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Suggested Improvements in Sanitary Arrangements for Hospitals, Barracks, Camps, and Shipping, &c

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LECTURE.

Friday, February 27th, 1874.

SURGEON-GENERAL JAMES MOUAT, *W.C., C.B.*, in the Chair.

SUGGESTED IMPROVEMENTS IN SANITARY ARRANGEMENTS FOR HOSPITALS, BARRACKS, CAMPS, AND SHIPPING, &c.

By Major-General MILLINGTON SINCE, Royal Engineers.

WHEN I received the honour of an invitation from the Council to address you on the subject selected for our meeting to-day, I could not question the intention that I should bring before you that particular branch of sanitary law with the importance of which I have been so much convinced, as to have in the first instance warmly pressed its consideration on various departments of the public service, and subsequently re-directed the aim what might remain of the energy of my life into a new direction and a fresh field.

Damp, cold, and vitiation are the three prominent evil agencies we, in this climate, have more especially to guard against. An abode, then, of whatever nature, in which any of us are to dwell, be it hospital, camp, barrack, or ship, should be supplied with dry, warm, and pure atmosphere. The true test, therefore, of the relative merit of all structural or mechanical arrangements of whatever kind, is the measure in which they may succeed or fail in conveying to us warmth, dryness, and freedom from contamination. I must not now dwell at any length upon these points; but I leave you to judge how far we have observed these extremely simple and elementary obligations in sending our artificial warmth up chimneys—except when these send us down the cooled carbon, and obstinately refuse to draw, and instead of fulfilling their intended office, go near to have us stifled and smothered—or in underlaying our ground floors with receptacles of the utmost possible revolting description of contents, the receptacles themselves being out of view and beyond access, the only thing known of them being that it is absolutely out of the question they should be anywhere

perfect except under a combination of fortuitously favourable accidents, on which it were sheer folly to base any rule of conduct or practice.

I must, however, invite your careful attention to the distinction between *Sanitary Law* and such changes or caprices as are apt to be given the name of *Sanitary Improvement*, and are often advanced by what in reality is penal legislation, waged (incautiously, it may be, but still waged) against all laws of health. The distinction is a wide and most important one. Law may be violated, but it remains law, be it never so much set at defiance, even by legal enactments. In like manner we may be absolutely certain, by analogy alone, that there is in all matters, but one law of health, and *that*, let us treat it as we may, remains unaltered and unalterable, terribly vindicating its infraction, or rewarding its observance by a decree of life or of death. I shall have to revert more fully to this branch of the subject presently; meanwhile I will ask you to bear in mind that if the law be violated, ending of the violation will be a great improvement in the state of affairs, and in individual conduct; but to pretend to improve what is in its very essence a violation of law, is of the nature of an absurdity. Framed in conformity with law (the unalterable law governing created matter), sanitary arrangements admit of constant improvement, but arrangements conflicting with sanitary law, are incurably vicious. *Insanitas* is not far from insanity, and it may be an interesting, and might prove a profitable investigation, to trace how near may be the connection between the *mens insana*, the diseased mind, and the neglect of natural law in the healthful preservation of the body.

Our condition—I mean the stage at which we have arrived in this matter—is aptly illustrated in the words we use. We term arrangements sanitary, merely because they deal with matters which affect the state of the general health, and not at all necessarily implying that they deal with them beneficially: nay, often their force lies in exactly an opposite direction. To bring the laws of health before you in an apt and striking manner, I purpose calling your attention in the first place to those cases which most palpably and largely affect the state of general health, namely, hospitals for infectious cases.

Happily, it is not necessary to argue out here, or in the present day, that the germs of disease are destructible by the agency of fire; nor that, on the contrary, water serves as a vehicle for the widest possible dissemination of such germs; but I will bring before you some striking evidence, both as to principle and practice, illustrative of these facts. Water—water in any form, rendered the vehicle of contagion—carries those germs directly in its own body, serves to evaporate them into the air, serves to impregnate the surface soil with them, and, receiving the inoculation of the corrupting process instituted, multiplies them perpetually, and spreads them irresistibly.

I have sought now for some considerable time how most effectively to bring this most important aspect of the wide subject under the direct cognisance of all the bodies, governmental, municipal, and voluntary, that have the control of hospitals, and I look upon the present opportunity of specially inviting to it the attention of the Army and Navy Medical Departments, through the medium of the present lecture,

as a most important step in that direction. In a paper read at the last meeting of the Social Science Congress, at Norwich, I pointed out that whereas it was incontestably established that the contents of sewers served to generate corrosive gases strong enough to eat through lead, and poisonous enough to kill, it has been proved as certainly, that the germs of disease may be entirely destroyed by resorting to the agency of fire. I also stated that if any means could hold such germs in a latent and harmless condition, short of their destruction by fire, that agency was to be found in charcoal, which application has now for a very considerable time past been carried out in the Infectious Hospital, as well as in the Convalescent Hospital in the city of Glasgow.

Dr. Russell, the health officer of the city of Glasgow, on my proposal that burning works, according to Mr. Stanford's system for dealing with such matters (for the discovery I have taken up is his), should be put up in all hospitals throughout the kingdom, or in groups receiving infected contents in receptacles hermetically sealed for conveyance to such central depôts, writes as follows:—

1. "No hospital should discharge into public sewers. They [that is "infectious materials"] should be destroyed as regards possibility of reaching the community.

2. "If General Syngé can get his proposal adopted, it would answer this end *perfectly*."

