles shall be carried out. Without actual military experience, but with considerable civil experience in the successful prevention of these same evils in the vast camps of European and native workmen employed upon the great barrage works of Egypt, I have taken the initiative in this movement, as I have observed that those actually engaged in the administrative work of our Army and officers generally, feeling themselves part only of an intricate machine, hesitate to make proposals involving radical changes which too often meet with signs of active disapproval and hasty rejection. Hence arises a strong inclination to allow theories which are antiquated to remain in force, reforms which may meet with any opposition to be left un-urged. Inertia reigns supreme. The intelligent officer, fast bound in chains of discipline, rapidly succumbs to the inertia, disturbed only by occasional impulses of "I would that my tongue could utter the thoughts that arise in me."

New methods often involve departure from accepted traditions, and too often are met with a prompt "impracticable" or "never," a reply which really represents only the "personal equation," or time required to absorb the idea. Such replies are an automatic function of the brain, and

only mean that the attention has not been riveted upon the subject. The same individual, after he has adopted the new scheme for some years, if asked to abandon it, would most certainly reply "never." Who would have ventured two years ago to have read in this place a paper on officers and men "seeking cover," and who now would read one neglecting "cover"? What "cover" is to the rifleman, that is "approved" water to the soldier in general. The object of war is to force upon the enemy surrender or annihilation. It is manifest that to wilfully allow oneself or one's men to be killed by the enemy's fire, or to be spending weeks in bed at the critical moment with preventable disease, before this result has been attained, is neither business nor war. The vast extent of the latter evil in this war led the House of Commons into a long discussion in which it was assumed that this evil was unpreventable, and it was induced to send out a commission to enquire if our men were comfortable with their typhoid at Bloemfontein, Kroonstaad, and other places. In that House it was stated that "In no previous campaign had the sufferings been more mitigated," as if the object of war, medically, were only to see how many thousands could be "comfortably" treated. This debate revealed a total disregard of the scientific work that has been done in the past twenty-five years for prevention, and of the serious risks to the Army that might thus follow from diminished efficiency, leading to possible total destruction, and inability to advance or to accomplish its object. The Under Secretary of State for War assumed in that debate that all that foresight, zeal, or intelligence could suggest to avoid these evils had been done. This was not the case. It is too readily assumed that, because there is a medical department at the War Office, all is done that can be done. The Medical Department have done all in their power, and have done it better than the public are entitled to expect. From the point of view of preventive medicine, however, they have been hampered by having to work on a plan which carries all the elements of failure, a plan that the very best men would find unworkable, and this the public and the Army should understand. The system of the Army Medical Department making "recommendations," which may be instantly neglected or evaded, makes it almost a certainty that they would hesitate to suggest such a scheme as I have proposed, which is essentially one liable to be sent back by the Staff. If then the view taken by the Army and the public, that the Medical Department is responsible for the terrible scenes at Bloemfontein, Kroonstaad, etc., is accepted by the Medical Department, an *impasse* is arrived at. The Medical Department hesitates to throw the responsibility for such occurrences where such responsibility actually rests—upon the then Commander-in-Chief—and, on the other hand, hesitates to promulgate the scheme that will obviate such disasters, on account of the difficulty of overcoming the passive resistance to reform, and the knowledge that the first refusal by the Staff must be regarded as final.

The result of the Hospitals' Commission then is, the reform of the Medical Service, but provides no glimmer of light as to the avoidance in future of the actual disasters which called it forth. The main issue—prevention—has been obscured. It is the object of this paper to fix

attention on the main question, that before the grass has grown over the mounds of typhoid dead we shall have resolved that these disasters shall not occur again, and that any steps taken in contemplation of such disasters-to-come, in pursuance of the idea that such disasters are inevitable, cannot be tolerated.

The great destroyers of armies in war and in peace are the diseases typhoid, dysentery, and cholera. They are mainly water-borne, and all are alike excluded by the measures to be proposed. Although there is some difference of opinion as to the relative efficiency of air and water to spread typhoid, the great body of medical opinion is in favour of the view that the main channel is water. In a paper lately read before the British Medical Association, I have brought evidence to show that if all the water avenues of typhoid to an army or camp are closed, the other avenues will cease to be effective. This was proved to be the case in the vast civil camps of European and native workmen at Assouan, and in other instances, such as in the prisons at Pietermaritzburg, Lucknow, and lately at Ahmednagar; whereas the soldiers and civil population, having access to unapproved water, suffered severely. It is on this ground that so much is to be expected from the present scheme. The Army starts free from typhoid, the primary typhoid avenue to the Army through the water is now closed, the soil therefore remains unpolluted with typhoid, and flies and dust, the secondary avenues, will remain ineffective.

These three water-borne diseases if allowed their natural incidence, as has largely been the case in the present and all recent wars on any large scale, seriously and often disastrously affect the efficiency of an army. They often paralyse an army in its movements, they embarrass the transport, produce inevitable chaos in the army hospital arrangements, and inflict enormous unnecessary sufferings, vast numbers continuing to march with the greatest distress until they fall out, and are left by the roadside.

The victims of these diseases, require careful feeding and nursing, which no possible previous preparation will ever be able to provide in war on a large scale. These diseases are all preventable during war by various methods known to medical science, yet the death rate in war from these diseases is far greater than from all other causes put together. If we take the present war, the number sent home *hors de combat* on this account is at least six times as great as those *hors de combat* from wounds.

I shall now confine the discussion to the chief of these destroyers, typhoid or enteric fever. I have shown elsewhere that the incidence of typhoid fever is a practical certainty in all wars, unless steps are taken to prevent it. I have shown that in every war in the past century where the men have drunk the water as they found it, appalling disaster has followed with mathematical precision. This enemy comes into action with concentration or mobilisation and speedily produces disaster. It dogs the army's footsteps to the end, not infrequently actually destroying the army of the conqueror. So certain is this factor, that it was fully calculated upon by the Medical Department before the present war. The appalling list of these disasters I have elsewhere cited, they are well

known to you. I wish, however, to draw attention to the effects produced by this agency on military policy.

The paralysis of an army produced by water-borne disease is often so complete, that the army fails to accomplish the work set before it. During the Civil War in England, neither of the opposing forces moved for many months on this account, though encamped in adjoining counties. From this cause, in recent times, the first army sent to the Crimea was practically wiped out by a death rate exceeding that of the Great Plague, and led "ultimately to the enforced abandonment of part of the enterprise the army was designed to accomplish." Still later, the Russians in Western Asia, had to abandon their projected policy by the paralysis of their mobilised army, produced by enteric fever. In Madagascar the slightest serious resistance would have practically annihilated the whole French army, paralysed and decimated as it was from this cause. In the present war I will draw attention to two instances in which the incidence of enteric fever led, in the one case to grave disaster and delay, and in the other case to the very verge of one of the greatest disasters that the reputation of the army could have been called upon to receive. I refer, in the former case to Paardeberg and Bloemfontein, and in the latter case to Ladysmith. In the case of the Bloemfontein epidemic, no one can deny that the delay involved in transporting all the food, hospitals, and equipment, required by a division of soldiers in bed with typhoid or other water-borne disease, and that required by their staff of attendants, must have had a disastrous effect in delaying many days the subsequent advance and the delivery of effective blows. The view taken by the House of Commons on this question, was expressed by Mr. Balfour in the statement "that the whole question is one of transport, avowedly one of transport." If this be true, then it will be seen, before the close of this paper, that there is no escape from the adoption of the scheme I have proposed.

In the House of Commons (30th June, 1900), Mr. Balfour stated: "The particular issue is, whether we are to insist that he (the general-in-the-field) shall limit the sphere of his operations, check the rapidity of his movements, dull the strength of his blow, that there shall be not a moment's delay in tending the wounded." That is the view taken by the Government and by Parliament of the Bloemfontein epidemic. The scientific, medical, and I take it military, view of the "particular issue" is that "we are to insist that the general-in-the-field shall not limit the sphere of his operations, check the rapidity of his movements, dull the strength of his blow," by neglecting to make his military arrangements so that by means of an initial minute fractional addition to transport, he shall obviate the need of this vast, subsequent, useless, but otherwise inevitable, transport.

In this particular case to obtain an effective force of 35,000 men at the objective, it was necessary to carry 500 tons of transport daily, and to have some 10,000 men in addition in hospital *hors de combat* from water-borne disease. If twelve tons more transport had been taken, which could have been obtained by leaving only a fourth part of a single hospital behind, or by employing the mules actually left behind, there

need have been no epidemic, no suffering, no delay, no dulling of the blow that would have been dealt by 45,000 effective men.

In the case of Ladysmith, not only military policy was on the point of receiving a severe check from this same cause, but national respect was on the very verge of suffering a grave disaster. General Buller has stated (10th October, 1901):—"I attacked Colenso and I failed, and having failed I had to consider the people in front of me in Ladysmith . . . . . I knew that enteric fever was endemic and was likely to become epidemic in the Tugela Valley at that time. I believed also that the Boers were engaged in putting dead horses into the water which the garrison was obliged to drink. I knew that the garrison would have trouble, great trouble, with their sick . . . . . I therefore suggested (by telegram) it would be necessary to surrender the garrison."

We see therefore, the neglect seriously to cope with the question of prevention of water-borne disease, in these cases the real enemy, has not seldom absolutely checked military policy and brought about national disaster, whilst the human enemy has often only been a passive onlooker.

*Methods of coping with water-borne disease:—*

- I. Drinking the water as it is found. This policy, in force practically in the Crimea and very largely in South Africa, I have termed the *laissez-boire* policy. It assumes that the men are uneducated, wilful, unrestrainable, and that they will drink and must be allowed to drink when and where they like. We have seen its results.
- II. There is the system at present officially recognised. This is an attempt at a compromise between supposed military exigencies and scientific laws, and is naturally doomed to failure. It provides approved water when it can, and if it fails, as at Paardeberg, Bloemfontein, Ladysmith, etc., these disasters are accepted in military circles with complete serenity as inevitable. Sometimes it provides the men with filters, which it is known beforehand may not work, and if found workable would still be absolutely dangerous if entrusted to untrained men. If the filters are absent, men are stationed above the camp, on the river the enemy has just polluted, as if their presence could frighten the bacilli descending with the water. Sometimes the men are instructed to "choose" or "look for" good water. Seeing that there is no water in war that any expert bacteriologist would venture to pronounce "free from enteric bacilli" even after long research, of what avail such advice? This system does not give due proportion to the fact that a single error in method on one occasion may suffice to paralyse the whole army.

