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Sanitary Precautions to be Observed in the Moving and Camping of Troops in Tropical Regions

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Evening Meeting.

Monday, 16th February, 1874.

SIR T. GALBRAITH LOGAN, M.D., K.C.B., Director-General,
Army Medical Department, in the Chair.

NAMES of MEMBERS who joined the Institution between the 2nd and
16th of February, 1874.

LIFE.

Wilkie, Hales, Lieut.-Col. 29th Regt.
Spring, F. W. M., Capt. R.A.

ANNUAL.

Savory, H. B., Capt. h.-p., 78th Highrs., Adj't. Rl. Lon. Mil.	Gamble, David, Lieut.-Col. 47th Lanca- shire Rifle Volunteers.
Elliston, E. C., Lieut. B. S. Corps.	Girardot, G. C., Capt. 106th Regt.
Wright, H. O. P., Lieut. R.M.L.I.	Lyons, W., Col., Assist. Adj't.-Genl. Recruiting Staff, Home District.
Hay, R. D. D., Capt., Adj't. 3rd Essex Art. Volunteers.	Trousdell, W. B. P., Lieut. 7th Hussars.
Lumsden, Sir Henry, C.B., K.C.S.I., General.	Spencer-Stanhope, F. W., Lt. 13th Regt.
Welby, A. C. E., Lieut. 90th Regt.	Crawford, G. A., Major 4th Royal Lan- cashire Militia.
Hughes, J. W., Major 51th Regt.	Gye, Lionel, Lieut. late R.A.

SANITARY PRECAUTIONS TO BE OBSERVED IN THE MOVING AND CAMPING OF TROOPS IN TROPICAL REGIONS.

By Surgeon-Gen. W. C. MACLEAN, M.D., C.B., Professor of Military
Medicine, Army Medical School, Netley.

MR. CHAIRMAN AND GENTLEMEN,—I appear before you this evening in obedience to a call from the Council of the Royal United Service Institution, to address you on the "Sanitary Precautions to be observed in the moving and camping of troops in tropical regions." In the month of March, 1862, my colleague, Professor Parkes, addressed you "On the causes of Sickness in the English Wars, and on the means of Prevention." In the concluding sentences of his discourse on that occasion, Dr. Parkes congratulated you "that at last an enlightened policy has been initiated," and that "in the words of Robert Jackson, the prince of Army Surgeons, the health of the soldier had become 'a primary consideration of the State.'" And he added, "that it must be for the Army at large, and for the general public, to support exertions which, without their aid, would languish and disappear. It must be for us, in fact, not to forget the teachings of the past, but to make them ever living, that their warnings shall not be forgotten, and that their lessons shall not be unfruitful."

It is, I know, a matter of sincere happiness to Dr. Parkes, and to those who labour with him in this cause, to find that the "teachings "of the past," as unfolded by him in the lecture under notice, have not been "unfruitful," and that their warnings have not been "forgotten."

This country has been called on, sorely against its will, to send a small portion of its land and sea forces to chastise an enemy in a climate "where fleets are silently decimated and armies melted away," but, unlike too many expeditions that in bygone years have left our shores for a like purpose, the force sent to operate on the Gold Coast has been provided not only with the appliances of modern war, but with everything that science could suggest and the national resources supply, to maintain health and efficiency under the guidance of an Officer, who, to military qualities of a high order, adds knowledge of, and respect for, the art which aims at the preservation of life, and the mitigation of human suffering.

It will be more convenient, and save much repetition, if, at the outset, I dispose of certain matters of importance regarding dress, water, and alcoholic stimulants.

Dress.

An immense stride in advance has been made in the mode of dressing the British soldier; as I had on a former occasion an opportunity of showing in this hall, up to the time of the mutiny of the Bengal Sepoys, one dress was supposed to serve his purpose for duty in India and Canada. This is no longer the case; Officers and men are not now exposed to the rays of a tropical sun, dressed in a manner calculated immeasurably to add to the sufferings and dangers of such exposure; and all who are impressed with the exceeding importance of the subject had the satisfaction of seeing, for the first time in our history, a body of men embark for African service, as comfortably equipped for the climate and work before them, as sportsmen starting for the moors on the 12th of August.

I have to congratulate the Army on another improvement hardly second in importance to the one just mentioned, viz., a vastly improved system of accoutring the soldier. I had, on the same occasion, an opportunity of bringing before the members of this Institution the mischief wrought by the old regulation system, which, while it set at nought all considerations based on the anatomy and physiology of the human frame, was, as a necessary result, most objectionable from a military and financial point of view, from the costly inefficiency clearly traceable to its use. The "Pack-Committee," of which my colleague Dr. Parkes was an active member, after years of patient experiment, at last introduced a system which has solved in a very satisfactory manner both the military and physiological problems submitted to them. We have only to ask any old soldier who has felt the pinch of the old, and the ease of the new equipment, for his opinion on the change, to be satisfied, that little as those whose withers have never been wrung by the old regulation pack and belts may think of it, it is in the estimation of those who have studied the subject, the greatest boon that has been conferred on the soldier since defensive armour

was laid aside. The trials made of the new valise equipment in Prussia have elicited strong recommendations for its introduction into a service where efficiency is so much appreciated; and Professor Morache, of the School of Military Medicine, Val-de-Grâce, declares that the trials made in France are conclusive in its favour, and were so regarded, not only by the soldiers who carried it on marches extending to 32 kilometres = to 20 English miles, without any fatigue, but also by the Officers who superintended the experiments. It is true that the knapsack is not carried by the British soldier in India, but in the old system it was not the knapsack alone that was in fault; every part of the equipment was so contrived as to press with severity on the chest-walls, and to impede the functions of the vital organs within them. The improvements I have thus indicated release me from the necessity of saying more on the importance of allowing free movement to the organs of respiration and circulation, when men have to exert themselves in the heated atmosphere of the tropics.

Water.

It is hardly necessary to say that few hygienic points are of more importance than a supply of the best procurable drinking water for men on the line of march. If this is left to the discretion of the water-carriers in India, they will take it from the nearest available source. After all that has been said and written on this subject of late years, it must suffice to say, that impure water is capable of conveying into the system the poison of malaria, or the germs of dysentery or cholera. The testing and purification of water are now carefully taught to Army Medical Officers, who, under present regulations, are charged with the responsibility of seeing that this is done by all the means available; and in their efforts to effect this, they should be seconded and supported by those in military command.* Filters, such as those contrived by Captain Crease, should be mounted on wheels, and the water-carriers, who attend to the wants of the men, should be obliged to draw their supplies entirely from them. Company Officers cannot be too watchful on this point, and should be diligent in instructing their men in the danger of drinking impure water by the way. Nor should a large supply for douching purposes be neglected. This is necessary at all times in hot weather, whether the men march by night or day. It is on this that Medical Officers place their chief dependence in the treatment of most forms of sunstroke by day, or syncope from great heat radiated from the soil at night. Every soldier marching in the tropics should have some form of pocket filter in his haversack.

Spirits.