He also states,—“For my own part I believe that, however it acts, charcoal in sufficiency disorganises every organic structure involved in it, and infecting organisms among the rest, and consequently do not see any need for keeping infected from innocent matter, *both being carbonised*.”

Writing on the same subject, Dr. Andrew Feargus, of Glasgow, whose scientific labours, both in research and publication, have contributed much to advance a more correct appreciation of the true merits of this question, states,—

1. That impurities from diseased patients produce like diseases, by tainting the air and water, and that decomposition increases this power very much.

2. That he holds all such matter injurious to health, if it is allowed to decompose.

3. That the present system of water carriage causes decomposition in the sewers.

4. That all matter of the kind referred to should be subjected to to chemical or other action, rendering decomposition impossible.

Lastly, he writes, “I have observed the carbon process for years, and highly approve of it, as it meets every sanitary requirement, inasmuch as it prevents the decomposition, and as both are subjected to a red heat, it follows that all germs of disease, and organic matter of every kind, must be thoroughly destroyed.”

Major-General Scott, than whom few have given more careful consideration to the subject, says,—

“The expediency of re-carbonization during the prevalence of disease cannot be questioned. The combustion would destroy all possibility of spreading infection.”

Going beyond the question of hospital application, General Scott, referring to localities limited by certain conditions, adds,—

“The material which Mr. Stanford has introduced, and his method of re-carbonization, . . . would contribute towards a scientific and economical solution.”

Upon this broader basis I take the following extract from the *Oldham Chronicle* of the 20th December last (1873):—

“Dr. Sutton (the health officer of the borough) reported that he accompanied the Chairman and Vice-Chairman (of the Sanitary Committee) to Glasgow, where they inspected the system of deodorization carried on. The report was exceedingly satisfactory.”

In another number of the same paper appears the following amusing, but at the same time instructive, comment:—

“At the close of the ordinary business the Committee entered upon a minute and interesting examination of several bottles of ‘inodorous’ [contents]. When the bottles were placed, the demand so common at this festive season to ‘hand a bottle round’ was urgently and persistently made, and one member of the Committee, in his admiration, described the affair as a grand Christmas treat.”

It is important to bear in mind, especially in connection with hospital treatment, that the medium which, so to speak, takes the infectious danger into custody and will not permit it to carry out its intended ravages, is in itself wholly inoffensive, perfectly inodorous and perfectly manageable, and as superior in the sick room to any other possible application, as it is in the prevention of farther contamination.

There are, therefore, clearly two rival agencies that may be resorted to in order to remove the impurities attaching to the sick room and hospital, from one locality to another. The one prevents the dissemination of infection and enables the germs of disease to be absolutely destroyed. By means of the other, on the contrary, nausea may be actively created throughout the whole range of hospital buildings, or of any other buildings or persons having unhappily to contend with personal or other sickness. Infection may, moreover, be spread over an indefinite area and by intangible means. Air and water may be corrupted beyond calculation and measure, by a pestilential and putrifying foulness, carrying with it everywhere the seeds of premature decay and death.

Let me sketch for you at somewhat greater length the action and characteristic marks of these contending forces.

I should scarcely need to remind you of the chemical constituents of water, were it not for their qualities being palpably either overlooked or set at utter defiance when its proper sphere of purification is neglected and it is thrust into that province of nature in which transmutation is indispensable before there can be restitution. By evaporation, the constituents of water are, as we are taught, perpetually ascending into the atmosphere, whence they are from time to time perceptibly, and, I believe, always more or less, precipitated. A very ready and effective means therefore of viciously impregnating the atmosphere, as well as water itself, is found in the pollution of water.

Substances hurrying to putrefaction when thrown into water neces-

sarily give rise to the formation of particular well-known offensive gases, which vary in malignity up to the point which is fatal to human life. The flow of water is irresistible and endless, excepting that of such portions as rise by direct evaporation or become transmuted by gradual absorption into, and are taken up by, mineral, vegetable, or animal life. Putrefying substances thrown into water *corrupt* it, and the flow of putrefaction is accordingly irresistible, and it is incurable, except by chemical agency.

In the one case we have therefore an agency offensive, and, but for an assumed (but an erroneously assumed) necessity, an intolerable agency introduced into the sick room, where it is difficult of application and disgusting in practice. It is improper chemically, and therefore very wrong in application. It immediately sets in increased action every ingredient that carries peril with it outside of the infected sick room. From the first moment of the unjustifiable admixture it becomes impossible altogether to arrest its action, or to say where or when the ill is ended or has been cured. Nor does the ingenious elaboration of mischief, artificially contrived, end here. The laws which matter obeys, are not lightly set at defiance, and their pacification is not easily effected. This one act of an originally thoughtless and wrongful admixture leads step by step to an all but irremediable condition. Human perversity has made this false step obligatory. Legal enactments, acting by virtue of the majesty of law, have singled out the area within which this wrongful course could work the most disastrous consequences, and instead of ordering that the voluntary putrefaction of water and the thereby debarring others from its application to its primary and proper purposes, should be punishable in conformity with law, these legal enactments have, on the contrary, *compelled* the corrupt abuse of water contrary to all law, and contrary to all science, whether chemical, economical, or moral.

I shall content myself upon this head with the words of Dr. Letheby, and only venture to add that the vengeance nature takes, does not confine itself to figures of arithmetic, although the ineffectual attempt to repurify the water wantonly and uncleanly corrupted in the United Kingdom would cost, I believe a sum that would seem to you utterly incredible.