Mr. Wyndham, in the House of Commons (29th June, 1900), asked: "Is it true that the Government went to war in South Africa without taking account of the outbreak of enteric on a large scale?" And



replies himself to this question by stating that each surgeon was supplied with Surgeon-General Sternberg's pamphlet on the American-Spanish war, and that "recommendations were made that each unit of 100 men should be supplied with a sterilising filter, and that one ton of quick-lime per 1,000 men should be laid down wherever standing camps were formed." From Lord Roberts' telegram (25th June, 1900), we may judge the state of the army from a sanitary point of view. He states:—"When we arrived at Bloemfontein we had an abnormal number of sick, due, no doubt, not only to the peculiarly exhausting nature of the march, but also terrible insanitary conditions of our camp at Paardeberg, where the only water available for drinking purposes flowed down from the Boer camp, 1½ miles up the river, which was crowded with dead animals in a state of decomposition. That this was "the only water available for drinking purposes" is no explanation of the army's being without the means of purifying it. Everyone knows that this is the kind of water you are likely to meet in war, and we could hardly expect the Boers to send it down to the camp ready boiled or filtered. Thus the army that started with some tons of quick-lime, an often unworkable filter and a pamphlet, arrived at Bloemfontein, armed for the future advance with probably only the pamphlet, which could not be expected to have of itself any marked therapeutic action in sterilising the water they had yet to meet. Is this scientific warfare? Are we to understand that these are the arrangements the Empire is to expect in its next great struggle, when the larger business may perhaps call for camps of some hundreds of thousands of Volunteers in this country, and vast English armies concentrated simultaneously, possibly in Afghanistan, Northern China, or elsewhere? Is there any military surgeon that would recommend this country to prepare for that day on these lines, and advise us to be satisfied to lay down endless typhoid hospitals that can never be worked, as some would have the House of Commons believe? Are general officers to conduct this and future wars as if nothing had happened in the medical world since the Crimea? Is the light that might be called forth from the Army Medical Department to save such disasters to be extinguished at the first glimmer? Are we to sit still and see our men struggling under ancient custom to certain destruction, and the palm for method and order pass to the soldier of the Far East or of Central Europe?

III. In the scheme which I have proposed, and now bring before you for consideration, I have endeavoured to keep the following objects in view:—

1. Certainty in method.
2. Simplicity of mechanism.
3. Continuity of action.
4. Automatic working.
5. Increased comfort of the men.
6. Diminution of transport.

The scheme starts on the assumption that all water in war is to be regarded as contaminated.

1. *Certainty of Method.*—I have adopted the method by boiling or heat sterilisation. This is the most practicable, least liable to errors in method, and requires less expert skill than filtration or chemical processes. This method has as advocates the late Professor of Military Hygiene at Netley, the present Medical Director-General of the Army Medical Department, and the highest medical authorities in the French and American Armies. In addition, it has met with marked success in two or three minor campaigns. The method is also more rapid and certain than any chemical method.

2. *Simplicity of Mechanism.*—The apparatus I have proposed consists of a cylindrical copper boiler with large heating surface below, arranged in wedge-shaped pockets which can be easily cleaned. It holds 50 pints (6¼ gallons) of water. An iron stand is provided under which a petroleum lamp is placed, with rapid and complete combustion under air pressure. The whole weighs 38½ lbs., and measures 33 inches in height by 17 inches in diameter. The apparatus is constructed to very readily allow repairing if shot through, and would be accompanied by duplicate parts, etc. Cloths would be used to strain mud from the water, but no other filtration of water would be desirable. This boiler and lamp can raise 50 pints (6¼ gallons) of water from 54° Fahr. to the boiling point in 11 minutes, consuming ¾ pint of petroleum. Cooling is effected, by covering the pint tins with cloth damped in the fluid, in 6 minutes.

I may here mention that the most practicable steriliser hitherto found of any use on service is the Waterhouse-Forbes, which weighs 29 lbs. and sterilises only 5 gallons of water per hour. There is also a later heavier variety.

The apparatus I have proposed sterilises about the same quantity of water as the best previously known in one-sixth of the time, with less consumption of fuel, and is about half the weight of the latter instrument.

One mule (carrying easily 200 lbs. weight) would transport the following supplies for the unit of 100 men:—

	lbs.
2 machines, in cases with lamps and stands	- 90
42 pints of petroleum (sufficing for 4 pints of boiled water daily for each of 100 men for 7 days) and case	- - - - 45
Sugar, tea, meat-extract, vegetable powder	- 40
Saddle, 2 collapsible buckets and ropes	- - 25
Total - - - - -	200

*Time.*—In cases of urgency the men of the water section would only raise the water to 180° Fahr. This would be reached in 9 minutes, and cooled sufficiently to drink as soup or meat-extract in two minutes. To obviate delay, the time required could in most instances of urgency be arranged for, by allowing the water section to advance half-a-mile in front of the troops, but a mile and a half behind the scouts, so that tea or soup should be ready on the arrival of the troops. The morning and evening meals would always be welcome as hot tea or soup, and probably

the mid-day meal. The water-bottles and carts would be filled over night with boiled water.

The machines and fuel would be used for no other purpose than supplying fluids for the Army. All water carts and utensils used to convey water to the firing line must be under the control and care of the water section. Mules have been chosen as transport to prevent separation of the water section from the men in difficult country. The advantage to the men of being able to obtain rapidly tea, soup, etc., with their dry biscuits when the transport is often miles behind, is something which, if once established, the men would never give up.

3. *Continuity of Action.*—I have shown that there is at present no method known to science by which any specimen of water likely to be met with in war can be declared free from the enteric bacillus. As you cannot say, therefore, what part of your lines of communication may be attacked, you guard the whole extent. The water section must not rely upon the chance of finding fuel. The fuel used in this scheme is petroleum, and must be as constantly at hand as ammunition.

For an army of 200,000 men, to give every man 4 pints of boiled water daily, would require 547,500 gallons of petroleum for the year. This would cost about £16,000, and weigh about 1,833 tons. The general transport required for this army daily is 2,000 tons. This fuel would add daily about 5 tons to this 2,000 tons, or an increase of  $\frac{1}{400}$ .

Further, to ensure continuity of action, the transport of this water section must be made very independent of the general transport, and must march with the regiment or unit. The transport of reserve fuel required by the water section, minute as it is in regard to the total transport, must take precedence of all transport except one day's ammunition. The transport of the water section must be regarded as sacred, the amount telegraphed for must be sent instantly. No general could stop it or cut it down on any account whatever. Neither could the mules be used for any other purpose. The more difficult the country from a transport point of view, by reason of "single lines of rail" or none at all, the more urgent the need for absolutely punctuality and precision in the details of the water section transport and work, in order to effect the immense reduction of general transport that I have shown must ensue.

4. *Automatic Working.*—To ensure this system working, a system which assumes that no water will be drunk in war from the day of embarkation to the day of return which is not "approved" by the water section, it is evident that much attention to detail is necessary, and that success depends on insisting that there shall be no man in the Army who is not directly interested in the scheme and its results. In fact, every man shall look to this section for that protection which shall keep him face to face with the enemy or his work, and shall regard any departure from its protective action, either in himself or in his comrades, as an act of cowardice and likely to lead to serious injury to the Army, to his comrades, and to his country. In this light also shall the country regard his action. To reduce the number of these departures from duty

to what no one can believe will not rapidly become amongst our men—Regulars, Volunteers, colonials and naval—a mere fraction, various steps are necessary.

1. *The Men.*—They must understand that the scheme is a sound one and can be relied on. Just as they rely on their artillery or service of ammunition, so they may expect smartness and training in their water section in the delivery of “approved” water. They must be earnestly taught by the sanitary officers of divisions, both by literature and otherwise, the consequences in the past to armies that have neglected these precautions. They must be taught to fear “unapproved” water, in peace and at manœuvres, not only on their own account, but for the sake of their comrades who will be exposed to grave risks in consequence of their departure from duty, for the sake of their families, and the reputation of their regiment. If there are a few men unamenable to teaching, their comrades will know how to deal with them, and neither the country nor the Army will regret their loss. This supposititious minority must be made no argument for neglecting to provide the remainder of the men with the means of keeping their face to the enemy they desire to meet.

2. *Officers.*—All officers must be trained and examined in the elements of sanitary science, as it concerns the management of camps, disposal of excreta, technique in force for providing “approved” water, selection of camp sites, etc. They must be directly responsible for the successful administration and working of the water section in the troops under their command and for the ordinary sanitation of their camps. In the sanitation of an army they must be considered to correspond to the sanitary or executive authority of civil life. In circumstances of real stress, such as the possible failure of fuel, the water section will, with the consent of officers “approve” water available, but the circumstances must be noted and reported to the Sanitary Officer of that division. In the promotion or distinction of every officer a record of his successful sanitary administration must be kept and required. This record shall be produced from the records of the Sanitary Department of the R.A.M.C., and be based on the incidence of water-borne disease amongst the men under his charge and on the Sanitary Officers’ previous reports of inspections of camps and methods, special note being taken as to whether the remedy for any defects was within the power of that officer, or whether the responsibility was to be fixed upon a higher officer.

There can be no officer in the Army, be he officer of Guards or Volunteer corps, who will not welcome this new interest and responsibility in the welfare of his men. It must at once be made absolutely clear that there can be no departure from this principle, and that there is no place in the King’s service for any officer who might think these duties and responsibilities of minor importance or outside the sphere of his deep interest.

In the official reports of the Sanitary Department on the sanitary work of superior and general officers, a record must also be kept of the efforts made by such officers to take into consideration the reports of the Sanitary Department on the sanitary administration of officers otherwise eligible for promotion or distinction. In the possible case of repeated

contravention of this principle, the Director-General of Sanitation will directly call the attention of the Advisory Board to the matter, who will bring the same before the Commander-in-Chief.