If there be any point of military hygiene that may now be regarded as settled beyond doubt or cavil, it is this, that spirits are not only not helpful, but are hurtful to the marching soldier, everywhere I believe, but nowhere more so than in hot climates. The

* The water at every station between Cape Coast Castle and the River Prah was carefully examined, and the best sources of supply selected by Surgeon-Major Gore.

evidence on this point is overwhelming. The Medical Officers of the French Army who have had great experience in the arduous campaigns in Algeria, denounce the spirit-ration as hurtful: and Dr. Morache, already quoted as a high authority on military hygiene, declares that unless coffee had taken the place of spirits, it would have been impossible for the troops to surmount the fatigues of what he justly calls *ces pénibles campagnes*. Were I the medical chief of an Army destined to take the field in a tropical climate, not a drop of spirits should, with my consent, accompany it, save what the requirements of the ambulance-service demanded. The evidence shows that wherever soldiers, by accident or design, have been cut off from the use of spirits on marches, on active service, in temperate climates exposed to wet and cold, or in the tropics to ardent heat, or in laborious sieges, they have maintained their health, spirits, and discipline far better than when the once-deemed indispensable grog was in daily use. My colleague Dr. Parkes, and the late Count Wollowicz, in a series of careful experiments on the use of alcohol carried on at Netley, and published in the Transactions of the Royal Society, have placed on a sure scientific basis what was before a matter of observation, and have established that alcohol, far from increasing the power of bearing fatigue, even when given in a quantity which many spirit-drinkers would deem within the limits of moderation, lessens muscular force; and a quantity in excess of this, it was shown, entirely destroyed the power of work. The reason, Dr. Parkes says, was twofold. There was in the first place *narcosis* and blunting of the nervous system—the will did not properly send its commands to the muscles, and the muscles did not respond to the will; and secondly the action of the heart was too much increased and induced palpitation and breathlessness which put a stop to labour. The inferences were “that even any amount of alcohol, although it did not produce symptoms of narcosis, would act injuriously by increasing unnecessarily the action of the heart, which the labour alone had sufficiently augmented.” For fatigue, rest and food are the proper remedies. Alcohol given alone under such circumstances can only stimulate the already nearly exhausted heart to fresh exertion. Under some very exceptional circumstances it may be a matter of absolute necessity to do this, but even then we must follow Dr. Parkes’s rule, viz., to give spirits in small quantity, not more than an ounce of brandy, and if possible it should be mixed with Liebig’s meat extract, which has a great power of removing the sense of fatigue. Dr. Parkes even gives a formula which is worth bearing in mind for use under such circumstances, as for example, when troops, after a fatiguing march, are obliged to engage the enemy without time for rest and food, he advises two ounces of red claret wine, with two teaspoonfuls of Liebig’s extract in half a pint of water. Wine not being available, half an ounce of brandy or rum would be a good substitute.

I cannot leave this important subject without adding, that for twelve years at Netley, I have had unrivalled opportunities of studying the effects of habitual dram-drinking on the persons of our soldiers; and I add my testimony to the immense weight of evidence accumulated by medical men in civil and military life, to the effect that alcohol is one

of the most active agents in causing degeneration of the human tissues, in other words, disease, premature decay and death. If this be true, as I believe it is, these Officers who, by precept and example, strive to wean their men from the practice of this our national vice, may with truth be said to be engaged in a patriotic work, and to deserve well of their country. Let me ask you to look at this alcohol question from another point of view. I hold in my hand a copy of a work known, I dare say, to many present, viz., "The Sepoy War," being the Private Journal of General Sir Hope Grant, edited by Captain Knollys, R.A.; a modest record of very distinguished service. At page 108, we have the following passage, referring to the siege of Delhi. "In order to fight to perfection, British soldiers must eat, and they must drink. "Would they drank a little less. There never appears to have been any lack of provisions, and vast quantities of spirituous liquors fell into our men's hands. Drunkenness became fearfully rife, entailing with it increased sickness, as well as a relaxation of discipline, which it was necessary to repress with an iron hand." We all know the stake played for at Delhi. It was the Empire of India. Mark how alcohol put the issue in peril. Mark also that from this danger we were saved only by that unrivalled power of maintaining discipline which British Officers have shown at all times, in all places, and under all circumstances.

Coffee.

It is almost superfluous to add that the best substitute for alcohol is coffee or tea. The French Military Medical Officers vaunt, and with justice, the superiority of the light wines of their own country over the more strongly brandied wines of Spain and Portugal, and they point to the fact, that when used in moderation, the aromatic principles and the various salts they contain, exercise an effect on the digestive organs which is alike wholesome and agreeable. With all this, the best of them give a decided preference to coffee. Morache, in particular, is emphatic in his testimony, and is even eloquent in its praise as an article of diet, a safe stimulant, an aid to digestion, and an efficient refreshment under fatigue. Coffee forms no part of the ration of the French soldier in time of peace; but Morache does not hesitate to urge its issue instead of brandy, and he instances certain regiments in which the custom of substituting coffee for the morning *petit verre*, had much advanced the cause of temperance.

That a cup of hot coffee is the best preparation for the fatigues of a march, is indisputable, and it should never be omitted. It is much better that the men should have it before leaving their ground, and not at the half way halt as was common in my time in India: it invigorates them at starting, protects, especially the young soldiers, against the griping abdominal pains to which they are subject particularly in the dark and chilly hour preceding the dawn, and the vigour it imparts helps the system to resist the miasm which at this hour is most freely evolved from the soil. It is worthy of remark that coffee was first issued to European troops for this very purpose,

on the advice of the great Larrey, during Napoleon's Egyptian campaign.

The chief enemies we have to guard against in tropical marches, are, malaria, dysentery, sun-stroke, cholera, and in the yellow fever zone, the terrible disease so named. Malaria is a poison given off by the soil under certain conditions. Dr. Parkes observes that "when a country is said to be '*unhealthy*,' it is simply meant that it is "malarious."

Malaria is a product of organic decomposition in soils, it is banished by the cultivating hand of man, by drainage, especially sub-soil drainage, and by such a system of agriculture as directs the energy of the soil to the production of healthy living vegetation. The skill of the chemist has never yet isolated this poisonous agent, we recognise it only from its effects on the organism, which have been known from very early times. It is the chief factor in the causation of the class of fevers known as intermittent and remittent, characterised by a remarkable impress of periodicity, and by a long catalogue of sequels in the shape of organic diseases, which may also be gradually developed without febrile manifestations. It acts with the greatest intensity on the human system in situations which are low and moist, abounding in vegetation undergoing decomposition, in jungly districts during or immediately after the rainy season, at the base of great mountain ranges, as in the terrains of India, those belts formed of detritus rich in organic matter retaining a large quantity of water and covered with rank vegetation. It is capable of drifting along plains to a considerable distance from its source, and aided by currents of heated air, it can ascend ravines in mountain ranges to an elevation of many thousand feet. Water absorbs it, and periodic fevers can be introduced into the system by drinking water thus contaminated. This absorbing power of water is often beneficial when a sufficient breadth of it is interposed between human habitations and its source. Belts of trees in like manner exercise a protective influence. An important practical point to be kept in mind is that so slight an elevation from the ground as the difference between the ground and the second floor of a house often gives comparative safety; nay, the difference between the level of the ground and that of an ordinary bed may often lessen the danger. How high must we ascend to get out of its influence? Supposing there be no local sources, such as marshes, and no ravines up which it may drift, safety may generally be obtained at an elevation of from 1,000 to 2,000 feet. The point of safety differs however in different regions of the globe. It is hardly necessary to give such familiar facts, but without some such statement, the precautions to be observed in marching troops through malarial regions would not be intelligible. In India the ordinary reliefs of troops are made in the season of the year when comparatively little malaria is evolved from the soil. There are jungles, to enter which at certain seasons is, if not death, certain fever, of the most dangerous type; the same place can at the proper season be traversed in perfect safety. Under the pressure of military necessity troops must sometimes be moved at all risks. I have known this done when no such necessity existed, and with the most disastrous