But in this selfish and perverse misapplication of that which was given us to assuage thirst and in which to wash our bodies, our clothing, and our dwellings, we have not only deliberately and intentionally disregarded the cardinal rule of our duty to our neighbour, but we have installed in our homes and houses the confederate of cholera, of typhoid fever, and of all other forms of infectious disease. In populous localities we only open our windows to escape from the fœtid odours we have introduced into our houses, it may be to let in the breath of death, which we call ventilation. Moreover this misapplication of water proves as costly as untrustworthy. From the plumber's corroded or bursting pipe to the builder's drain failing in its level, it is an endless harassing of never effectual repairing. Lastly, the legal tyrannous enactment which forces their whimsical combinations of stupidity and deadly danger on us, finally mocks us with commands, first to corrupt the

water supplies of the kingdom, and then to keep them out of the channels of those waters.

Dr. Letheby only says too truly (we put a final question),—

“Whether the present system with the agency of water has not created more waste and greater sanitary danger and more expensive litigation than any other system which the ingenuity of man could have devised? Not forgetting that the water which is thus waste-fully and irreparably fouled amounts to from 20 to 30 gallons per head of the population daily, and has been brought at great cost from the purest sources, and perhaps filtered in the most careful manner. What other nation would have been guilty of such folly?”

If you should be inclined to think I have wandered too much aside from my immediate subject of the military and naval application and bearing of this flagrant abuse, let me venture to remind you that legislation for the metropolis not only might be supposed to embody the results of the most matured consideration and of the most decided approval, but in the case of England, the metropolis is the key and heart of all the empire, and its position in relation to the empire deserves fully as much consideration in a military, as in any other aspect. Besides, it furnishes me with the most striking illustration I could have brought before you of the consequences of that reprehensible act which, with the bigotry that seems inseparable from folly, has made compulsory within its limits, this foul misuse of water.

In an amusing, but extremely pertinent speech before the Philosophical Society of Glasgow, Mr. Stanford lately said, “The city of Glasgow was about to apply to the city of London for advice in sanitary matters. Before doing so, would it not be worth while to inquire what the city of London had done in the matter? The city of London drank the diluted sewage of about half-a-million of inhabitants who resided above her, and she was allowed to pour her sewage in one unpurified flood at the doors of her neighbours below her.”

Such are the characteristics, such the results of the one system. This is the result to which sanitary legislation has been led by contracted views, looking only to self, and so to being driven into all manner of acts carrying with them dire retribution. This it is to sink in moral sense so low as to pour the most revolting contamination possible into the drinking draught and washing portion of your neighbour. Vicious and unclean, ruinous and deadly.

The other agency, charcoal, is, in all respects, opposite to this. I have already briefly sketched its action, and need only remind you of the testimony already brought before you as to its purity and perfect sanitary attributes. As to its application in a sick room, it is unnecessary to add a single word to this assurance that, used in due quantity, it necessarily carries with it an entire absence of odour, is a complete absorbent, is (as we have been told), a safeguard against infection, and acts mechanically as a perfect carrier.

The first point, therefore, on which in summing up this portion of my subject I would here insist is—

That it is **WRONG** to remove the corrupting impurities in question by water, and this especially in the case of all hospitals, but most particularly so wherever infectious diseases occur.

Secondly. That it is **RIGHT** to provide for the use and application of charcoal in all such cases, whereby, first, cleanliness, comfort, and purification are given in the sick room, or ward, or bay; and whereby the spread of infection is guarded against, and all possibility of the same may be destroyed by the agency of fire, a matter of vital importance to all, inasmuch as, unfortunately, none of us carries with him an immunity from suffering, infection, or death.

I shall scarcely need, I think, after the very conclusive evidence, as it appears to me that I have been enabled to bring before you, to dwell at very great length on that which seems to follow irresistibly, viz., that that which is incontestibly best for all cases of sickness, carries with it a strong presumption of universal superiority. The case is palpably not quite so strong or so imperative either in merit or demerit in general practice as in special disease; but after all, possibly, quantity in this case may fully compensate for any diminution in intensity.

For my own part, I should prefer to put the matter on its true footing, and to let it rest on that. I believe it incontestibly wrong, wantonly and selfishly to corrupt one of the indispensable sustainers of human life. I say we may not, and **WE SHOULD NOT DARE** to pass on our defilement to mingle with our neighbour's drink, nor with the means of his personal ablution. And with the manifest proof of the wrong, the evil ought to cease.

Western nations—and our own, I fear, is no exception—pay, however scant regard to man's primary obligations, be they never so fastidious, as to philosophical or metaphysical crotchets, or philanthropists of that fashion I have heard defined as *men* so busy about people's faults they quite forget their own. At all events, within the metropolitan area, military hospitals and barracks are alike compelled to spread pollution in this matter, and I cannot, therefore, well omit the subject, and I must now bring before you the broader of the grounds for abandoning a course which, I have no hesitation in saying, were it not in actual constant practice among us, would better entitle its advocate to a place of punishment than to admission among men capable of distinguishing between right and wrong.

Are you disposed to believe that I exaggerate, being led away by concentrated attention to a particular subject? If so, let me pray you picture the position I should stand in before you if, instead of pleading the cause of neighbourly consideration, I had to argue in behalf of the practice that obtains. How could I reply to such questions as the following?

You propose, then, to put a corrupting substance into water?—I do. You know that will disengage dangerous gases?—I do. You know these are corrosive enough to eat through lead?—I do. You propose to make an inlet for these gases in every dwelling?—No, a great many more than one. You shall not open a window without a chance of such an inlet, and you shall not lay a floor, nor build a wall without a chance of the kind.