*Sanitary Officers of the R.A.M.C.*—Whilst all officers of the R.A.M.C. are to be, as at present, trained in military hygiene, that they may be able to advise combatant officers on the best means of applying their new knowledge and instructions to the greatest advantage, a special number of R.A.M.C. officers, who have either distinguished themselves in this branch in the Army or have been passed into the Army on this account, must be regarded as Sanitary Officers, in the proportion, perhaps, of one to a division. Their duties shall especially be :—

1. The education of all officers placed under their care in the methods regarded by the Sanitary Department of the R.A.M.C. as the best to be adopted at the time. This information they should give by printed instructions, lectures, or demonstrations, in such a manner as to enable officers to qualify in this subject either on admission to the Army or at the subsequent examinations required at present for promotion.
2. The education, certification, and re-examination of the men of the water section.
3. The education of the men on the disasters resulting from insanitary conditions of camps or water supply, and the encouragement of the men in a feeling of comradeship in prevention of water-borne disease—their worst foe in war or peace.

Practically speaking, the Sanitary Officer's duties terminate at the declaration of war; if his work of education has not been completed by then, his presence on the battle-field can have but little influence in warding off the coming disaster. If his work has been well done in the time of peace, success will follow his men. The responsibility is now with the officers of all units, they are the responsible executive for the sanitary teaching given. On active service Sanitary Officers would best be employed in the immediate separation of any suspicious cases of these three diseases, and in assisting general officers in the selection of camp sites. In addition to the Sanitary Officers of divisions, there must be a Sanitary Officer, ranking with the P.M.O. on the staff of every army corps, and on the head-quarter staff of every expedition or war. There must also be a Director-General of Sanitation, or Chief Sanitary Officer of the Army, who shall be on the Medical Advisory Board, on the Army Board, and on the War Office Council. Sanitary Officers shall only deal with questions of preventive medicine. Sanitary Officers are not officers of the water section, except when the men of the water section are being trained by them.

*The Water Section.*—The men of the water section should be specially recruited for intelligence and trustworthiness in the proportion of 2 per cent. of strength. They are to be specially employed men, borne on the

strength for one purpose only, to be recognised as men technically trained to provide their corps or unit with "approved" water, and to guard it against all the water-borne avenues of typhoid. The training of the men of the water section will devolve upon the Sanitary Officers of the R.A.M.C., or in exceptional cases on the medical officer of the unit or garrison. The Sanitary Officers shall also train a reserve of water section men, not exceeding another 2 per cent. of strength. After training and certification, the men of the water section shall pass absolutely under the control of the commanding officer of the corps of which they are to form part, who is directly responsible for the carrying out of their duties, subject to the advice, recommendation, or orders he may seek or receive from the staff officer (sanitary). These men shall be taught the responsibility of their work. Their success, as in the case of officers, must be noted and meet with its reward, both in war and in peace. The duties of this section stationed abroad in times of peace, I have indicated elsewhere, suffice it to say here that the principle of "approved" water only is to be carried out by them at all stations abroad, and is to follow the men into the bazaars, which are at present largely beyond barrack rules, and produce disastrous results. The men of the water section will learn that the technique required for the sterilisation of typhoid or cholera water to be used for drinking purposes is a laboratory experiment, and is not the same thing as preparing hot water for a bath. The serious responsibility of their duties, requiring special recruiting and training, the smartness and rapidity of action required, and the influence and respect they are to command amongst their comrades, require that everything should be done to give them prestige in the corps or unit of which they form part. The designation "water section," in preference to "sanitary section," has been adopted for several reasons. These men must have no other sanitary duties whatever, and therefore, they are not a "sanitary section."

*Progress and Advance.*—Every effort must be made, by offering distinction or reward to officers or men of either Navy or Army, or to civilians, who shall be able to suggest any suitable modification of the methods at any time in force, which shall render the work of this corps more simple, rapid, or effective.

It will have been noted that the scheme endeavours to interest directly every officer and man in the Army in preventing the action of their three main destroyers, and to bring the highest sanitary teaching to the service of every interested officer and man. It endeavours to avoid adding one ounce to transport unnecessarily, and at the same time to make it clear that the general who shall leave that ounce behind is courting disaster and inflicting on himself the absolute penalty of subsequent tons of useless transport. If he deny the soldier that ounce of extra transport, he will have to carry as an invalid the soldier himself. I have shown that the remedy for these evils is a campaign within a campaign, to be fought *pari passu* with every step of every unit of the Army, and that the unseen bacillary enemy is as real and as disaster-bearing as the human

foe. To take no account of this foe, to under-rate its power, or to trust to the chance of avoiding it, as is the rule in military strategy at present, is to be a quarter of a century behind the times, is futile, and must in the future bring disaster and disgrace on the general who shall exhibit such weakness.

The advantages of this scheme are:—

1. Total immunity from water-borne disease, which amounts to four-fifths of the mortality and invaliding of Armies.
2. Absence of discomfort and inefficiency on the march from minor illness.
3. Diminished thirst and discomfort by accessible tea, meat-extract, soup, etc., several times a day, in place of foul water, a biscuit, and late transport.
4. Enormous reduction of transport.
5. Great increase in effective strength.
6. Liberation of the R.A.M.C. officers and men for care of the wounded, by emptying the typhoid and dysentery hospitals.
7. Acceleration of the war and saving of enormous expense.
8. The placing of responsibility in the proper quarter for the future, making such subterfuges as "Hospital Commissions" or enquiries an impossibility.

The *essentials* in this scheme are:—

1. A trained water section of 2 per cent. of the strength.
2. The training and education of all officers in sanitary methods.
3. The education and training of the men in the advantages to themselves and their comrades.
4. The appointment of expert Sanitary Officers.
5. The responsibility of all non-medical officers for the executive sanitary work of camps or units.
6. Responsibility of the same officers for the incidence of water-borne disease—enteric, dysentery, and cholera—in their units.
7. The transport of this water section to be sacred, used for no other purpose whatever, largely independent of all other transport. The transport of reserved fuel, etc., to take precedence, if required, of everything except one day's ammunition.
8. The establishment of a tradition, that it is dishonourable and a crime to use any water for drinking purposes not "approved" or allowed.

I now leave the scheme in your hands, anxious that if you are in agreement as to the essential points and as to the considerable success that might fairly be expected, you will express that opinion, as well as any difference of opinion on any minor points. The particular technique at present suggested is likely to be much changed and improved upon in the

course of time. The essentials in organisation, to which I have referred, are likely to be found permanently necessary. I trust, however, that you will agree with me in insisting that the time has come for systematic endeavour to secure for the rank and file of every part of our forces in both Services, in war and in peace, an "approved" water, and the closure of all other avenues of water-borne disease. It must be remembered that in any great struggle in the future the Regular Army will only be the trained nucleus of that great force of Volunteers, home and colonial, who, desirous to meet the enemy, do not volunteer to suffer uselessly weeks of filthy, neglected, and too often fatal sickness, through being compelled to drink "unapproved" water, when the avoidance of these evils together with the means to prevent them can be shown to be a direct benefit to every department of the Army in the immediate function for which it has been created.

The CHAIRMAN (Sir William Broadbent):— I am sure we are all greatly indebted to Dr. Canney for his most interesting lecture. We are all agreed as to the destructive influence of typhoid fever in Armies, especially when on active service, although not confined to active service, and we are bound to admit the insufficiency of the existing means of prevention. This is not altogether from ignorance; but we have almost confessed our impotence to deal with this fatal disease. Dr. Canney in his address, proceeds on the assumption that the main channel of infection from typhoid, and other diseases which he has specified, is water. Other channels have been suggested, viz., dust and flies; but the degree to which they contribute to the spread of typhoid fever is still very much a subject of discussion. Whatever importance may be attached to them, they are subsidiary to the water-borne typhoid fever, and I hope the discussion will turn mainly on the prevention of water-borne typhoid, for it would be a pity to divert our attention from this, which is certainly the most important means of disseminating typhoid fever, by a discussion of methods which are of secondary importance. With regard to the efficiency of the method proposed, if it could be insured that no soldier drank anything but boiled water, I think we should get the upper hand of typhoid fever entirely. The whole question turns upon its practicability. This we can say anyhow, that the scheme has been well thought out. It is not brought before us in a nebulous condition. Dr. Canney has gone into details by which this boiling of water may be secured, and although, of course, it must be borne in mind that after a long march, or after the excitement and exertion of a fight, a soldier cannot be prevented from drinking the first water he comes across, yet, if he starts with his flask full of pure water, if the water-carts which follow contained nothing but pure water, and, if at these camps where men are assembled and most of the disease is contracted, nothing is drunk but pure water, an enormous gain will have been obtained. With regard to the practicability of the scheme, I am not in any wise in a position to speak. We must look to members of the R.A.M.C. and to those engaged in the administration of military work for their opinion. An extremely important part of the scheme is the education in peace-time of everybody, officers and men, in the importance of drinking this pure water only, and of endeavouring to enlist their sympathy to make it a point of honour among them to carry out these instructions, which are for the safety not only of themselves but of their comrades. I hope we shall have the benefit of the views of those who have had actual experience in the present war, such as Lord Dundonald, who, I am glad to see, is present, and who have had experience in India.