effects. A General Officer whose name became in Spain imperishably associated with a regiment he had often led to victory, was in command in Madras when his old regiment landed; anxious to show favour to the successors of his old comrades, he determined that the regiment should at once occupy the pleasantest and most healthy station in his command. To effect this: another regiment then occupying it, must of necessity march more than 200 miles to a bad station in the midst of the rains through pestilential jungles. This was pointed out, with the inevitable consequences. The General was inexorable; the march was made, and when the condemned regiment reached its destination, a hundred sickly men were all that were capable of bearing arms, the rest were buried by the wayside, or were in hospital prostrated by fever, dysentery, and disease of the liver and spleen. For all purposes of service, the regiment was blotted out of the army list, until it was re-made, merely to indulge what was at best a bit of good-natured sentiment. A malarious district having to be traversed it should be done quickly. Night marches, always hateful to soldiers of all nationalities, are not under such circumstances to be thought of. In all climates they are to be avoided. They deprive men of repose at the time when nature most demands it, and for this nothing can compensate; they involve depression of spirits; even the light-hearted French soldier loses all his gaiety as he stumbles through the darkness; a night march is twice as fatiguing as one made in the cheerful light of day, and above all, it exposes the system of the soldier, at the time when it can offer least resistance, to the insidious attack of malaria, then given off in greatest abundance from the soil. In such localities, the afternoon should be selected; the men should be fortified by a good meal, and at least 3 or 4 grains of quinine, and an evening meal of which hot coffee should be a part should await them at the end of the march. The camping ground should be selected with care; should be in the driest available spot, not near ravines or any watercourses, and if possible, to windward of marshes, or any other obvious source of malaria.

The rules regarding drinking water already given, should be observed with more than ordinary strictness. The tents should be closed on the windward side, but kept open to leeward at night. Until the malaria-tainted district is traversed, halting days should be dispensed with. The tents should invariably be supplied with tarpaulin to spread on the ground, and Officers should see that the men have their blankets to protect them from the chill night and early morning air; which, charged with malaria, would otherwise certainly bring on fever, or dysentery, or both.

Officers can, without difficulty, carry with them their gauze curtains which they should use at night. The mechanical filtration to which the air is thus subjected is certainly, to some extent, a protection from malaria. When serving in China, I carried my own in the folds of my blanket, and invariably used them, even when sleeping in the open air in calm weather, thus securing, not only the advantage above hinted at, but protection from the attacks of insects—the well-known murderers of sleep in such regions. When with the Army of Exercise,

as it was called, assembled at Agra to coerce the Rajah of Gwalior, I well remember the surprise universally felt in camp on the arrival of the late General Sir Thomas Valiant, who, with his aide-de-camp, had traversed in safety the pestilential jungles which intervene between the Bombay frontier and central India. They owed their exemption from fever to double gauze blinds, kept closely drawn night and day, with which their travelling palankeens were furnished.

The length of marches in India is, on ordinary occasions—that is for the routine of the service—regulated by the Quartermaster-General's department, in communication with the Commissariat, who arrange with the District Civil Officers for the needful supplies. The march should average about ten miles, and on ordinary occasions should not exceed twelve. Sometimes, to escape camping in an infected or unhealthy locality, it may extend to fourteen miles. It is always, however, open to the Officer in command, on the advice of the Medical Officer in charge, on good and sufficient reasons by him shown, to modify the length of the march or change the camping ground, as circumstances may demand. Troops, under the guidance of Officers experienced in tropical service, have, however, when well fed and otherwise cared for, accomplished as much as thirty miles a day, and that for several days. This was sometimes done during the mutiny in Bengal; but the limit of human endurance is soon reached, if such a strain is kept up for many days. The 52nd regiment accomplished forty-two miles in twenty hours, part of the distance in the sun, marching ten miles more next morning, and engaging the mutineers at the end of it. Dr. Parkes, who records this fact, is careful to add, "that the men were dressed in light and suitable clothing." Under the old tight-fitting uniform of heavy red "shoddy," I believe such a feat would have been impossible, without dropping half the strength by the way.

I have already said that night marches, from any point of view, are not advisable. All the French combatant and Medical Officers of Algerian experience are unanimous against them, save for good military reasons, to which every other consideration must give way. The practice of dividing the day's march into two, with a mid-day's halt, is not to be commended. It is unpopular with soldiers, who infinitely prefer being called on to make some extra exertion to finish the day's work. In India, the practice occasions much additional labour on those whose business it is to pitch and strike the tents. It is, moreover, prejudicial to the beasts of burden, interfering with their proper time for food and rest, and it soon tells on their health and condition.

Pace.

On ordinary occasions, if the end of the march is accomplished by 8.30 or 9.0 A.M., the troops need not be *en route* before 4.30. The marching pace is regulated by order in all armies. Nevertheless, I have often heard old soldiers on the line of march say, that the walking pace of the Adjutant's horse had a good deal to do with it. Halts at the usual distances are, in the tropics, of paramount importance. To such an audience, it is unnecessary to say that a regiment will

march faster than a brigade, a brigade than a division, a division than an army. Yet, in practice, forgetfulness of this well-known fact often leads to unnecessary exposure of the men. When the halt, which lasts from ten to fifteen minutes, is sounded from the front, it should be repeated rapidly to the rear; if this be not done, the troops in the rear halt just as the march is beginning again at the front. They are thus either deprived of their rest, or the continuity of the column of march is broken while they get it.

During these refreshment halts men may sit, but should on no account be allowed to lie down. This rule should be stringently enforced, when marching in the sun. During the French campaigns, so many men perished from sun-stroke while so doing, that Marshal Bugeaud published an order forbidding it. The reason, I suppose, is this:—A thermometer placed on the ground, in the sun in India, will mark 160° F., two feet from the ground it will stand 40° lower—an enormous difference. It makes a great difference whether the column marches in close or open order. So dangerous is the former, that the medical authorities in India long ago brought it to the notice of the highest military authority, and, except under a real military necessity, no experienced Commander would ever subject his men to the distress and danger inseparable from it in hot climates. Marshal Ney, indeed, declares it to be unsafe anywhere. I need not occupy your time by enforcing the necessity for personal cleanliness. It is of the greatest importance everywhere to see that men, young soldiers in particular, do not become footsore.* Non-commissioned Officers should be instructed to see to this important point, and by careful inspection to be sure that the under-clothing of the men is properly washed and well aired, more particularly on halt days, which should be allowed at least every fourth day, besides Sunday. If the families of soldiers follow their regiments, advantage should be taken of halt days to see that the country carts in which they travel and carry their luggage are unpacked, and their contents freely exposed to the air. Without this precaution, I have known them to become as unwholesome as some of the lodging-houses in our crowded cities.

Dysentery.