You propose pouring in one concentrated flood all infectious matter into these common and communicating receptacles?—I do. You then propose to pass on the foetid air pestilence-breeding contents into the rivers to mingle it may be with the drink and washing portion of your neighbours?—I propose making this absolutely certain. Can you form any estimate of the expense of the course you propose?—Yes, tolerably; I should get rid of a gross value of about £15,000,000 per annum on the population of the United Kingdom, and it would cost me not much more than a capital outlay of £1,320,000,000 to do so effectually all over the kingdom. Does this include any provision for re-purifying the water you corrupt, or do you know of any effective means for effecting such re-purification?—As to the first part of your question, certainly not; as to the latter, there are chemical means of re-purification, but they involve such an outlay as would ultimately ruin anybody resorting to them. Then you propose, first, an act of indecency and neighbourly disregard, in reality, therefore, an act of personal uncleanness, an act chemically vicious as well as dangerous to health, and ruinously extravagant in itself, besides its waste of a material renovant in nature.—All this I do propose. Does not an act of such extreme disregard of neighbourly duty approach to an act of indecency and uncleanness?—That is for you to say.

Have I overdrawn this picture? Not by intention, certainly. The course I have after all inadequately described, forms the scope and operation of one of the most popular panaceæ, namely, an act of compulsory legislation, an act of the Parliament of the 19th century.

The *Times*, ever vigorous in counselling compulsion and Government interference, wrote, in apprehension of an outbreak of cholera:—

"In the first place, the destruction of the infectious matter from cholera patients must be insisted on under the heaviest penalties, and a system of inspection adequate to enforce this provision must be organised. Without these preliminary safeguards we cannot hope to resist the enemy with any success. So long as the germs of the disease are allowed to pass through the sewers into the rivers, to be washed up by the tide against our seaside villages, to be wafted about our streets in the form of an impalpable dust, we cannot hope for any good results from sanitary measures of the ordinary kind. Cleanliness, ventilation—above all a pure water supply, are advantages which cannot be over-valued. But until the germs of disease are systematically destroyed and excluded from any chance of mingling with the air we breathe and the water we drink, nothing will control the ravages of cholera. Every other precaution is subordinate to the main preventive measure, which it will need special powers to carry into effect—the destruction of the cholera germs before their diffusion."

Perfectly true of the whole subject; but the childish feebleness, the aged impotence or mental imbecility that can see no remedy except in perpetual recommendations of penal or compulsory legislation, are possibly more to be deprecated than even death from preventible disease. They are the pallor and paralysis of the soul and spirit.

The cure, once for all, of many errors would be never to interfere by

legal enactment positive, but to adhere to negatives. Sanitary law would then be simply,—You may *not* pour corrupted water into rivers. You may *not* release destructive gases into the atmosphere. It would abstain from first compelling the corruption to be set up.

I base all proposals for dealing with the scientific substitution of a proper vehicle to take the place of water on Mr. Stanford's dictum, which I hold to be correct, viz., "We ought to seek a disinfectant which will add as little as possible to bulk," and I should myself add to weight. In other words we should endeavour to reverse the course we have pursued. In lieu of adding liquid to what liquid causes to putrify, we should endeavour to solidify by drying and imprisoning foul substances. A very preponderating and by far the most troublesome portion of human waste is not in a dry condition. Therefore whilst in charcoal there is an agent of indisputably perfect efficacy, the efficacy of that agent is increased as well as made more and more available the more the drying process is favoured and accelerated. The application of charcoal to liquids may be of two kinds, either by sufficiency in quantity to absorb, when it practically is made to act something like a mop, or the liquid may be strained through charcoal, or a combination of charcoal with other suitable chemical or mechanical agents, until a degree of purity is attained that renders the liquid flowing off harmless.

In the abstract, and from an exclusively sanitary point of view, the former is, I presume, incontestibly superior; but in practice, the latter may prove so thoroughly adequate to most, if not to all occasions, as to render it preferable on account of its far greater convenience and economy.

That such a mode exists I am confidently led to believe, and I have no doubt the full merits of the subject in this aspect will in due time be brought forward by Major-General Scott—to whom I have had already to refer—the discoverer of this valuable mode of assisting the great principle of abstaining from water abuse.

My object, however, in mentioning this double mode at the present time, is to show that we are in possession of more than one method by which a perfect sanitary result may be ensured. The *Pall Mall Gazette* of the 27th January, 1874, writes as follows on the sanitary value of the agency of fire in the prevention of contagion and disease:—

"The 'cremation' of our own remains is not a matter of more importance than the cremation of the less romantic refuse which chokes the dust-bins of our houses. Here at least there can be no sentiment to interfere with the annihilation of rubbish injurious to health, and any one who suggests an effectual plan for reducing it to harmless atoms will deserve well of his country, and rank among its benefactors. It is a mistake to suppose that the injurious effects of the accumulated rubbish of our houses cease when the dust-bin is emptied, and the dust contractor has at last kindly consented to perform the service for which he is paid. The dust thus carted away returns to us in another shape. Dr. Corner, the medical officer of Mile-end Old Town, in his recent report on the condition of the dwellings of the poor in the district under his charge, points out the

"intimate relation between houses and the health of their occupants, and calls attention to the well-known fact that the contents of dust-bins are mostly used in the manufacture of bricks, &c. If these contents were composed of ashes only, no danger need be feared, but it is, says Dr. Corner, a question whether the baking process always destroys any deleterious ingredients. The truth is that little else but ashes should be placed in dust-bins; all other refuse capable of 'cremation' should be at once destroyed by fire. In the meantime there is a class of rubbish, such as the old materials from fever dens, which ought beyond question to be immediately burned. Under present arrangements these materials may, observes Dr. Corner, be used with impunity in the erection of new houses; and 'thus ensure 'an early outbreak of fever.'"