Major R. H. FIRTH, R.A.M.C. (Professor of Military Hygiene at Netley):— I have great pleasure in opening the discussion on this extremely interesting lecture; it is a subject in which I have been interested for many years, and which in my official capacity engages my attention almost every day. One could not help being struck, in listening



to the lecture, with the fact that the predominant tone was that "prevention is better than cure." That is a doctrine to which I think all in this room can subscribe. No intelligent man who has been on service could help being struck with the enormous leakage and wastage which takes place in a force in the field from disease, and which we know is largely preventable. There is no doubt that if we can check that leakage and wastage and the resulting overloading of our hospitals, we not only add to the numerical effectiveness of the force, but we add materially to its mobility, and we also add to its efficiency and rapidity of striking a blow, and thereby reduce the cost. Although Dr. Canney's paper bears the title "Typhoid, the Destroyer of Armies, and its Abolition," I think that any remarks we may make may be specially directed to two points which stand out pre-eminently in the lecture: first, that the greater part of the disease in Armies in the field is mainly preventable; and, secondly, that this preventable disease is largely water-borne. As you, Sir, have just said, the question as to whether enteric or typhoid fever is entirely water-borne is a moot point, and I do not think we need enter into that question to-day. But even supposing it is not all water-borne, or that only one-tenth is water-borne, if we can check that one-tenth, we shall have done good. Dr. Canney's proposal is essentially a scheme to obviate leakage and wastage from a preventable disease, which preventable disease, as I say, is largely water-borne; but when we come to look into his proposals we are at once confronted with the fact that the author's suggestions are very closely associated with the larger question of general sanitary organisation in our Army. Our history in the past in respect to sanitary organisation has not been altogether satisfactory. That fact is familiar, probably, to most persons in this room, and I need not dwell upon the reasons why; but there is no doubt there has been a certain want of sympathy in high places with the general policy of prevention of disease up to the present time in the Army. But although the past, as I say, has not been very promising or very satisfactory, I am disposed to think that our future is extremely hopeful. I believe that in the hands of a sympathetic War Minister a great deal can be done, and will be done, to evolve in and for the Army a sound sanitary service. The whole gist of Dr. Canney's paper is really, it seems to me, a question of how we are going to organise that sanitary service. There are two possible ways by which we can do it: one is to evolve through the present R.A.M.C. certain highly specialised companies and hand over to them the whole of the sanitary service of the Army. That may at first sight seem logical, and a very good arrangement, but a moment's reflection will show that it would be impracticable. The time is not ripe for that, and it would be a fatal error to hand over the sanitation of the Army at large to a corps which is not endowed with executive powers to carry out what they consider to be right. If these powers can be given to them, well and good; but my own opinion is, that the time is not ripe for such an evolution. Then we must ask, What is the alternative? The next best thing, in my opinion, is to organise somewhat on the lines of the scheme we have heard from Dr. Canney, and in the main I express great sympathy with the views he has put before us. It is very clear that the fundamental basis underlying the scheme is, that any sanitary organisation for the Army must be put on as broad a basis as possible—that is to say, we must place the onus of responsibility for sanitation upon the smallest unit possible. That, in my opinion, is extremely sound. Such being the case, Dr. Canney very rightly divides the whole organisation into three definite parts: you must first have the sanitary officers; secondly, you must have the *personnel* or men; and, thirdly, you must have a full and whole-hearted co-operation from all ranks to secure adequate sanitation throughout the Army. Now I do not propose to occupy too much of your time, but I should like to speak briefly on each of these points. Take the case of sanitary officers. It is my privilege in my position to have the instruction of all young officers for the R.A.M.C. in preventive medicine, and I say, without any hesitation, that we have in the R.A.M.C. many officers who have been for years eminently qualified for the duties of sanitary officers, and the fact that they have not had full scope to perform those duties has been no fault of their own or of their immediate chiefs, but has been the fault, or largely owing to the fault, of the want of sympathy for this class of work in high

places. I have reason to believe, however, that that era is passed and that we are near the dawn of a new epoch—at any rate I hope so. That being the case, there is no doubt there will not be the slightest difficulty in obtaining an adequate number of highly qualified and competent officers from the R.A.M.C. These officers after undergoing special training should be allocated to divisions, or even smaller bodies of men, and would be able to supervise the whole of the sanitation of the Army. Having thus provided certain qualified experts as guides, what is the next stage? The next stage is to find the tools by which those experts can carry out their work, and those tools, in the ordinary language, mean men. Dr. Canney suggests that we should organise and place with each unit what he calls a water section. For myself I think there is a great deal in that idea; I do not say I accept it absolutely at this present moment, because it is a matter which requires further consideration; but at the same time we must look at it sympathetically, as I believe there is something in it. To many this may seem a somewhat radical and revolutionary proposal; but if those cognisant with Army life think for a moment, they will be aware that there are already existing in each unit or corps a body of men who are, so to speak, ear-marked and set aside for specific work—I refer to the men told off for “first aid.” I do not wish to be misunderstood on this point. I do not want to see the men for this water corps ear-marked as the men are who are trained for first aid to the wounded, because there must be an essential difference between the two groups. The men who are at present trained for first aid to the wounded are fighting men, men who bear weapons of war and take their places in the ranks on the parade ground. They are only, so to speak, lent for this specific purpose if they can be spared from their other duties. If I understand the author rightly, the men who are to form the integral part of the water section are to be special men, and very rightly so. They must be men specially enlisted, and highly intelligent men; they must be borne on the strength of the corps or unit for no other purpose than that of supplying “approved” water. The moment you depart from that idea and allow the men to be put on ordinary fatigues and general sanitary duty, the whole scheme must break down. That being so, it will not be difficult, starting as we do with our trained sanitary officers, to train these men in the technique of obtaining pure water. Although I go so far with Dr. Canney as regards the scheme, I am sorry to say I join issue with him somewhat in regard to his method of obtaining that “approved” water. I think he has been a little too narrow in his views. He has dwelt too much on the possibilities of obtaining good water by boiling only. I hope if this water section ever comes into actual existence, that the men of that section in the hands of my hypothetical sanitary officers, which I think will come into existence, will be taught not only the sterilisation and preparation of “approved” water by means of boiling—that is to say, heat sterilisation—but that they will be taught to do it by every possible means known to science—it may be by filtration, or it may be by chemical re-agents, because there are cases constantly occurring in military life when one method is suitable and the other may not be. We must take what is suitable to the occasion, that is to say, make use of every possible means at our disposal. Having got our teachers and our men, the whole crux of the problem, it seems to me, will turn upon the question of responsibility being carried home to the smallest commander, that is to say, to the company officer; and anyone who has had experience of service knows perfectly well that sanitation in actual practice really does come down to the company officer. The point I should like this meeting thoroughly to ventilate and grasp is, that for the success of any such scheme we must have the most whole-hearted co-operation of the ordinary officer—the non-medical officer—because unless that is done the whole scheme must break down. Dr. Canney, I notice, suggests that cognisance should be taken in confidential reports by general officers commanding of the sanitary efficiency of regimental officers, especially of the commanding officers. That will strike many as a rather dangerous proposal, but for my own part I think it is rather a good proposal, because unless officers commanding units—it does not matter whether a bearer company, a battery, or a regiment of infantry or of cavalry—have brought home to them that on them the responsibility rests,

you will never have efficiency, and they must be further made to understand that they will get *kudos* for their corps if they have a low percentage of sick; whereas if their percentage of sick from preventable disease, the class of disease we are discussing now, water-borne disease, is high, then by all means let those commanding officers of units get a black mark. I do not think I have anything more to say on the subject, except that on the whole the scheme as propounded by Dr. Canney has my cordial sympathy, and I think myself, with a little further thought and consideration, we may be able to make something of it.

Major-General the Earl of DUNDONALD, C.B., M.V.O.:—I must apologise as a layman for offering a few remarks on the admirable lecture of Dr. Leigh Canney. My experience in South Africa led me to the belief that it is impossible to make water safe for drinking purposes by filtration only. To my mind it can only be done by subjecting it to heat, and with that object in view on my return to this country I devised a water-cart, the vessels of which could be used for boiling purposes. With ordinary fuel, in cases where this cannot be obtained, petroleum, if carried, would be invaluable as recommended by the lecturer; at any rate the idea should receive a fair trial. When we went to war, our arrangements for water were no doubt in accordance with the regulations, but all thinking minds must feel that they were not in accordance with the general progress reached in the year 1900; but no doubt in future if we attend, or those in power attend, to the advice of men like Dr. Canney and the last speaker, we shall save our thousands in war-time. With regard to other causes which promote enteric, I think the question of rations might be considered, as to whether a long continuance of bully beef and biscuit does not render men's stomachs irritable and susceptible to the easy assimilation of the germs of disease. There is another matter which it strikes me is worthy of consideration in a meeting such as this, and that is the question of standing camps. It appears to me that no site of a standing camp covered by bell tents can remain for any length of time in a sanitary condition. I refer here more particularly to camps that must of necessity remain for long periods on the same place. To make camps such as these healthy for refugees or soldiers, the floors of the tents and a limited space round them might be asphalted, and thus could be periodically cleaned, while other portions of the camp could be kept from being contaminated by dirt if surrounded by wire fencing. In other words, the soil of every portion of a camp in the immediate vicinity of cooking or sleeping should either be rendered impermeable by asphalt or inaccessible by fencing to a distance of say 100 yards from the tents. I do not think it is possible to over-estimate the importance of instructing every officer in the Army in sanitary work, on the maintaining of camps in a cleanly state, and in everything which will assist the preservation of men's health in the field. You cannot expect the company officer and the colonel of the regiment to be the only persons to take an interest in this matter. If those in positions of responsibility will only take a proper and thorough interest in sanitary matters, and in introducing proper sanitary systems and appliances we shall have the junior officers of the Army and the men soon following suit, and adapting themselves to new conditions.

Dr. J. W. WASHBURN :—You have kindly invited me, Sir, to take part in this discussion. I feel I have some qualifications for doing so, inasmuch as I served for many months in various parts of South Africa, and am consequently well acquainted with the conditions under which the soldiers live. We are all aware of the terrible loss of life and the serious loss to the effective strength of our forces in South Africa through enteric fever. We have to consider how this can be prevented in the future, and in order to do so we must have, first of all, a clear conception of the mode by which the disease is conveyed. Enteric fever is due to the swallowing of food or drink which has been polluted with human excreta. In the vast majority of cases, the disease is conveyed by the excreta of patients suffering from the disease, but in certain cases it may be conveyed by the excreta of persons who are apparently healthy. Contaminated water is certainly the principal means by which enteric fever is spread. This has been well shown by Dr. Canney in his paper as occurring in South Africa and in Egypt, but we need not go so far afield to recognise the truth of his statement. Not so many years