Dysentery has, time out of mind, been the scourge of armies. With

* The lecturer here showed a pair of shoes, and remarked—I hold in my hands a pair of shoes that I daresay would provoke the contemptuous laughter of a London bootmaker. Few of us would like to walk down Bond-street with them, and the Guards would object to parade in them for guard-mounting at St. James's. Nevertheless, they enabled an Officer to make the journey between Simla and the Thibet frontier twice over, without the wearer being foot-sore. They have been used also in pursuit of the mountain ibex, and have given a secure footing in places where the happy possessor of a pair of London-made boots, in a similar position, would be hurled from the line of eternal snow into an abyss 10,000 feet below. The "uppers" are made, you will observe, of the woven hair of the mountain goat, the soles of the untanned hide of the ibex, and sewn on to an elastic cushion of the wool of the mountain sheep. Notwithstanding the hard service they have seen, they are still as good as new. This is the shoe worn by the whole of the inhabitants of the Khunawur district, where a foot-sore man is never seen, and where a London chiropodist would starve.

good hygienic arrangements it ought to be a rare disease in modern times in well-regulated camps. Army surgeons of the present day are well instructed in the means of prevention, both in moving and standing camps. The measures already detailed all act in this direction. The grounds used for camping along the great lines of military communication should be kept with scrupulous care, and the severest sanitary police discipline should be enforced by every regiment using them, otherwise a privy-atmosphere, of all things most dangerous to health, will surround the place. The latrines for both men and followers should be carefully attended to, disinfected, and filled up as soon as the troops leave the place. It must be kept in mind that the excretions of dysenteric and cholera patients are active means of propagating both diseases, and no pains should be spared to prevent the camping grounds being soiled by them. Want of care in this particular in past times was a fruitful source of mortality. To be brief, cleanliness of place and person, temperance, good food, and good water, are the chief means of prevention; while marching in India, soldiers must sleep on the ground, but the tents should, I repeat, always be floored with good tarpaulin to prevent dampness, and, where possible, clean straw should be added, and the bodies of the sleeping soldiers, not overcrowded in their tents, should be protected from the chilly night wind.

What is called the cholera-belt should be worn by all soldiers. It is a great protection against the chilly air which invariably precedes the dawn, and which often brings on in young Officers and soldiers, severe abdominal pains, often followed by diarrhoea. The modern treatment of tropical dysentery is highly successful. The mortality among those treated by it is considerably less than one-half of what it was within my own recollection; but to be successful, this treatment must be early, and all Officers should give their cordial support to the Medical Staff in enforcing early application for aid on the first symptoms declaring themselves; and should impress on the men the disastrous consequences of concealment, and vain efforts to quench their sufferings by a recourse to such stimulants as they can command.

Sunstroke.

The next danger to be guarded against is sunstroke. Military reasons sometimes compel troops to march in the sun. It is to be hoped the day is passed for parades in heavy marching order in the hottest part of a hot tropical day, such as are to be read of in our Indian annals, with results that, little as they were thought of then, would in the present day raise a storm of indignant remonstrance against the cruel pedantry of those who ordered them.

I have elsewhere shown that men will bear a high temperature in the open air with comparative impunity, provided, 1st, it is not too long continued; 2nd, that the dress be reasonably adapted to the temperature and work to be done; and 3rd, that the free movements of the chest be not interfered with. Sportsmen in India know this well. It is impossible to exaggerate the importance of dress and accoutrements, not alone in India but wherever troops have to make long

marches in the sun. On the 6th of July, 1760, towards the close of the seven years' war, Frederick the Great marched from Kloster Marienstern to the Spree, to reach Silesia, if possible, before the Austrian Field-Marshal, Daun. The soldiers were dressed after the rigid Prussian method of that day, which I take to have very closely resembled, in all its important details, the equipment we have just discarded, which in fact was a copy of the Prussian system. Mr. Carlyle, deriving his facts mostly from the German military historian Archenholtz, gives a terrible description of this march: "The windless day grows hotter and hotter; the roads are of loose sand, full of jungles and impediments. This was such a march for heat and difficulty as the king never had before. . . . The soldier, for his own health's sake, is strictly forbidden to drink; but as the burning day rose higher, in the sweltering close march, thirst grew irresistible. Crossing any of these brooks, the soldiers pounce down, irrepressible, whole ranks of them, lift water clean or dirty; drink it greedily from the brim of the hat. Sergeants may wag their tongues and their cudgels at discretion; showers of strokes, says Archenholtz, Sergeants going like threshers on the poor men, though the upper Officers had a touch of mercy, and affected not to see this disobedience to the Sergeants 'and their cudgels,' which was punishable with death. War is not an over-fond mother, but a sufficiently Spartan one, to her sons. There dropt down, in the march that day, 105 Prussian men who never rose again. And as to intercepting Daun by such velocity, Daun too is on the march; gone to Görlitz, at almost a faster pace, if at a far heavier—like a cart-horse on gallop; faring still worse in the heat, '200 of Daun's men died on the road this day, and 300 more men were invalidated for life.'"

On the 8th July, 1853, a body of men, 1,200 strong, marched from Beverloo to Hasselt. They started at eight in the morning. Only 500 reached Hasselt in the evening, 19 perished *en route*, and a great number, in a state of furious delirium, were taken into hospital.

The 43rd Regiment, during the mutiny of the Bengal Sepoys, marched from Bangalore in the Deccan to Calpee in central India, a distance, by the route taken, considerably exceeding 1,100 miles. With the exception of a few brief halts by the way of a few days at a time, the march was made continuously, a great part of it during the hottest part of the year; the men being exposed to a very high temperature by night as well as by day.

Dr. Barclay, the surgeon of the regiment, while in a valley at the foot of the Bismarunge Ghat, observed the thermometer at 118° F., in the largest tents during the day, 127° in the smallest, and on one occasion he observed it at 105° at midnight. This terrible temperature and prolonged exertion, told with fearful effect on the men: long before they reached Calpee, they were reduced to the last extremity of weakness. When at the foot of the pass just named, cases of insolation were brought to the hospital tents at every hour of the day and night, and although a large proportion of them were recovered by prompt treatment, two Officers and eleven men died in one night and were buried under one tree in the neighbourhood of the camp. I could

multiply examples of the terrible power of the sun on soldiers in the field; the above must suffice. Examples of these gathered from the medico-military and naval annals of our own and other countries, I have given in the article "Sun-Stroke," in Russell Reynold's System of Medicine. But I cannot miss the opportunity of warning those inexperienced in tropical service, of the great danger of crowding soldiers in barracks, tents, or even ships at sea, in hot climates; direct exposure to the sun's rays is not the only way in which high temperature kills; it is often quite as fatal in the close ill-ventilated and crowded barrack dormitory, tent, or the main deck of a ship, as under the rays of a vertical sun. This suggests the question whether it would not be safer in such circumstances to dispense with tents altogether, and make the men sleep on the ground, or on such raised beds as they can extemporise from the materials at hand. No one can be more impressed than I am with the great danger under such circumstances as we are considering, and indeed any circumstances, of causing men to breathe the foul air of a crowded and ill-ventilated tent, and as the least of two evils I would sanction a bivouac in the open air rather than expose them to it. At the same time I must add, that so far as my experience goes, chiefly gained in India, it is opposed to the general practice, and in localities notoriously malarious, it is I am sure unsafe. I must only note here, in passing, a curious peculiarity in the behaviour of Frenchmen when under the influence of high temperature; viz., a disposition to commit suicide, seamen by throwing themselves into the sea, soldiers with their arms. In one of Bugeaud's marches in the province of Oran, 11 men destroyed themselves, 200 on the same march suffering from insulations. The thermometer taken alone, does not always indicate the danger. There are other facts not as yet very well understood, such as the nature of the soil on the line of march, whether or not it be covered with vegetation, the hygrometric condition of the air, its electric tension, and the state of health of those exposed. I have already sufficiently adverted to the effects of dress and accoutrements, the weights the soldier has to carry and the mode of carrying them.