Compelled as I am by limits of time wholly to pass by many interesting points connected with this subject, and to touch on others only very lightly, I will conclude with a very brief summary of the mode in which charcoal has been applied, in order first to prevent contagion; and, secondly, to destroy, by the combustion of the germs, the possibility of contagion spreading.

Mr. Stanford, to whom we are indebted for this discovery, says:—

"I employ, by preference, seaweed charcoal, because it is the most porous, the best absorbent, and the cheapest. It only requires one-fourth of the weight, compared to earth, and when the mixture is removed and placed under cover, it soon dries." This mixture can be stored for any length of time and used again several times. When convenient it is re-burned, like the char in sugar refineries, except that this process is carried out in apparatus which admits of collecting the ammonia and other products condensed. The whole of the ammonia is thus collected; whilst the phosphoric acid, potash and mineral matters accumulate in the charcoal, together with the carbon from the organic constituents of the excreta. The weight of the charcoal is increased to the extent of about 5 per cent. with each using, and if dried and re-used five times, about 25 per cent. with each re-burning. With this constant addition, the char does not require replacing with fresh material, so that its cost is only a primary outlay—the ultimate result being that the excreta is deodorised by a charcoal derived from itself, and a company working this process would, in addition to securing the whole of the ammonia, become sellers of a charcoal second only in value to that from bones to the extent of, in Glasgow, if the process were general, 19 tons a-day, or 6,935 tons a-year, the total quantity of excreta which Glasgow has to remove being 385 tons a-day, and its value at £1 9s. 6d. per ton equals £569 (value given in my former paper). The ultimate result being the same, any charcoal may be used at first. The process is carried out without odour, from the closets to the finished products. Of course the process may be modified; for instance, suppose the char to be used five times, and only dried, the addition to its value would be as follows (I take equal parts, as this charcoal will absorb at least an equal weight of even urine):—

1 ton seaweed char at £2 = 30 cwt. manure at £9 7s. 6d.
 5 tons excreta at £1 9s. 6d. = £6 5s. per ton.

Or, if re-burnt, it would yield 25 cwts. of charcoal, and the whole of the nitrogen would pass over in the distillation as ammonia. Dr. Wallace estimates the cost of re-burning char in sugar refineries at 3s. 6d. per ton for labour and fuel, containing 31 per cent. moisture, which would be much over that referred to. Here, then, we have a simple process for recovering the whole of the value from excreta, of general application, and the results of which can be predicted by chemists with absolute certainty, as far as those products to which we at present attach value are concerned.

Mr. Stanford goes on to say that the uncertain portion is, as usual, the most interesting, for in it we are exploring a new field, which promises great interest.

I have brought the subject forward here as of great interest, especially in relation to hospitals and foreign stations.

The CHAIRMAN: We shall be happy to hear any remarks that gentlemen may feel inclined to offer on this question. No doubt a large amount of time would be required to solve the difficult question of the disposal of sewage, and the man who does so, will be a benefactor to his race; but I am sure everybody here must feel that this, as a sanitary question, is one of very great and very vast importance. The problem to be solved is, how is this sewage gas, that is supposed to be contaminating our rivers and our houses, to be rendered perfectly innocuous? Charcoal, in some form, is named as the panacea. The question is—how is it to be done? I do not know whether anybody here has devoted any time or attention to the subject; if they have, probably they will be kind enough to favour us with their observations. For my own part, I cannot see any practical solution of it.

Colonel ALCOCK: As you have been kind enough to invite anybody to express an opinion, I should like to be allowed to say that I think the subject of this lecture exceedingly well chosen at the present time, because it is very probable that some sanitary legislation will be required during the present session. There is much importance not only in what scientific men may bring forward, but also in what practical men may have to state; and any discussion which arises will be of the greatest possible advantage, as throwing considerable light upon matters which are probably but little understood. It is quite clear that we are on the threshold of great changes, for science has proved their necessity, while melancholy occurrences in very many families have forced their consideration upon the attention of the public. Still, you have to overcome fixed routine and established habit; you have to overcome prejudice and certain rules—and that is very difficult to effect. Some time ago, I was at a Poor Law Union, and had the curiosity to ask what were their sanitary arrangements; and the person who was kind enough to show me over the building, told me that as at night, after the doors were shut, the bad air that came through the sewers into the building was perfectly intolerable, it was decided to try some experiments. The first thing they did was to put a stop to this, and the immediate effect was that they had pure air in the hospital. The sewage had passed into the harbour. In order to remedy this, they introduced experimentally three different systems. There may be more, but there are three well-known systems of what is called the dry process. Up to that date they had been polluting the water and rendering the air of the hospital intolerably impure, and at the same time paying £30 a-year for manure, which they now provide from the premises.

I know also another instance, which I happened to see in print. A lecture having been given upon some sanitary subjects, a poor woman who was present, said, "I have lost eight children; but if I had ever known before what I have heard this day, I do not think I should have lost one."

A good deal has been said about the Small-pox Hospital at Hampstead; and the

objection that it would bring the disease into the neighbourhood, was looked upon almost as frivolous; but it did do so, and the reason why it did so was that there was a communication through the public sewer between a great number of houses and the hospital, and small-pox broke out in that neighbourhood. I think that instance was very conclusive. I do not, of course, go into these subjects with any pretension to scientific knowledge upon them; but I have ventured to mention these matters that have come under my notice, in the hopes that some other gentleman will be kind enough to follow my example, and that with the chemical and medical knowledge which I do not possess.