ago an outbreak of enteric fever occurred at Maidstone, where some 1,900 people in a short time were down with the disease. This outbreak was most definitely proved to have been due to the contamination of the drinking water. But we ought to consider whether there are not other modes by which the disease may be conveyed. At Maidstone, after the contaminated water had been shut off, cases of enteric fever continued to arise, and their distribution was of great interest. The first large outbreak of the disease could be easily traced to the water; it followed the distribution of the water of a certain section of the public water-works. The subsequent distribution of the disease was spread much more irregularly through the town, and was no doubt due to some other method of conveyance of the disease. This had been prophesied by Dr. Adams, the Medical Officer of Health. We all know that those who are in attendance on cases of enteric fever do contract the disease; and I think everybody who has been in South Africa must be convinced of the fact that the disease is also conveyed by flies and dust. The enormous number of flies that collect around the latrines, and in the cook-houses, at once suggest that they are partially responsible for the spread of enteric fever. Anyone who has been in a dust storm and has seen the quantity of dust that is carried into various articles of food, cannot fail to be impressed with its importance as a means of conveying the disease. What we have to do in order to prevent the spread of enteric fever in the field is this:—First, we have to provide a fair water supply; and, secondly, we have to see that excreta is properly disposed of. We must consider whether that is possible. It has been often urged that when an army is on the march it is quite impossible to procure proper water and to take proper sanitary precautions. Dr. Canney has shown that it is possible without any very great expense, and without any very great extra amount of transport, to provide pure water; and I think it is not very difficult to provide for the proper disposal of excreta. It is chiefly on the march that the difficulties arise. Everyone who has had experience, at any rate in South Africa, will agree with me that soldiers do not contract enteric fever while they are on trek, but that they do contract it when they come into standing camps; and it is in standing camps where proper sanitary precautions are perfectly easily made. The next question is, How can these precautions be carried out? Dr. Canney has made a very admirable suggestion, that there should be a water corps, who are to look after the proper supply of water for the troops. But I think one ought to go even further than that. I think we ought to have a proper sanitary corps to look after not only the providing of pure water for the troops, but also to see that all other sanitary precautions are taken, especially in the case of standing camps. I think that corps should be a branch of the R.A.M.C., who should have proper authority, proper rank, and proper responsibility. I have not the slightest shadow of doubt that enteric fever can be prevented with very little trouble and very little expense from occurring in armies in the field; and I think Dr. Canney has done a very great service in bringing the matter before us this afternoon in so able a manner.

Mr. S. RIDEAL (Fellow of the Institute of Chemistry):—Being neither a medical man nor in the Service, it is difficult for me to deal with the question of the methods of organisation suggested by the author, but they seem acceptable to those speakers who have already spoken, and it is obvious that some such organisation is absolutely essential to diminish the terrible mortality of armies in the field. I wish, however, to speak on the method by which the sterilisation of the water is to be brought about. Dr. Canney's kettle seems to be a very crude method for attaining this result. We all know there are three methods of producing sterile water: boiling, filtering, and by chemical means. The latter two methods seem to me to have advantages over Dr. Canney's suggestion in the question of transport, which seems to be one of the very fundamental things that one has to consider. From the transport point of view, the thing which brings about the sterilisation of water without requiring any daily dose of fresh material either in the form of chemical or in the form of fuel, will commend itself to the authorities. This condition is fulfilled by a sterilising filter. We have had experience in the South African campaign of one form of filter, which apparently has not fulfilled the conditions of

actual warfare, but since that experience, which has been dearly bought, we have had experiments made by an official of the Army, Professor Horrocks of Netley, who has shown that another form of filter, the Pasteur-Chamberland, is capable of producing under long periods of service a water free from typhoid germs. The difficulty, however, in the past with regard to this filter has been that its yield is small; but if the yield of a single candle is small, it is only necessary to increase the number of candles to obtain any given quantity of water. That brings it back to a question of transport, and in a long campaign such a battery of filters must necessarily weigh less than the *matériel* for heat sterilisation which involves a daily dose of fuel. On the other hand, for emergency purposes, chemical means seem to warrant their use on several occasions. Dr. Parkes and myself,<sup>1</sup> reviewing the different methods available for chemical sterilisation last year, came to the conclusion that bi-sulphate of soda was capable of bringing about sterilisation of water as far as typhoid is concerned. The quantity necessary is 15 grains per pint, and a time of contact of 15 minutes before the water is fit to drink. Dr. Canney states that the actual weight of apparatus and fuel required on the march to Bloemfontein would have increased the transport by 2 per cent., that is, 12 tons upon the 500 tons. By the bi-sulphate of soda method the actual increase per cent. on the transport would be only 1-25th per cent. In passing, I may mention, in regard to bi-sulphate of soda, that this weight, 15 grains, is much higher than the weight required by other chemical sterilisation agents. Bromine, for example, which was used in the Soudan Expedition, is effective when only 2 grains per pint are used, or practically 1-7th of the weight of the other chemical, so that if this bromine method, which is used in the German Army, was found practicable in ours, the actual weight of transport would be even less than that required by the bi-sulphate of soda method. Dr. Canney finds that 200 lbs. per mule would give 4 pints of boiled water per man for 100 men for seven days, whereas the actual weight of bi-sulphate of soda for the same work is only 6 lbs. The criticism of the chemical method is the time required. Fifteen minutes is the minimum time in the case of bi-sulphate of soda before the typhoid organisms are killed; but I find that Dr. Canney suggests with his kettle waiting practically 17 minutes—11 minutes to raise the temperature of the water and 6 minutes for cooling it sufficiently to drink—so that the heat sterilisation method takes a longer time than the chemical method which I am advocating. It seems, therefore, that for long campaigns and for permanent camps, a sterilising filter of the Pasteur-Chamberland type is preferable, and that for rapid marches and short campaigns through countries with doubtful water supplies, the chemical method is also preferable to that of heat sterilisation, except in those cases in which a regular supply of fuel is likely to be found *in situ*. I thoroughly agree with Professor Firth in his view that the officers in charge of the camp sanitation should be trained and efficient in all the likely methods of water purification, as local conditions will determine which of the different methods can best be utilised.

Surgeon-Major W. G. BLACK (retired A.M.D.) :—I took some interest, when serving in South Africa some years ago, in the question of typhoid fever, which existed then, as it exists now. In South Africa a great deal depends on the locality and on the river near which you are encamped. Some rivers are foul and unhealthy, naturally from their position and course, while others are perfectly clean and healthy. The waters of those in the mountainous districts of the Drakenberg, Amatolas, and Winterberg are perfectly pure and healthy. There is as magnificent water to be obtained there as you can get in this country in Westmoreland or Cumberland. When you come to the flats you have a different kind of water altogether. The rivers there run through flats of clay soil and marshes, and the water is naturally muddy and contaminated all through them. In the course of campaigns in South Africa the greatest danger is to be apprehended from standing camps. The water from the rivers or springs becomes polluted by the

<sup>1</sup> "A suggested method of preventing water-borne enteric fever amongst armies in the field."—*Transactions of the Epidemiological Society of London, N.S.* Vol. XX. 1900-1901.

denizens of the camps, their followers, and their cattle, and their horses, which graze all over the neighbouring fields and hills. It is necessary then for the camps to be moved occasionally. The generals themselves and their staffs may take the precaution to remove the camps to more healthy localities, when the old ones get fouled, because there are abundant areas in South Africa to choose from. Some years ago typhoid was prevalent in towns as well, during the existence in them of wells and of rivers that passed through the places. Those rivers were contaminated by the consequences of agriculture, that is, the fields were cultivated in the neighbourhood, and irrigation established from the river by sluits, and the cattle and sheep were fed over the mealie and grass fields, with the result that the water which came through the sluits in the streets of the town was contaminated by the excreta of the animals. Therefore, typhoid fever prevailed in the garrisons, as well as among the inhabitants through the same water. That was remedied in after years by establishing water-works, as in Pietermaritzburg in Natal. There they obtain the water from the hills, and conduct it into the town and issue it to the different houses by pipes, and typhoid fever has nearly disappeared. In Cape Town also some years ago, typhoid arose from somewhat different causes. Cape Town is a dry place, with no river, and the contamination came from what were called "stercus carts" which conveyed the excreta of the inhabitants every morning from 6 to 9 o'clock through the streets for the purpose of taking it to the farms, as is done in many districts of this country, where it was sold. The air in the morning, especially when there was no wind, was of the most offensive description, and permeated through the open windows, the consequence being that one quarter of the barracks in Cape Town was called the "Dead House," and any officer not on duty, who had no other place to go to, was put in the "Dead House," and invariably took sick of typhoid fever, and was eventually invalided home. In Cape Town now they have established regular water-works on the summit of Table Mountain, which gives perfectly clear water, and is not subject to defilement by animals grazing, with the result that Cape Town is nearly free from typhoid fever. The essential necessity in a war at the Cape, is to have camps which are movable, so that typhoid may be escaped by moving the camp when required. I see Dr. Canney has not introduced the question of the prevention of typhoid fever by inoculation when it prevails in the district. That, of course, is an abstruse medical question which is not even yet settled; and the reports in the course of this war may induce a settlement of the question, as to whether it can be prevented by the methods which have been recommended.

Dr. A. CONAN DOYLE:—Anyone who, like myself, with a minimum of medical knowledge on this point, but with a good deal of zeal, went through the epidemic at Bloemfontein, must have had an indelible impression left on his mind by that most pitiable event. When on that occasion I used to go from the hospitals, and, as I had the privilege of doing, accompany the Army for a short period, I could not help being horrified by seeing the absolute neglect of every possible precaution on the part of the men. You would see a man coming in, at one end, with that terrible illness which has invalided so many men back to England, and at the other end you would see the cause, the gross carelessness which could be easily obviated, men kneeling down drinking from wayside pools water obviously polluted, without any remonstrance on the part of anyone. Apparently it was nobody's business. To anyone who had just seen the shocking results of such conduct it was a most pitiable sight, especially when one felt oneself absolutely powerless to prevent it. It is for this reason that I have listened with the greatest admiration to Dr. Canney's paper, as it seems to me a practical, bold method of combating this evil, and I hope that the paper itself and the discussion which has followed it will bring it to the notice of the authorities. It seems to me that if it was not stretching the red tape too far, one might say, "Why should not Dr. Canney be sent straight out to Africa, with as many of his apparatus as he wished to take, and be attached to one single column, so that we may see whether the results of his scheme in that column will be better than the results obtained in any other column"? When one remembers that in the papers this very morning there were 40

deaths, nearly all of them from enteric fever, and that those 40 deaths means that many hundreds, and possibly thousands, of men are lying in their beds in South Africa at the present time suffering from this fell disease, which Dr. Canney says with truth can be stopped, why should we not send him out to try his own experiments with his own apparatus? And if my friend behind me, Dr. Rideal, thinks that the chemical solution is the better one, let us send him out to another column, and let us compare the results of the one column with that of the other column. It seems to me that this is not a time for academic discussion. The house is on fire, and it is time we took some practical means of putting it out again. Although I am in entire sympathy with Dr. Canney, my only criticism is, that by the time we get our private soldier into such a state of discipline and such a state of self-denial that he will look at water when he is thirsty and not drink it, by that time the whole of the human race will be educated beyond all war. The English soldier, as brave a man as ever lived, often takes a perverse delight in doing the thing he should not do, the moment the eye of his superior is withdrawn from him. I remember a case just at the beginning of the Dongolese War, when the troops were going up, an English regiment was passing an obviously polluted pond close to the Nile. Being very thirsty, they broke their ranks and made for the pond. An officer rushed between them and the water, and cried out to them: "For God's sake, do not drink: it is poison." One man shouted out: "If it was labelled red lead and cholera, I would drink it," and they did. I believe in that regiment there were 110 cases of cholera in a short time. I am afraid that this is the real difficulty, the human element, in Dr. Canney's scheme. And I cannot imagine our young sporting regimental officers in the character of the Sanitary Inspector. Allowing that our officers and soldiers can only rise to such heights, I think that Dr. Canney's scheme is a most admirable one.