What then are the precautions to be observed to minimize as far as may be, the dangers above indicated? They are briefly, loose and light dress, protection to head, neck, and spine, and, let me add, the abdomen also. I am informed by one of Dr. Livingstone's companions in his African travels, that they were all as solicitous to protect this region of their persons from the heat radiated from the soil, as their heads from the direct rays of the sun. For this purpose they used waist belts made of hunting, *white*, when they had it.* Anatomists and physiologists, remembering the position of the great plexus of the sympathetic

* The lecturer here remarked on the necessity of making that part of the cover of the soldier's cap, which protects the nape of his neck, not of one, but of many folds of white cotton cloth, which should come lower down on the shoulders than it usually does. He also produced a waist-cloth or Kummerbund, of the finest Ram-poor shawl cloth, 30 feet in length, so light and flexible as not to incommode the wearer, and yet to give perfect protection to the abdomen. He also pointed out the universal use of this among the natives of India.

system of nerves, will understand the *rationale* of this precaution. Marches of moderate length, in open order and with frequent halts, the men being allowed to sit, but, for the reason already given, not to lie down. Personal cleanliness, an abundant supply of the best water procurable, for drinking and douching purposes, good food, and tea or coffee, instead of spirits, for refreshment. On one of the last occasions when Canton was occupied by British troops, there was an alarm at noon day, and the troops had to turn out. An Officer in command of a battery, thinking to do his men a kindness and to "fortify them" against what was before them, opened the canteen and gave each man a glass of spirits before starting; that battery had more cases of sun-stroke than all the rest of the force put together. Is it then advisable to drink water when exposed to the sun? With a good intution no doubt, the Great Frederick forbade this indulgence to his men, and we have seen what came of it. All sportsmen know that if they once begin to drink water, on the moor for example, obeying the first craving for it, they must go on so doing all day. If they resist, the inclination passes away, and they go on without suffering until they reach the luncheon basket by the side of a cool spring. This, however, is a different case from that of the laden soldier toiling in the ranks along a dusty road, half choked with dust, and sweating profusely. Water is then a necessity, and men, like the hart "heated in the chase," "pant" for it. The blood is every moment becoming heated, and but for the cooling effect of the enormous evaporation from the skin, would soon become super-heated, with effects fatal to the centres of nervous energy and power. It is parting also with its watery constituents, and nature cries aloud for its renewal. To withhold it under such circumstances is as stupid as it is cruel. It will surprise those who have no experience in such matters, that in sun-stroke the temperature of the human body will sometimes reach 110° F., that is within 3° of a temperature at which the albuminoid constituents of the muscular system coagulate, and late researches have shown that the sudden failure of the heart's action in some forms of sunstroke may be due to this very occurrence. This will explain why the modern treatment of insolation is mainly based on the rapid reduction of temperature.

Cholera is our next subject. During the greater part of my service in India, the belief prevailing in high quarters was, that cholera was like the wind "blowing where it listeth;" that nothing was known or could be known as to its origin, its movement, its propagation; it was felt to be a frightful evil, one that as it could not be cured, was to be endured. So long as this state of mind continued, measures of defence or precaution were deemed as futile as an attempt to get to the back of the north wind. If cholera was known to prevail along the route about to be traversed by troops moving both ways in the course of the usual reliefs, that was not considered a sufficient reason for interfering with the routine of the service. One regiment was sent on the track of an infected one (already carrying the disease from village to village along its route), occupying the same camping ground, soiled with the poisonous discharges from the persons of the sick. The whole atmosphere was tainted with the stench of the bodies of the wretched followers,

always furnishing the largest number of victims, torn from their shallow graves by obscene beasts of prey; but enough of this past, fruitful in scenes of horror on which I seek not to dwell. This was pre-eminently the pre-sanitary age. There is enough of mystery about cholera still; its exact cause we do not know, it may be we shall never know it. It may in the future, as it has in the past, elude all the most refined methods an advanced science can bring to the enquiry. For some years past many ardent minds have sought to look into this mystery in vain. Two young men in particular, singularly gifted with the philosophic spirit, and armed with all the means science can supply, were set apart for this honorable but dangerous service by the Professors of the Army Medical School, with the approval of the Home and India Governments; Drs. Douglas Cunningham and Lewis have laboured in this cause, and although their labours have not been unfruitful, and are still full of promise, nature has not yet been forced to yield her secret to the persistent enquiries of these young philosophers. For all this, we do not despair; and even if we are destined never to see the veil withdrawn that hides the mystery from our eyes, we believe that in time we shall learn how to restrain the ravages of this disease within narrow limits, if not to stamp it out altogether. We now know with some exactness its birth place, or, in the language of Dr. Bryden, an eager labourer in this field of enquiry "its endemic "area," whence it starts on its "tours of invasion." The laws governing its movements are being patiently examined, the means by which it is propagated from man to man, and from one congregation to another, are being sifted and recorded, and although on such points there is much conflict of opinion, I am confident the truth will appear at last "with healing on its wings." Already the enquiry has not been unfruitful in important results. Four times in the course of last year did cholera effect a landing on our shores, in London, Liverpool and Southampton, from foreign lands where it widely prevailed, and on every occasion the energetic efforts of the local sanitary authorities stamped it out before it could establish itself in its old haunts, and carry death to thousands of our countrymen.

To make intelligible the precautionary measures I am about briefly to give, I repeat here what I have elsewhere written. From the carefully observed and recorded histories, not of one, but of many epidemics of cholera, not in India only, but in every country yet invaded by the disease, I believe that human locomotion is the means of its extension from one distant place to another; in other words, as Dr. Netten Radcliff has expressed it, "Cholera does not travel, but is "carried;" while air and water are the main agents of its diffusion in the vicinity of a place into which it has been brought, aided often by the agency of infected clothing, bedding, or whatever has been contaminated by the excretions of those affected by the disease. Let this most pregnant fact, well insisted on by Simon, be kept ever in mind, viz., that where cholera is epidemic in any place, persons who are suffering from the epidemic influence, though, perhaps, with only the slightest degree of diarrhœa, may, if they migrate, be the means of conveying to other places an infection of indefinite severity. That

the "quality of infectiveness" is in the matters which the patient discharges, that if these matters undisinfected are permitted to mingle with the contents of drains or cesspools, the very effluvia from them may infect; finally that if the cholera contagion from the above or any like sources, gains access to wells or other sources of drinking water, it will infect large volumes of the fluid. With regard to infected clothing here is a well-authenticated fact. Towards the close of the last epidemic of cholera in Malta, a woman in attendance on a soldier's wife affected with the disease, purloined and secreted an article of under-clothing worn by the sick person; weeks after the death of the woman, and after the disappearance of the disease from the island, this unhappy creature put on the stolen garment, without washing or disinfecting it, caught the disease and died. In like manner washerwomen who have had to wash the linen of infected persons without previous disinfection, have thus caught the disease.