Mr. RAWLINSON, C.B.: I received an invitation to come here, I suppose because it was thought that by listening I might learn something useful; but I have learned nothing practical. I do not think I ever heard more fallacies crowded into the same space of time. I wish to speak with all respect of General Syngé; I cannot, nevertheless, refrain from coming to that conclusion. I will, however, try to show him why his propositions are fallacies. If the public health is to depend on the abolition of sewers and drains, it will be a very remote period before we shall do that. I will refer General Syngé to the reports issued by the "RIVERS' POLLUTION COMMISSION," and he will there see that which, if he continues of the same mind, must drive him to utter despair, because if London were treated by his charcoal process in the most perfect manner that he himself could wish or devise, the sewage of London would be rendered very little better than at present. Surely he must have looked at this subject from one side only, and I am quite aware that there are two sides to every question. The story of the shield is very old and very true. I probably may have been looking at it from the opposite side; but, taking the thing generally, what you require for health is to remove swiftly, easily, and cheaply the effete matter of the population, of all kinds, not of one kind alone. Everything that is done with, which has become waste material, must be removed. Many of our towns which have refrained to adopt sewers which the General seems to dread, and which he calls the "water system," have tried the dry system. Many of the Lancashire and Yorkshire towns have endeavoured to apply some such system as General Syngé seems to recommend, namely that of having hand movable apparatus—charcoal, the General prefers. In those towns where latrines, privies, and movable boxes are used, there is the highest rate of mortality, the greatest amount of labour, and the greatest possible expense. With regard to the water system, the mortality returns show that where you have a complete system of sewers, drains, and water-closets, you have the lowest rate of mortality. Those facts being put together, should convince you that there is not altogether the evil in using water that we have been told there is, and that there are many advantages which I could detail which are not to be obtained by the dry movable box methods. Take any dry system that has ever been invented, and you necessarily multiply the manipulations in every household in placing and again in removing the apparatus and the material in and out. I would ask any gentleman in this room, if the law were altered, and he were compelled to take the water-closets out of his house, and only to use the sewers and drains for removing slop water, and were to use the best devised earth closet or charcoal closet that could be brought him, how long would his servants stop with him? How many more servants must he have to do that necessary work? And if the cart did not wait upon him with punctuality—and we who live in London, and have dry matter to be removed, know that these men do not wait upon you with punctuality—what sort of difficulty would he be in? Then, as to the danger of contagion from evaporation, I think that the General, who has spoken several times about the laws of nature, if he had studied them a little more closely, would find that impure water being evaporated, does not give off its impurity to the extent he anticipates. What is the great purifier of water on this globe? The ocean. What is the ocean? Salt water. What comes from the evaporation of the ocean water? The purest water we know; the ocean is, in fact, the only source of pure water. Now I, as a Government Commissioner, have had to investigate this question with regard to the Rivers' Pollution, and I am not here for one moment to advocate pollution of any kind—especially river pollution; but when I tell General Syngé that that case has been investigated not only in gross, but in detail, that house to house investigation has been made on the margins of the foulest rivers in England—far fouler than the Thames ever was

at its foulest—and that these districts having been thoroughly examined, it has been found that the charge cannot be brought home to them of creating disease in excess. There have been many investigations made in districts in Lancashire and Yorkshire where rivers exist which are positively as black as ink and as stinking as fluids can be, and yet the houses bordering those rivers and in the district, have had a less rate of mortality than houses situated further away, where they happen to be more crowded together, and the cesspool matter is confined behind them. I have, therefore, been compelled to come to this conclusion—that if you pass fresh closet refuse into water that is flowing in not less than ten times its volume of fresh water, you have done with it as an injurious agent. If, however, you stagnate it, either in tanks, in cesspools, or in any places where the sediment remains as a coating upon the surface, you may create disease; but let that polluted water continue in motion, as in a well-constructed sewer, and it goes to any point you like, without causing injury on the way, and you can manipulate the whole at the outlet or outlets. In discussing the sewerage question, do remember that this metropolis is the largest city in the world that is purely and entirely a water-closet city. There are upwards of 700,000 soil-pans and water-closets in this great metropolis, or about one to every 5½ people, all draining into the sewers of London. Those sewers go down and empty themselves into the Thames at Barking and at Crossness, which I say they should not do; but however they do empty into the Thames at those points, and, at this moment, London stands at the head of all the cities of the world in relation to its public health, and yet look at it in its population! Go into its denser parts—go into its old lanes and alleys, where there are houses six and seven storeys high, and the width between them is not much more than the length of my umbrella, every floor being tenanted, crowded from top to bottom, where life has the least possible value, where health has the least possible chance, inhabited by gin-drinkers and foul livers of all kinds, and, notwithstanding, averaging these with the general population, you have a rate of mortality varying from 22 to 25 and 26 per thousand, when in other large towns, even in England, it ranges from 30 to 35 and 40, and, on the continent you get it even higher. I do say, when you are dealing with a sewered and water-closeted city, and you find such results, how can the charge be justly brought against the system that it is destroying life wholesale? and how can you with truth make the charge that the persons who devised it were all insane, and that you ought to turn to something that is absolutely unknown? I have been obliged to investigate these questions both individually and officially, and have gone through asylums and public buildings where they have introduced the dry earth to supersede water-closets. So long as there is a person enthusiastically looking after them, determined to carry out the pet system, he makes it answer; but let him make a debtor and creditor account of the trouble and cost, and let him debit the labour with anything like its value, and you will see that the so-called dry closet cost is 10 to 1 that of the water-closets with sewers and drains. I do not wish to speak with any disrespect of any paper read in this place—it would ill become me—I only wish to put such information before you as I have; and I am very sorry that the paper is not one that I can accept.