Brigade Surgeon-Lieut.-Colonel A. B. MYERS:— Having had some experience, especially in connection with the Suakim Campaign, I think I am at liberty to make some remarks on this occasion. We all agree with what Dr. Canney has said in his paper, that any steps which can be taken to diminish the curse of our Army in time of war are most important. I should like to ask the lecturer one point by way of criticism. I think he says that these water-bearers should be in front of the army, and just behind the scouts. If they are 2 per cent., and there are 10,000 men approaching the enemy, you would have 200 men with their water supply, and I should like to hear what would become of this body of water-carriers in front of the army if the enemy suddenly came upon them. Undoubtedly in time of war, if you could get your men with the water supply ready for the army when they arrived at any given place, it would be an enormous boon, but is that practicable in time of war? I think not. As to the question of men arriving at a place parched with thirst, we all know that they will drink any filth. In the campaign of 1882 I believe men drank water in which their fellow comrades were rotting. Therefore, if this boiled water is ready for them, well and good; but if they have to wait a quarter-of-an-hour or 20 minutes, you will not stop them drinking any water they can find. Even if the enteric produced by foul water is prevented, there are still other sources of this fever. With regard to the education of our men, this is a point that has not been touched upon. Going out to the war, I took upon myself to lecture our officers and men on the great importance of training themselves not to drink. We know that at home men are supplied with water-bottles full of water. What do they do? They have not started more than 20 minutes or half-an-hour before many of those water-bottles are empty. At least that has been my experience. We can go many hours without water, and you know very well that when you touch water your thirst is soon increased tenfold. My teaching was that these men should learn to go without water. I trained myself to do so all day in the hottest parts of Central Africa. If you could train your men to avoid water it would be the saving of many lives, because it is this dreadful craving that makes men, when they arrive at a place, drink anything they can find. I believe that education, and explaining to the men the importance of training themselves to avoid drinking on the march as long as possible, would be of the greatest benefit to them. There is an interesting fact I should like to

mention with regard to flies—one little practical fact. When we were marching across the desert in that Suakim Campaign, starting at early morning, I used to amuse myself by counting the flies on the soldiers' backs, and the average was 60 to 100 flies per back, so that when we arrived on fresh ground, where there had been no flies, we brought tens of thousands of flies with us to set up a new centre of pollution.

Major H. A. CUMMINS, C.M.G., R.A.M.C. :—I feel sure there is not very much left for me to say after all the other speakers, but there is one thing I should like to mention which struck me in Dr. Canney's paper, namely, that he seemed to infer that a method of boiling water had not been used by the R.A.M.C. in previous campaigns. In the Ashanti Expedition of 1895-96, where it was practicable, and there were posts up the country as far as the Prah River; at all these stations the water was boiled, cooled, and served out to the troops, and no doubt this precaution kept down fever to a very large extent, especially enteric. There is great difficulty in rapidly cooling water after it has been boiled. With regard to the present campaign, especially at Paardeberg and Bloemfontein, I think the author is rather hard on the Sanitary Department. When we came to Paardeberg, supposing we had had our cans for boiling water, our paraffine oil would have failed, as our large convoy was unfortunately captured and there was hardly enough food for our soldiers. How would you deal with the soldiers in advanced trenches and with the men who were on picket on the hills? This question of boiling water is a most difficult one. Fuel was very difficult to procure. Paardeberg itself possesses only a low scrub with very few palings or anything that can be used for fires. As we marched to Bloemfontein it was amusing to see the soldiers seeking every scrap of wood they could get hold of. The Boers had miles of barbed wire attached to wooden palings, and all those stakes in the line of march were pulled up by our soldiers and brought to camp with them in their endeavour to get sufficient wood for cooking purposes, and even on their march up to Pretoria and Johannesburg the noise they made by pulling up the floors of the houses to get wood to cook their food sounded almost like guns going off. Under those circumstances it was extremely difficult to obtain any material for boiling the water. When we arrived at Pretoria the water was very good—still many people boiled it. In our hospitals, as far as possible at Bloemfontein we boiled the water for the men. One of the causes of the spread of enteric fever may possibly arise in the hospitals themselves. It is very important to prevent them becoming centres from which infection can be conveyed by the flies to the camps. Every precaution was taken to destroy the excreta. The flies, however, were dreadful, especially at Bloemfontein. I think there is no doubt that the epidemic arose at Paardeberg, and this is shown by the Boers who were taken prisoners at Cronje's laager. I saw by the papers that they suffered severely from enteric fever soon after they reached Cape Town. The epidemic in Bloemfontein was terrible; I suppose the worst ever experienced, certainly in South Africa. We find it hard to deal with epidemics at home. How difficult it was in South Africa, especially at Bloemfontein, can be seen from the fact that the enemy cut off our supply of water by wrecking the water-works, so that in the earlier period of our occupation water was scarce. We were under very great difficulties, and, I think, scarcely sufficient consideration is given to us under those circumstances.

The CHAIRMAN (Sir William Broadbent):—It is with very great regret that I have to retire before the discussion is terminated, but I had no idea that it would go on quite so long. There have been some extremely valuable suggestions made in the course of the discussion. The special value I should place on what we have heard from Dr. Canney is the educational influence that should be brought to bear long before the men are engaged in war. They should go to war prepared by their previous education to take the precautions which they are already accustomed to take against disease in this country, to carry them out, perhaps not perfectly, seeing that soldiers are after all but soldiers, but still, carry them out in a very much more efficient manner than they do now. To our disgrace we have enteric fever constantly in our great military centres, and we ought to begin by exterminating it there, and then we should have a chance of carrying out the methods adopted in times of war.



Sir William Broadbent then vacated the Chair, which was taken for the remainder of the meeting by Colonel Lonsdale Hale.

Brigade Surgeon-Lieut.-Colonel HILL CLIMO :—There are two points which have not been under discussion on which I should like to make a remark or two. We have discussed very largely the sanitary conditions of South Africa since the war began, but we have said nothing about what the state of South Africa was before the commencement of the war. We look upon India as almost a charnel house for enteric fever, and yet in the first 41 weeks of 1899, which corresponds with the period of peace in that year, the incidence of enteric fever amongst the British Army in South Africa was 80 per cent. greater than it was in India! I think that proves the necessity of organising a sanitary corps during peace-time. The second point is the importance of having a means of distilling pure water or boiling it. There is no better proof of that necessity than the state of the American Army in China during the recent campaign. In the first two months of the campaign there were 500 cases of enteric fever among the German troops, who used the chemical method, and they were nearly all fatal. From the time the American troops went there up to last August, when the evacuation began, their hospitals were singularly free of that disease.<sup>1</sup> I think that is a most important point, and if we get a pure water supply, acting on the lines the lecturer has given us, then I hope to see a measure of safety introduced. It is a subject I have given a great consideration to for many years, and I am perfectly sure that when we have a better water supply, and when our young soldiers are taught, as they ought to be taught, by the medical service, how to maintain their health, they also will understand the necessity.

Mr. W. D. SCOTT-MONCRIEFF :—I venture to make a few remarks from the point of view of an engineer, not speaking with any authority on the important subject of typhoid fever. Although I do not suppose that the proposals which have been made by the author are final, either as regards the apparatus itself or the means of utilising the apparatus, I do not think that is altogether to the point, because if he has proved his case by showing that the sterilisation of water by heat is a practicable method, it follows that we should not wait indefinitely for a better, but give him an opportunity at once, if possible, of proving the efficiency of his system without the loss of a single day. It ought to be done at once. Dr. Conan Doyle really anticipated what I had to say in that direction. Speaking from the practical point of view, not with regard to bodies of men upon the march, but with regard to stationary camps, I cannot imagine that a more efficient steriliser could be designed than the old locomotive. It is a very efficient form of apparatus for heating water and raising steam, and after it is too old for the purpose of bearing any pressure it would need to be very old indeed before it was incapable of boiling water, and would be an economical and thoroughly efficient means of sterilising large quantities of water wherever it was available. I do not think that the argument is worth very much as to the incapacity of the soldier to resist the temptations of polluted water. If the importance of the sterilisation of the soldier's drinking water is properly realised, surely his training will begin in this country. It is a matter of little importance whether the water for the purpose of his training is pure, or not so long as the point is gained of his being thoroughly trained. At every march out from Aldershot, when there is a halt, there ought to be an opportunity for the water corps to go through the whole performance of sterilising the water and teaching the men to wait until it is ready for them to drink.