It was long one of the "mysteries" of cholera, that it often localised itself in a particular house, a particular block of barrack buildings, one side of a street, and so on. The "mystery" is frequently explained by a careful inspection, disclosing local sanitary defects, a tainted water supply, and in some exceptional instances, even tainted food. I well remember one block of barrack buildings at Arcot, in the Madras Presidency, a very cholera-haunted station. It was on a much lower level than the main body of the buildings. To one division of this block in particular the disease, so soon as it appeared in the station, returned with the regularity of the swallow. At last, the floor of this pest-house was dug up, and a drain, choked with frightful accumulations, was discovered, the existence and direction of which had been forgotten. The barracks were built in the days of Clive, when Arcot was a place of importance, and, in their construction, every principle of sanitation had been violated—in nothing more than in the direction of the drains, driven as we have seen through the very centre of a dormitory. Bearing the above facts in mind, let me urge, first, that troops should not be marched into an infected locality, or tainted district. By way of illustration, take an historical example "written for our learning," what is known as the Mhow Case. A detachment of artillery, with women and children, was ordered to march from that station to Poonah. It was reported to the General commanding the division that cholera prevailed on the route, and delay was urged on this ground. It, unfortunately, happened that this Officer, on a previous occasion for a like good reason, had delayed a movement of troops, for which he received a rebuke from head-quarters. Unwilling to expose himself to another, he allowed the detachment to march, which in due time entered the "tainted district." All the world knows what followed. A shocking mortality among men, women, children, and followers. The time had gone by when such untoward events could pass without notice. A great outcry arose all over India. It reached this country. The facts were commented on by the press and discussed in Parliament, and after an acrimonious correspondence between the General and the authorities, he was deprived of his command.

2nd. When cholera attacks in cantonments or on the line of march,

change of locality is a point of primary importance. Flight out of the tainted place is not left to anyone's discretion; it is now a standing order in India. The Shakesperian maxim, "stand not on the order of your going, but go at once," should be the rule of conduct; go, ere the men get tainted; go, before they become depressed and panic-struck, by the rapidity with which the disease carries off its victims. The move should be made to the driest soil, where cholera victims have not been—where, as Dr. Parkes puts it, "it is pure, impermeable, and un-contaminated."

3rd. It is advised, when overtaken by cholera on the line of march, to move at right angles to the line of the prevailing wind. The plan may be tried—it sounds very reasonable—and if it be true that cholera germs or dust are carried to great distances by the wind, it ought to be effectual. Knowing however, as I well do, that cholera takes little account of the wind, finding its way, as I believe, by human means, not much hastened by a favourable, or much delayed by a foul wind, I do not personally think much of the measure. Others, however, whose opinion is deserving of respect, think differently.

4th. If a tainted village be on the way, avoid it; and, above all, if a body of tainted troops be approaching, it must not only be avoided, but the ground they have encamped on, being highly dangerous, must not be even approached.

5th. If a river be in front, cross it quickly. Do not linger on its banks, for the disease evinces a disposition to cling to rivers, which is probably only another way of expressing the fact that it follows the course of human intercourse.

6th. Need I repeat once more all that I have said about jealous watchfulness over the sources of water supply, and the necessity of the careful purification of it? To the next and last point I attach the greatest importance, viz., frequent inspection of the troops, at least three times a day, by Medical Officers, to pick the men out in the first stages of the premonitory diarrhoea. The eye of the experienced physician will detect at a glance the tainted man, before he has a suspicion that anything but a painless diarrhoea affects him. This is the stage when treatment avails; check this at the outset, and the man is saved.

It is needless to repeat once more, that attention to the conservancy and disinfection of latrines is more necessary in this than in all other diseases which may attack troops in camps or on the line of march.

Yellow fever is the next and last subject to be briefly noticed. This terrible disease has a *habitat* of its own, viz., the shores of the Gulf of Mexico, and the northern and eastern shores of South America, and the islands of the Caribbean Sea. From this, its home, its "endemic area," it has often been imported into other regions with destructive effect, but has never established itself in any of them as an endemic disease. Unlike cholera, which can live and thrive at St. Petersburg as well as in Calcutta, yellow fever loves a hot climate; there is much evidence to show that it has never established itself in any climate

where the average temperature is below 72° F., and the late Dr. McWilliam, of the Royal Navy, one of our highest authorities on the subject, has shown that it is driven from the coast of inter-tropical Mexico between the months of November and March, when the mean temperature does not exceed 71° F. Humboldt was of opinion that yellow fever cannot exist at an elevation of 3,000 feet above the level of the sea. But the truth is that it has three times been imported into the mountain military station of Newcastle, in Jamaica, where, however, I must add, a most efficient *nidus* had been prepared for it by faulty sanitary arrangements. Again, cholera destroys men of all races with perfect impartiality. From some peculiarity in the organization of the negro race, they enjoy a certain degree of protection from yellow fever. Our Army records show this incontestably; the mortality among the black troops is as nothing compared to the whites from this cause. I have called your attention to the fact that cholera often operates in a limited area or "tainted district." One of the most fortunate circumstances connected with yellow fever is, that this is, in a much higher degree, one of its distinctive peculiarities, and I invite attention to it as of the highest practical importance to military men, as on it is based the chief measure of precaution. I have not time to give a brief summary of the evidence on this point, but from the earliest examples with which I am acquainted, down to that of the Lisbon epidemic, the different invasions of the terrible outbreak at Buenos Ayres, and that of Shrieveport in the United States, the disease has evinced no disposition to extend the area of its operations beyond the tainted district. The lesson this teaches us all is that in flight we must seek safety for those committed to our charge. At Buenos Ayres, safety was found a few miles outside the city; it was the same at Lisbon, and at Shrieveport; and Blair of British Guiana, who has written one of the best treatises on the disease, has recorded the same fact.

Whatever be the exact cause of this pestilence, which is as yet as obscure as that of cholera, one fact of primary importance stands out clear as noon day. It is emphatically a child of dirt; or, if this be going too far towards its filiation, an atmosphere of dirt is that which it loves and affects, and within which it confines itself. So long as New Orleans was an uncleanly city, yellow fever was an annual visitor. Whatever we in this country may think of General Butler, however little most of us would like to live under his rule, he did one thing for New Orleans, he vigorously enforced sanitary laws, and for nine years that city has enjoyed an exemption from the disease, a thing unknown in its previous history. Most of us know, by hearsay at all events, that Lisbon is not famous for that which is said to be near of kin to Godliness; Buenos Ayres, when at last, notwithstanding its attractive name, yellow fever was imported into it, was nothing but a network of enormous cesspools. The streets were covered with swill and offal. The water of the river was so affected by the fluids that drained into it, that fish died and were thrown upon the banks. The people drank the water, and met the same fate; Shrieveport was much in the same condition; and when yellow fever entered, a New Orleans physician

declared, that all who were seized with it dropped off like sheep seized with the rot.

Surely I need not point the moral?

Yellow fever is a disease with which our naval brethren have more to do than we have, now that so few troops are serving in its *habitat*. Naval Commanders and Surgeons know that when boarded by this unwelcome visitor, there is but one course to pursue, viz., to shape one for higher latitudes; and the sooner this is done, the better for the safety of the crew. In one word, by sea or land we must seek for safety in timely flight. This is a case in which discretion is certainly better than valour.

And now to conclude. It will be seen that I have not so much sought to lay down hard and fast rules; to say, "do this," and "don't do that," as to establish principles from which precautionary measures flow as their corollaries. In other words, within the narrow limits, of necessity assigned to me, I have given you, in merest outline, it is true, a sketch of the natural history of the diseases which assail us in tropical climates, in the belief that this is the true way when addressing educated men to teach them how to meet and disarm them. This is not the ordinary vestryman's view of sanitation, and let me add, of those who act as if they deemed the conciliation of vestrymen of more consequence than national health. To such, given any unsanitary condition, and it is, in their opinion, "the toss of a half-penny," whether the outcome be small-pox or "fever," under which term they lump up half-a-dozen diseases specifically different in their cause, their symptoms, their anatomical lesions, their portability, their treatment, and mortality—cholera, or any other item in Pandora's box.