Surgeon-General GORDON, M.D., C.B.: I am glad to find that doctors are not alone those who differ. The remarks I shall presume to offer will be confined chiefly, to the subject as it bears directly upon soldiers and barracks. It strikes me that we have not yet quite arrived at that state of knowledge when we can bring forward our opinions as definite either one way or another. It seems to me, from the remarks we have listened to, that there are equally strong grounds to be brought forward in support of the one argument as the other, and the only conclusion that we are justified in drawing from that is, that there is much room still for investigation. General Synge, in commencing his remarks, made various allusions to the influence of infection with regard to hospitals and barracks. Every one who is accustomed to go among such buildings knows very well that once infection enters them it becomes too late to apply what are commonly called disinfectants. The combination and arrangements of a barrack or hospital ought to be such as to prevent as far as possible the introduction of such an influence, I may observe, especially in hospitals; and, as General Synge included hospitals in his remarks, I hope I am in

order in alluding to them. There are special kinds of infection, which, introduced once into hospitals, render those hospitals for the time, and for long afterwards, utterly uninhabitable. During the late great war on the Continent several instances of this took place, and not only in hospitals built of stone and lime, but in the more temporary kinds, including huts and tents. It became well known then by very sad experience, that when once pyæmia declared itself among the wounded, the use of disinfectants had not the slightest power in moderating or stopping it. The only thing was to vacate the establishment, and not only that, but instances have occurred in which, after the establishments had been so vacated, they had been submitted to fumigation, to cleansing in every possible method, and at the end of three months, fresh wounded being introduced into them, the pyæmia burst out again as if the places had never been vacated. The purport of my remarks is to vindicate the necessity for so arranging buildings as to prevent, as far as possible, an evil which, when once it has broken out, cannot be removed. The next remark I would make is with reference to charcoal. There are, of course, three kinds of infection to be guarded against. There is an infection that is communicable by water; there is an infection which is communicable by air; and there is an infection which is communicable both by air and by water. In India for many years, under the orders of the Government, the use of charcoal has been authorised in barracks, in hospitals, in latrines and washhouses, and the various other buildings occupied by troops. That is with reference to the infection conveyed by air, and there is every reason to believe from the Reports that the existence of the charcoal in these places has been followed by very good results. I find, however, by experiments that have been performed by some of the Continental medical men, there is very great reason to doubt whether charcoal is capable of destroying infection in water. There are certain kinds of infection which seem to resist its influence, more especially that which gives rise to typhoid fever, dysentery, to cholera, and also, it is believed, to intermittent and more severe kinds of remittent fever. However, that is one of the questions that are as yet, so far as my knowledge goes, undefined; at the same time doubts have been very strongly expressed with regard to it. With regard to the remarks on cholera, it is to be observed that in India, where cholera prevails to a very sad extent, one of the regulations laid down in regard to it is, that all excretions, all liquids coming from the person of the infected, should in the first instance be disinfected by a particular process, partly by permanganate of potash, partly by other disinfectants in common use, and that then they should be specially buried in such a manner as, if possible, to prevent any evil effects arising from them and being communicated to the troops. I may also observe during the siege of Paris the practice was adopted of similarly collecting and destroying, after being disinfected, all the clothing, the dressings, the secretions and excretions, of the wounded in the hospitals. But, again recurring to what I said of pyæmia, so little effect had all these remedies, that in some large ambulances—as, for instance, that of the Grand Hôtel—so fearfully offensive and powerful became the odour from pyæmia and from other hospital diseases that were prevailing, that during the time it was occupied towards the latter part of the siege, the odours were perfectly perceptible to those who walked along the Boulevards on the one side, and the street near the New Opera on the other. It illustrates how extremely powerful the infection is when once it becomes introduced, of whatever kind. With reference to the dry earth, it strikes me that dry earth conservancy can only be applied under certain conditions. For example, it requires an immense quantity of earth when employed for a large number of people. That earth has to be got somewhere, and it becomes a very serious question how it is to be disposed of, and there is reason to doubt whether, even when practised with the utmost care, it is really efficient. We know that the practice of the dry earth system is no new discovery. If we refer to the days of Moses, we find it was followed out in his camps. Various experiments on the subject were made in India, and it was found that, however carefully mixed, and however long it might remain, when spread afterwards upon the ground, and when the rains and the elements worked their effect upon it, then it became offensive to the senses. In China also, where it has been practised from time immemorial, the same thing occurs; the fields, as any person who has been in China knows, where this is used, are extremely offensive. Those who have studied the matter believe thoroughly that diseases such as typhoid

fever and dysentery are very liable to be spread by it in both conditions. When it is dry their germs are spread abroad by the winds, and when it is wet, they are spread in a liquid condition.