Captain G. WALKER, R.E. :—It is with some diffidence that I rise to speak in this discussion, as perhaps I have not looked at the subject from as scientific a point of view as others who have spoken. I hope, however, that some ideas born of regimental experience in India and other places may not be considered out of place. The first thing I have to say with regard to the lecturer's proposals is, that although they are admirable no doubt in the main, and their object is even more admirable still, yet

<sup>1</sup> Their water supply being produced by "water-distilling plants."—H. C.

perhaps he has rather failed to appreciate the difficulties which may beset their practical application on service. I think it is rather a question of transport. One mule will be required for every 100 men, and with eight companies that will make, say, 10 mules per battalion, which will mean a good many animals to be added to the transport with our armies in the field, which is already enormous. I think what we want is some sort of chemical sterilisation, which I believe is possible; some method which can be worked by the regiments themselves, the officers and the men being trained to do the sterilisation for themselves. This brings us to what I believe is the crux of the whole question. The officers of the regiment are the only people who can be held responsible for the efficiency of the men under their command, and they consequently are the only people you can come down on if the men are not fit. For example, if the men cannot shoot, the officers are held responsible, and the physical fitness of the men should be on the same basis. A most important thing in connection with the prevention of water-borne disease amongst troops in the field is the prevention of casual drinking on the line of march. You may give a man a bottle of pure water when he starts in the morning, but before long the bottle will be empty, and long before the march is over he will have a thirst that will make him capable of drinking anything. Unless you can put a stop to this casual drinking, I fear that any water-purifying scheme will be shorn of a great deal of its effect. I speak as a regimental officer, as my experience has been largely in regimental work; and I think the regimental officers have a great deal in their own hands. They are the proper people to take this particular point in hand. It will probably be said that it is visionary to expect men, with the education which our soldiers have received, to have such self-control; but if in times of peace men are educated with this object in view, I think a great deal of good could be done; I may say that I know from experience that it can be done. It is a matter of education—habit, if you will—but it is only by the cultivation of a habit that you can make it strong enough to withstand the promptings of nature. One more point occurs to me, which is, that most of us do not appreciate sufficiently the necessity of camp sanitation. On marching into camp or bivouac sufficient trouble is not taken with the arrangement of latrines and the prevention of the troops going all over the place for the purposes of nature. This is another matter which the regimental officers alone can effectually deal with, and you must, I think, convince them, and through them the men, of its necessity, before water purification will have any large measure of success. Briefly, the three main points in any scheme for the abolition of typhoid fever among troops in the field should be: First, the provision of pure water for the troops and the placing the responsibility for this upon regimental authorities; secondly, the education of the soldier in habits of self-restraint as regards casual drinking on the line of march; thirdly, the persuasion of all ranks of the necessity of proper camp sanitation. I think if we can devise a scheme embodying these principles, we shall be, under Providence, on a fair way to success.

Surgeon-General A. C. C. DE RENZY (late Indian Medical Service):—At this late hour there is only one point in the discussion on which I wish to say a few words, and that is the question of the danger of the propagation of typhoid and other water-borne diseases through the agency of flies and dust. My experience has led me to the conclusion that this danger is of little or no consequence, and should not be allowed to divert attention from water, which is the dominant factor in the spread of these maladies. My reason for saying so is that I know of several stations in India which were formerly great sufferers from typhoid and cholera, but which have, for many years, enjoyed almost complete immunity from them, this change coinciding sharply with the introduction of a pure water supply, while the dust and flies, which were always a great nuisance, have continued as they were. Two stations come prominently to my mind in this connection, viz., Fort William in Calcutta and Colaba, a suburb of Bombay. In the 10 years preceding the Mutiny, the average death-rate of the British troops quartered in Fort William was 102 per 1,000. In 1870 the Fort was provided with a pure water supply, and since that date the death-rate has been about 10 to 12 per 1,000. In the four years ending in 1899 it was only 9 per 1,000.

Cholera, typhoid, and dysentery used to be the prevailing diseases among the troops, and to this day they are very fatal among the adjacent native population, who use the polluted tank water. The case of Colaba is very similar. This station was formerly so excessively unhealthy that the Government were strongly urged to abandon it as a garrison for European troops. Fortunately, this was not done. About 45 years ago the Vetrar water was laid on to the barracks, and ever since the troops have had fairly good health. In the four years ending in 1899 the average death-rate was about 10 per 1,000. These two cases are instructive, because the facts extend over a long series of years, and leave no room for doubt that, where a pure water is in use, flies and dust are impotent to disseminate such diseases as typhoid, cholera, and dysentery to any great extent.

Captain C. E. DANCE, R.E. (Chief Surveyor Metropolitan Fever Hospitals) :— I am not going to detain you at this late hour for more than a couple of minutes ; but as my work takes me into the whole of the fever hospitals in the Metropolitan area, I may perhaps be permitted to say a few words. There is one important point in connection with the prevention of typhoid and other infectious diseases which has not been touched upon in this afternoon's discussion. I think that, as a Royal Engineer officer, Sir, you will agree with me that the "pioneers" of the ordinary (Line) battalion should be specially trained in regard to the first principles of sanitation, but as far as my experience goes that is not so. In the corps in which I have the honour to serve now as acting adjutant the men are all mechanics, and we send a good many of them into the Royal Engineers, the Regulars, and I make it my duty from time to time to see these men and ascertain whether they have learned anything further since they have been transferred from the Volunteer service of the Royal Engineers into the Regular branch of the Army, and I am amazed to find that positively the instruction they received touches little if any more upon the mere rudiments of sanitation. We have had a good many eminent speakers here on sanitation this afternoon, more particularly on sanitation in the field, but the one point which I think I may be allowed to impress upon the assembly now is that boiling all water, and boiling only, has been determined by the greatest sanitary authority in the Metropolitan area—I am speaking now of the Metropolitan Asylums Board—to be the best deterrent against enteric fever. Recently I had to make preparations for the receipt of plague patients, and at the time there was a very long discussion by the principal medical and other officers of the Metropolitan Asylums Board as to how they should treat the excreta, and as the result we had to make arrangements for "boiling" the whole of the excreta from the hospitals which were to receive plague patients.<sup>1</sup> I hope my few remarks will be accepted, coming as they do from a junior officer of the Royal Engineer branch of the Service.

Dr. LEIGH CANNEY, in reply, said :—The practical unanimity and approval that have been expressed by this large meeting of experts from all departments of the Army, and especially by those of the R.A.M.C., and by the highly qualified civilian opinions you have heard, leaves little for me to add, except to reply to certain points that have arisen in the debate. It is obvious to all present that in this representative meeting there is a strong feeling of entire practicability, both as to the scheme of prevention itself and as to the measures put forward as necessary, and that those measures do not conflict with the work or interests of any other department of the Army, but are directly beneficial to the work and aim of each department. Practically complete approval has been expressed in the "essentials" of the scheme I have put before you. The object we have before us is simply, that by organisation and method the Army—Regular, Volunteer, and Colonial—shall, as regards methods of preventing typhoid, dysentery, and cholera, its three great destroyers, be absolutely level with the best that can be obtained in civil life. We are all agreed that no trouble as regards the actual

<sup>1</sup>The "boiling" of excreta would be in addition to the chemical treatment which is in force for dealing with the sewage from the Metropolitan Asylums Board Fever Hospitals ; hence this fact further shows the great value that specialists place upon the "boiling" method.—C. E. D.

education of non-medical officers, of men of the water section, of the pioneer section, and the men in the ranks, is too great in order to attain this far higher result as regards efficiency. Several speakers have drawn attention to the long delay in the adoption of the inevitable reforms I have indicated; no doubt the responsibility for such delay is a very serious one, and attention will probably be drawn to it in another place. Major Firth, who holds the high position of Professor of Military Hygiene at Netley, and has, both by his practical experience and by his high scientific attainments, authority to speak on the essential practicability and usefulness of this scheme, whilst reserving his opinion as to the final form it may take in organisation, has expressed strong approval of the same. He has drawn your attention to the enormous wastage in war from these causes. He agrees that the main channel of these evils is water. Just as we have prevented these evils entirely in the vast civil camps of susceptible Europeans in Egypt by the methods proposed, so there is strong reason to suppose a like result could be attained in the Army, both in the field and at stations. He has pointed out very clearly the radical importance of thoroughness in the execution of the details of the essential points raised. He has laid great stress on the education of, and the responsibility for these diseases being placed upon, the non-medical officer. As I have pointed out, the executive power and influence of these officers, after thorough training in practical sanitation both as regards the work of the pioneer section and the water section is very great, especially when success in this direction is to be recorded and to meet with recognition from the authorities. The officers of the R.A.M.C. can never acquire this direct power and influence themselves to the same extent, and they should limit their work to recording and to reporting the efforts of and the success attained by each of these officers after they have instructed them. The R.A.M.C. must never be tempted to take upon themselves the responsibility for such occurrences as Paardeberg, Bloemfontein, and Ladysmith. By including thoroughly in the future all officers from the general downwards in that responsibility, an enormous access of power, interest, and attention will be forthcoming to ensure the careful execution of orders, thus saving the whole force from the disasters which must otherwise overtake it. The R.A.M.C. must consider very seriously whether they will not gain great strength towards preventing these evils by such means, and if they are of opinion that this interest and responsibility to be shown by non-medical officers will, as I believe, greatly influence the result, they must insist upon securing it. Major Firth further pointed out what doubtless all those with special knowledge will feel, the importance of recognising that the water section will do no other sanitary work but preparing and securing an "approved" water. The remaining sanitary duties of camps, etc., will be carried out by the pioneer section. These two sections are totally distinct and must be kept so. Captain Dance, R.E., to whom I shall refer again, has very ably urged the importance of the men of the pioneer section being scientifically trained by the sanitary officers to divisions, and in the carrying out of these duties the non-medical officers who have been instructed in the same methods will be the executive power. Everyone will agree that the work of supplying an "approved" water, and guarding the other avenues of water-borne disease, is of such importance that it will fully occupy the whole time of the water section. Major Firth has said that there are other possible methods of providing an "approved" water which must not be lost sight of. I wish it to be clearly understood that the object of this paper is to show the need of a system of organisation sufficient to meet and defeat disease in war. At present, the system I have proposed as best suited to the requirements of an Army in the field is the method of boiling and serving rapidly tea or soup. That method may of course be changed to-morrow for a better—we hope it will be. It is, I think, important to have at one time only one system on which one absolutely relies, lest the multiplication of methods in force might lead to a tendency to delay in the prompt and ready delivery of materials, such as fuel required, etc. Major-General the Earl of Dundonald, so well known to you all for his past services to the Army as a great practical soldier, has agreed heartily to all the