I am thankful for the progress we have made, I am hopeful of conquests yet to be achieved by preventive medicine at home, abroad, by sea and land; but I cannot withhold the expression of my belief that until the vestryman's "view" of sanitation ceases to influence the minds of those who aspire to direct public opinion and to guide legislation on this subject, the cause of what our continental neighbours aptly call "State Medicine," and with it all that belongs to the health of fleets and armies, will not take the place in the administration of affairs, its importance in relation to the happiness and well-being of our country, demands.

The CHAIRMAN: We have listened to a very interesting lecture upon a very important subject, and one which involves not only medical but military points. As the Sanitary Schoolmaster has been abroad so long, not only in private life but also in the Army, perhaps some officers or gentlemen whom I see present may be disposed to offer some remarks upon the points contained in the lecture.

Captain LEARD, R.E.: There are one or two points in the lecture that, with your permission, sir, I will comment upon. I think the most remarkable point was with reference to the height above the sea at which camping stations and garrisons should be placed, and this bears more especially on our position at the present time on the Gold Coast. We have been maintaining garrisons all along the Coast in positions which we know are not sanitary; but the probabilities are that, in future, stations could be selected on that Coast where troops could remain without any chance—or at least with much less chance—of their suffering from the terrible climate. We know that in the district of Akropong there are hills and uplands varying from

1,000 to 1,500 feet in elevation. The probabilities are that, if the troops were concentrated in that part, they would still be able to maintain a military control over the whole Coast. There is nothing, probably, from which soldiers suffer more than from drought, and anything which would tend to preserve them from thirst during campaigns and during marches is of the utmost importance. The lecturer commented on a beverage which he strongly recommended to troops, and that was coffee. Now some years ago I was hunting chamois in a very hot season of the year, and it was a most important thing to ascertain what was best to drink. We tried coffee and tea and cocoa; and my friends and I were unanimously of opinion that cocoa was far superior in enabling us to resist thirst to anything else. The use of spirits was entirely, as I understood, tabooed by the lecturer, but I would ask whether a very slight modicum of spirits mixed with the cocoa or coffee would be hurtful to the troops. My impression has been that although raw spirits are undoubtedly very bad for men, injuring the coats of the stomach, yet, mixed with soup or coffee, they are not deleterious in their effects, and are occasionally beneficial.

Sir WILLIAM CODRINGTON: There is one matter with regard to the clothing of troops. As long ago as 1812 I think, the Government gave to every soldier in Canada his fur cap and his mocassins at a cost of £3 to the country as an addition to his kit.

Dr. MACLEAN: What I had particularly in view was this, my colleague, Mr. Longmore, professor of Military Surgery at Netley, who served with the 19th Regiment in India, has often told me—in fact it is now in print—that he took the trouble to weigh the clothing sent after the regiment to Calcutta, which arrived in the dog-days to be served out to the men; he found that it was actually heavier than the clothing which had been issued to his own regiment whilst serving in Canada. Of course I did not allude to the external clothing superadded to that, but merely to the ordinary dress. In the case of the 19th Regiment, that certainly was so—the clothing served out in Calcutta, weighed more than that which had been issued to the same regiment in Canada.

Sir WILLIAM CODRINGTON: I imagined that you mentioned there was no change in the dress in Canada.

Dr. MACLEAN: I was referring to the ordinary uniform, not to great coats and such like additions.

Mr. G. W. COCKBURN: If not intruding on the meeting, I would support what the lecturer said about the unadvisability of commencing to drink in hot climates, and how well I know the truth of his assertion that every true sportsman knows the danger of commencing to drink, in hot climates. I think we may learn a great deal from the natives of those countries; and I can also speak from experience, having kept the fast of Ramazan with a certain Mussulman regiment in India, who urged the fact that they were keeping the fast, against doing any work. I accordingly kept the fast myself with them, so that I might say "I am keeping the fast myself, so we will go along together." The fast was kept from the first dawn of day until sunset; and the abstinence from drink was much more difficult to bear in the hot weather than the fasting from food. No Mussulman, as soon as the sun sets, thinks of quenching his thirst by taking a drink first; but he takes a small piece of salt and eats it, and he always takes a bite of food of some sort. The necessity of doing this should be always urged on our troops, whenever they halt, viz., to eat a little before they drink, as then the drinking will not bring on that fearful thirst, which, even the purest spring-water in the Himalayas will do, if you once commence to drink. If you commence to drink very early in the day, you will have raging thirst all the rest of the day; but if you resist that temptation to drink and take a small mouthful of food first and then drink afterwards, the effect is very different. I learned this very notably on a certain long march in a region I have no doubt well known to the lecturer, to the top of the hill near Simla. I was very anxious to get there in a very short time; and, before starting, an old lady had told me that ginger-bread nuts were a great thing to keep down thirst, and insisted on my putting some in my pocket. I laughed at the old lady's story and did not believe in it at all. The following day we had to start at two o'clock in the morning. I got nothing to drink; and marching in the month of May, although in the hills, is extremely hot work in the sun. I had a bottle of cold tea, which I would not touch myself, because if the

men had seen me doing it they would have said that I was drinking and they were not, and would have made that an excuse for any further advance. I was very nearly dead with thirst at one time, when I thought of these ginger-bread nuts. I put a small piece of one of them into my mouth; I found to my astonishment that I went on with perfect ease afterwards. This is an old woman's recipe, but it is a very good one; and if the soldiers were furnished with ginger-bread nuts or a biscuit on these long marches and told to eat a small piece of that before they drank, I will guarantee from my experience, that drinking would not have the same effect of bringing on a raging thirst.

Mr. RAWLINSON, C.B., C.E.: I hope I shall not be obtruding myself upon this meeting, this being a medical question, for I can only speak upon it from an engineering point of view; but I may, however, speak with some experience, seeing that I have been one of the Inspectors of the Board of Health since its formation in 1848, and that I had the honour of being appointed engineer to the Sanitary Commission sent out to the Crimea (1855). With regard to provision to be made for armies on the march, I am not going to occupy your time with any story of my own about that. I would simply supplement some of the lecturer's remarks with regard to the care that is necessary; and I will state briefly some regulations that I found neglected in the Crimea. I am speaking in the presence of Sir William Codrington, and I simply wish to explain certain regulations which I considered necessary, but which were neglected. The water supply of the camp at the front was obtained from natural springs and from ruined wells. The natural springs at the beginning of the second summer were in a muddy condition. There had been no attempt made to store the flow for 24 hours. The men drew water indiscriminately as they could get it. There was no regularity in the order of drawing, but each man drew as he went to the spring, the result being that the water was muddy from morning till night. It was the same with the wells. They were also drawn from indiscriminately from morning till night. The water slopped over the bank, went back again, and so contaminated the water. It did seem to me that it was so easy to remedy that state of things that in future it ought never to exist; as that whenever an army occupied a country, even for a brief space, the first thing to be done should be to put a guard upon the sources of water supply, and that the drawing of the water should not be done by the men individually but by orderlies told off for this purpose, and that some simple tank expedient should be adopted to economise the water for 24 hours. With regard to the watering for the cavalry camp, there were some 12,000 horses, and there were rows of watering troughs erected for the horses to water from—ten or twenty in a row; the water was run into the top trough, and then fed into the next, and into the next, and so on, the result being that before the water got half way down, the horses coming to the lower troughs would not drink it. This might have been obviated by a very simple expedient, for a small trough-spout or pipe might have been carried down in a line with the row of troughs with a small feed into each trough which would then have given an independent supply without its passing through any second trough.