principles I have laid down. So keenly has he felt, from the point of view of efficiency, the need of such a system of approved water, that he has spent much time and thought in developing an improved method of protecting and serving water. He agrees upon the importance of the education and responsibility of the non-medical officer being at once insisted upon from the highest officers downwards. He has pointed out the advantages of boiling as the present best method, and in this again he was supported by Captain Dance, R.E., the distinguished adviser to the Metropolitan Asylums Board, who has told us that a like conclusion is the result of the combined counsels of the medical and other officers of this Board. Dr. Washbourn, an authority on questions of pathology and bacteriology and with large medical experience in South Africa, has expressed again the view which he gave at Cheltenham, after hearing a paper read by myself on air-borne typhoid in Armies at the meeting of the British Medical Association, that if you protect an Army or camp against all the avenues of water-borne typhoid, as was done at the great barrage works at Assouan, you will have no epidemic of typhoid, but only a few scattered cases. Surgeon-General De Renzy has pointed out how in cases where such steps have been thoroughly taken, though the flies and dust storms remain, the camp or station is free from typhoid. Dr. Washbourn hoped that if the transport difficulties could be overcome the scheme would be adopted, as undoubtedly promising success. I think I have made it absolutely clear that, though there is initially a minute extra fraction only added to transport, transport on the whole is greatly reduced, and the scheme is one that should be properly put forward by the Transport Department for this very reason. Mr. Rideal drew attention to the interesting work he carried out in conjunction with Dr. Parkes on the use of a chemical. Whether this chemical is equally effective against dysentery and cholera, I think has not been shown clearly, whereas the method of boiling we know excludes all three. It is certainly a method requiring less transport, but unless it can be shown to be as certain as boiling in all cases, the minute fraction (only  $\frac{1}{400}$  of total transport) required to be added daily for fuel in the boiling process is so small, as to be immaterial if there are compensatory advantages. It is probable that the ready service of warm drinks, as tea and soup, night and morning would be more acceptable than cold water containing a chemical. It is probable also that the filling of the water-bottles overnight with cold tea for the day, and the water-carts with cold boiled water would meet all requirements. Mr. Rideal referred to the "kettle" as "crude." I think, however, that an instrument that can produce sterilised water in one-fifth of the time taken by the best previously known instrument, with a smaller consumption of fuel and half the weight, and satisfying the extra condition that it shall be simple and readily repairable on the field if shot through, and capable also of serving tea or soup, can hardly be called "crude." It satisfies the requirements of all officers who have considered it as regards speed, etc., and they have described it as "perfectly feasible," and it has met with the approval of naval experts. It must be remembered that no other instrument has yet fulfilled all these conditions. Let us, however, hope that future developments will rapidly prove it to be "crude." At present it happens to be far ahead of anything that could possibly be regarded as fulfilling the above requirements. Dr. Conan Doyle has referred to the perverse mind of the British soldier, who delights in drinking anything bad or nasty. What appears as perversity is too often unfortunately the action of the man, who has no alternative. Knowing the unsatisfactory water arrangements in the past, as a rule, how can we regard his action as perverse, when he has never had an alternative? He knows perfectly well there is no systematic attention and care paid to water in war, and he frames his mind and action on the same basis. What can we think of officers who waste their time at a polluted river or pool urging thirsty men not to drink, whilst providing nothing else? Is the perversity in the man or in the officer? If you educate the British soldier on the advantages to be gained by himself and his comrades in accepting soup drinkable in 11 minutes from the moment of arrival, and served as readily and continuously to him as ammunition is served, he will come into line with the method. Who of us, with all our knowledge, would act differently from the man in the ranks

at Omdurman or at Paardeberg under existing arrangements, and who under the new system would prefer the polluted pool to cold tea or warm soup? Dr. Conan Doyle thought it would be difficult to see the sporting officer interested in sanitary questions. That may be the case; but even this class of officer may, when he finds promotion or distinction hanging in the balance, develop as keen an interest as any of us in the safety of his men. At least it must be made clear, if he thinks differently, his proper vocation is not the Army. Surgeon-Lieut.-Colonel Myers wished to know the disposition of the mules and men of the water section in the field. That, of course, would depend upon the value placed upon them by the commanding officer. They would not unnecessarily be placed under fire. One could not imagine them being placed between the firing line and the enemy. One could easily imagine them at the close of a thirsty march half-a-mile ahead serving warm tea precisely as the men came to the halt, the scouts being far ahead and the enemy further still. Surgeon-Lieut.-Colonel Myers made, as did other speakers of experience, some excellent remarks on training men only to drink at the end of the day. This has been largely practised in South Africa with comfort. Major Cummins, R.A.M.C., thought I had overlooked the fact that boiling had been successfully practised in Ashanti and elsewhere. In a pamphlet published three months ago on pages 6, 10, and 13 he will find the success of the system fully pointed out in the small campaigns of Ashanti, Suakim, and Abyssinia—the only three successes, sanitarily, of the past century. We all know the Army frequently boils water, especially at foreign stations in peace, but we know also that the technique of boiling infected water has not been taught to the men, and this most necessary education is provided for in this scheme. Major Cummins thought I had been a little hard on the Medical Corps regarding Paardeberg, etc. I have endeavoured to make it perfectly clear to the Army and to the public that such occurrences do not concern the Medical Corps. The responsibility was entirely upon the Commander-in-Chief at the time that this war broke out, he knew the dangers ahead for the Army, and the arrangements made to provide an "approved" water were absolutely inadequate. If I thought the R.A.M.C. could regard themselves or be regarded in any way as responsible for these continued disasters, no blame would be too great. If any members of the R.A.M.C. think that in the future they can take upon themselves executive power and responsibility for the carrying out of instructions and advice—a responsibility which Captain Walker, R.E., has also pointed out, must be regarded as the duty and responsibility of non-medical officers—then he is, I fear, only exposing the country to the danger of the like or greater disasters. Major Cummins referred to the difficulty of small pickets on distant hills, etc. In these cases the men would probably drink their soup before going forward and take water-bottles of hot tea with them, or, if desirable, smaller very light apparatus could be taken forward by hand, with the few ounces of fuel ration required. Mr. Scott-Moncrieff, C.E., in his able remarks, has pointed out that I have not regarded the apparatus as at all final. My particular duty has been to point out that what was regarded a year ago as quite impossible, is now, since I have drawn attention to it, regarded almost everywhere, by thinking soldiers and others, as quite practicable. I regard the practically unanimous opinion expressed and unexpressed of this large meeting of able experts on all the various points bearing on this question, in favour of practicability, as the sure seal that this scheme will essentially be carried out. Mr. Scott-Moncrieff has urged ably the immediate taking of steps towards a serious careful trial. He has ably pointed out how the scheme should be at once put in force at all manœuvres or marches, whether Regular or Volunteer, both at home and abroad. He has also placed stress upon the necessity for the education of officers and men commencing at once at home. Captain Walker was anxious to know if there was any chemical that could be relied upon for immediate action. There is none at present. A great deal of work is being done upon the subject in this country, in Germany, and elsewhere. Some process will probably be evolved in time. Captain Walker thought the ten additional mules per 1,000 men a large addition of transport. I have shown the penalty in transport and in diminished efficiency if they are left behind. I have shown that that penalty will happen with mathematical precision. I have shown

that the leaving behind a single one of the numerous typhoid hospitals, otherwise necessary, will more than provide the necessary water section transport for 45,000 men. I regret to have taken up so much of your valuable time in going thoroughly into the main principles involved in what is a new departure. I am sure that by your valuable opinions and remarks, the time has not been wasted. The question is a very serious one, and I have no doubt from certain official communications I have received, the whole scheme will directly be brought before the new Medical Advisory Board, who will spare no trouble in bringing their valuable experience to this question. They will not hesitate in their plain duty to the country, to urge the adoption of every point regarded in this scheme as essential, if they are convinced that it will add in any degree to the safety of the Army and the country. In some form, this scheme will have to be adopted. It is to be hoped that no effort will be spared to secure success in each essential point, however revolutionary these advances may seem to minds unaccustomed to the method and order necessary for the successful prevention of such evils.

The CHAIRMAN (Colonel Lonsdale Hale) :—I shall not detain you more than a moment or two in moving a vote of thanks to the lecturer. I am very sorry that the discussion has not been quite of the character that I hoped it would be. As Chairman of the Journal Committee, and with the aid of the Editorial Staff, I tried to get together an audience composed of holders of various views. To my mind, there has been a great deal too much approval of Dr. Canney's method to call this a satisfactory discussion. I happen to live near a military centre, in which are younger men than myself, and going there the other day I mentioned this lecture. These officers had all come back from South Africa, and when I mentioned that the lecture had relation to boiling the water for an infantry battalion, one of them said: "What, boil water for an infantry battalion with their tongues hanging out? Damned rot!" I wanted some representatives of the "damned rot" persuasion here this afternoon, but they have not come. We know there are very great difficulties in controlling the action of men in the field, but I wanted men to come here and declare what was their actual objection to the scheme. But the effect of Dr. Canney's lecture will be felt far outside this theatre. We have got so accustomed to seeing in the morning paper lists of casualties with these words, "When not otherwise stated, enteric," that we are coming to consider typhoid is a matter of course. But is it absolutely impossible that typhoid can be prevented, some times at all events? I have gathered, this afternoon, from what has fallen from men of experience who have been in South Africa, that it has been accepted as an inevitable thing, and that officers and others have not taken the proper precautions to guard against this terrible disease; and therefore, that whereas, the public are actually almost led to think that all these casualties from typhoid are natural, and cannot be prevented, yet in many cases they could have been prevented, and the list of casualties are in these cases to be regarded as due to the same class of shortcomings as those known to us as "regrettable incidents." If this lecture had been merely confined to the audience here this afternoon, perhaps it would not have a great result; but when any valuable views like these are brought forward in our lecture hall, I always ask the lecturer to think of the people who are not here, but who will read his lecture. Some 5,000 copies of what we have heard this afternoon will go all over the British Empire—5,000 copies are distributed in the Colonies and elsewhere, that being about the number of the issue of our JOURNAL. Dr. Canney has done great service in bringing to the notice and consideration of the whole of the Army, not only at home but abroad, and in our Colonies, through our JOURNAL, the extreme importance of the question, and the immense amount of responsibility which rests with someone or other in the prevention of typhoid; whereas at present, as he says, there is no personal responsibility; but yet, there is really an enormous amount of responsibility resting on all officers, from the Commander-in-Chief to the youngest subaltern, with regard to looking after the water supply of their men. I will ask you to allow me to return, on behalf of the Council, your thanks to Dr. Canney for the very able lecture he has delivered to us, and I have to thank very much those gentlemen who have taken part in the discussion.