With regard to the huts sent out to the Crimea, the roofs were covered with patent felt. Unfortunately for the soldiers, felt being waterproof was also air-proof, and no adequate provision had been made for ventilation. That was, however, sought to be remedied in different ways by the different medical officers of the different divisions; but I do not think any of the plans were entirely successful. The remedy that we recommended (and which was carried out) was to cut a slit in the roof, and then to cover it with a louvre-board raised about an inch above. If in the huts sent out to Africa the same form of roof has been continued, and that remedy has not been provided for giving ventilation, those huts may afford shelter to the men, but they will, at the same time, breed fever. So much was that the case, that some huts in the Crimea were emptied, as every man went down with fever when they were kept at the full charge of 25 men to each hut. With regard to cholera and what may cause cholera that is a question I am not going to enter into, excepting so far as to state that it has been my fate to examine almost every seat of cholera in this country, and whatever may be the cause of cholera, as the lecturer has remarked, it cannot be said (independently) "to travel," or "to jump," or progress in other similar ways described in many, even medical, reports, such as "passing mountains."

"running up rivers," and "marching over plains." It requires human intercourse. It follows the human being; it is attached to him; but there may also be something else besides the human being to cause cholera. After investigating one site of cholera after another in this country, and thinking "Now I have found something about it; now I know something about it," I was driven from every post—one after another—and had to come to the conclusion at last that I really knew nothing about it, except that it had an affinity for dirt. There was the instructive case of the town of Alnwick. The medical officer there jotted down upon a map every case of cholera and of cholera death, and in looking over the map and examining the ground I found that cholera had fastened upon the site where the back land drained into and through the basement; where the houses built upon the slope had the fall away from them, they were exempt. At the backs of the houses were great heaps of ordure and refuse, and the sub-soil becoming tainted beneath the basement, the atmosphere of the interior had become contaminated with foul vapour. As to cholera crossing a river, the lecturer has explained that there was a large traffic of human beings on the one side and little or none upon the other. I remember a French commission inquiring into the cause of cholera, and it came to the conclusion that cholera did not prevail upon the granites. I said, "Have you much population in France upon the granites?" "No." "Then, how can it prevail there?" I said. One of the most severe cases we had in England was upon granite. It was at Megarissy, in Cornwall, where one-tenth of the inhabitants died in a month; so that stratification has little to do with cholera. With regard to clothing conveying cholera, and with regard to the notion of woollen garments being specially impregnated with virus, let me tell the lecturer one fact. At the time I was Chairman of the Rivers Commission I was holding an inquiry in Yorkshire where the manufacture of shoddy was first perfected. I had before me medical men who remembered the introduction of shoddy, which is old woollen garments, gathered from every dirty quarter of the globe—Egypt, Poland, &c., to the extent, that year, of 35,000 tons of shoddy, and principally into that district. I said, "Have you disease when you break open these bales and handle these woollen rags?" "Not one single case." I said, "Are you quite sure?" "Not a single instance within our knowledge." There was an experiment upon a gigantic scale, whether or not the virus, or whatever it may be that impregnates woollen clothing, for I am not going to say that a woollen garment taken from the back of a cholera patient and immediately put in contact with another, may not carry the disease, but whether length of time or ferment destroys the virus, and how long it takes to do so, is really a question well worth inquiring into. Inquiry has been made with regard to small-pox and linen rags, and the commission found that there was only one small paper manufactory where small-pox had broken out, and there the commissioners could by no means fasten the outbreak upon the linen rags.

With regard to water and cholera, I know something about the water supply of India. Having the honour to serve upon the Army Sanitary Committee, it is my fate to glance over the reports from every part of India, and that cholera should prevail in India, that fever should be rife in India, and disease in excess, need not astonish any person who will take the pains to look at those reports. Anything more abominable, more horrible, than the water supply of India generally cannot by any possibility be conceived. Many of the wells are so tainted by the water filtering in from the tainted sub-soil as to be utterly unfit for any form of use. And again, the Hindoo has a ready facility of committing suicide, and in one of the provinces it was found that in one year some 1,700 bodies had been taken out of wells and tanks used by the inhabitants of that district. Attention is now turned to it, and analyses have been made by hundreds, I may almost say by thousands, and means are being taken to improve the water-supply of India, and as that improvement takes place, I have not a doubt but that the mortality will be reduced. I entirely agree with the lecturer as regards the use of spirits, and I am delighted beyond measure to hear him denounce any use of spirits as a ration for soldiers in the field. I am fully satisfied that doing away with the use of spirits both for our Army and Navy (other than as a medicine), will be one of the greatest improvements.

Sir W. CODEINGTON: I may mention that it was in times of great difficulty that the Sanitary Commission came out to the Crimea. There was the difficulty

of getting up huts, the difficulty of getting provisions, and the difficulty of getting water. I think that these things have not been quite considered in the statement that has been made to-night by Mr. Rawlinson. (MR. RAWLINSON: I did not wish to cast any censure.) I do not mean that at all.

MR. RAWLINSON: I only say, if I had to do with an Army in the field, a well or other source of water should never be left to be indiscriminately drawn from, as was the case in the Crimea; there ought not to be a single case of it in future.

DR. MACLEAN: I have really very little to say in reply in addition to what I have already said. I believe I am quite at one with the gentleman who has just addressed us on so many points connected with sanitary matters in India, and more particularly with what he has so forcibly stated with regard to the water supply there. I did not go into all the details, but I am thoroughly acquainted with the truth of the facts that he has just stated, more particularly what he referred to just now with regard to the enormous number of suicides, particularly of women, in the wells and tanks of India. In the place where I myself did duty upwards of eleven years when I was attached to the Residency at Hyderabad in the Deccan, in the wells of the immediate vicinity of that great city, suicides took place in the way described by Mr. Rawlinson at the rate of three or four a night and frequently more. I would wish also to observe with regard to what was said about the non-introduction of cholera by shoddy that the instance I gave of the disease having been transmitted from one person to another, was exactly such a case as Mr. Rawlinson allowed might possibly be an exceptional one. This garment had not only been used by a person sick, but was tainted in the way in which you might naturally expect, and it had not been exposed to the air until it was again used and in that way we can very well understand that the germs of cholera or whatever you may choose to call them may have retained their vitality.

I should merely like to add that the blanket that you see before you, formed the side walls of a tent used by the Officer whom I have previously mentioned. The tent was in use for upwards of ten years, in very unhealthy localities, in the deep valleys of the Himalayas. The blanket was found to be capable of resisting any amount of rain, and, when exposed to the severest tempests, the tent was perfectly dry, and—what was noticed as a thing of very great importance—it also acted as a mechanical filter to the air; and the gentleman and his wife, who inhabited it for many years, never suffered from malaria. It is a notable fact that the people who live in the district I have mentioned, when they are obliged to sleep in malarious regions, invariably use a sort of mask made of the same material, though somewhat finer; having been taught by experience, the immense importance of filtering the air and thereby protecting themselves.

THE CHAIRMAN: I am sure you will allow me to return your thanks to Dr. Maclean for his very interesting lecture, in which he has laid down maxims that may act as guides for the future. A more able or more philosophic lecture we could not have had, and I have great pleasure in conveying your thanks to Dr. Maclean.