Colonel MURRAY, Commanding R.E. Officer, Home District: I came here very much like my friend, Mr. Rawlinson, with a view of learning something; because, with regard to the conservancy of barracks, I suppose that if anybody has got a new system of conservancy which is practicable, and can be carried out at any moderate expense, there never was a time in our country which presented a finer opportunity for it than the present. The new localisation scheme involves the erection of a great many new barracks. There are 26 new barracks to be built in England. I have four or five to build, and at hardly one of them is there the slightest facility for drainage of any kind. I am at my wits' end, and can only say I shall be most happy if anybody will give me in detail a scheme which will meet with the approval of the authorities. I came here, I say, with a view of learning something, and I candidly own I have learnt nothing. I have heard general theories propounded that it is very wrong to pollute water. I dare say it is, but how am I to wash without polluting water? How am I to carry on domestic household duties without polluting water? We cannot wash in charcoal. You must show me what I am to do with the water when it is polluted, because I find that is the great difficulty. I have had a good deal of experience in building barracks at Aldershot, and I saw a good deal of the drainage. We polluted the river; it was a very nice little trout stream before we came here, and I had the whole country down on my back. Not that I did it; the drainage of the camp was carried out by a very eminent civil engineer. Lord Panmure had a very bad opinion of military engineers, and he entrusted this work to Mr. Simpson. He did not know what to do with his dirty water. He knew what he could do with the clean water, and he put down two systems of drainage, a clean system and a foul system. He discharged the clean water into the Blackwater, and his foul water drainage into some pits. He trusted to Providence to get rid of it—he hoped it would soak away. It required a 10-horse power steam-engine to pump the water out of this place, where these tanks were made. The result was the place became a large fetid swamp; you could not go in summer time within a mile of it. In perfect despair I cut a grip, and let it out into the Blackwater. I could not help it. Even before that was done, what had been intended as fresh water drainage was very nearly as stinking as the foul, in fact I do not think you could have told the difference. This was very remarkable, because in these days there was not a single water-closet in the whole camp; there was not a water-closet to any Officer's but a General's hut; the whole system of conservancy was a dry one. We were at that time paying £1,200 a year for carrying away the whole of the contents of the latrines to a man who came and sprinkled them every day with charcoal. They were all received in wrought-iron tanks, which were over the ground; notwithstanding this, nothing could be more offensive than the water which was discharged from the camps at Aldershot. I was there five years, and saw it myself, and I do not believe that the difference of adding the water of the latrines to the sewage has made any appreciable difference in the noxiousness of the effluent water. The only system that I have heard of at all approaching what we want is the sewage irrigation scheme. As far as I can see, you must in a barrack have an outlet for your liquid refuse. It might be all absorbed by charcoal, but I should imagine that the cost would be very great, and that it would be totally impracticable to carry it out. A man takes a bath in a hospital, and pollutes 70 or 80 gallons of water. What is to be done with it? Will charcoal restore it, or enable it to be carried away without polluting the streams of the neighbourhood? That is the question. As far as our present knowledge goes, we must have an outlet for liquid refuse, and the best way of disposing of that liquid refuse is by sewage irrigation. If you adopt a dry system for your latrines you deprive your liquid sewage matter of its most valuable constituent as applied to the land, and you also incur a double expense. Therefore, in any place where you can dispose of your sewage by irrigation on to the land, it is much better to mix it, and let the latrines go with it; it is much less costly, and it also improves the value of the land irrigated. There is another great difficulty with regard to the dry earth system as applied to barracks. I do not at all find fault with the regulations laid down by our

medical Officers, and carried out by the Control Department. We have had a great many barracks, and notably in Ireland, where the dry earth system has been adopted for the latrines. It certainly is a fact that up to the present day the rivers in Ireland have been preserved with much greater purity than any of our rivers in England. Their manufactures certainly are not so extensive, but even with regard to the ordinary sewage of towns, I do not exactly know how they manage it, but during my charge of the barracks I found that we had more complaints from Ireland if we attempted in the slightest degree to pollute the water than we had anywhere else, and they have thus managed to keep their rivers tolerably pure. We have had the dry earth system also in operation at the cavalry barracks at Brighton, and it answers tolerably well. The regulation I refer to, as laid down by the medical Officers, is that the earth shall not be used more than once; it must be immediately removed out of the barrack after once being used. That is a capital regulation, as far as regards health, but a very bad one as far as regards finance, because that earth has little or no value as a manure, it is absolutely worthless; you must use the earth, and you can re-use it six times at least before you can make it of any commercial value as a manure. This is a subject to which I gave a great deal of attention during the five years I was at the War Office, and had charge of all the barracks. There were subjects daily coming before me, and this was one of the most perplexing with which we had to deal. I cannot help thinking that we have made very considerable improvements over the barracks that I can remember thirty years ago. It is a subject which is not only found to be of very great difficulty in England, but also abroad. I remember several distinguished German princes coming to Aldershot, and there was scarcely anything in the barracks that they cared to see but the latrines. It was—"Show me your latrines. How do you get over this difficulty?" from which I gather that others are still coming to us for instruction, and we are not behindhand, as far as the age is concerned, generally speaking, in our conservancy in barracks. I for one shall be very thankful if any one can give, not these general theories, but a plan in detail which may be applied in practice, showing how sewers can be abolished and how we can get on without them at a moderate expense. If such a plan, and one which the authorities will accept, can be produced, I shall be delighted to give every assistance in my power to facilitate its adoption.

MR. RAWLINSON: There are two systems in operation at Aldershot; you have the "Goux" system and the irrigation system. As far as the authorities are concerned, they have been satisfied with the Goux system; but the proprietor told me himself that he had entered into an arrangement with the War Office that he could not abide by; that is to say, he undertook to remove the material without it costing the Department anything, but he had been losing money by it.*

GENERAL SYNGE: At one time, I was almost afraid that the purpose and hope of a discussion would fail, and I felt, like my countryman, I wanted very much indeed to have some one tread on the tail of my coat, when Mr. Rawlinson was kind enough to do it, in what he conceives a very effectual manner indeed. I think the remarks sum themselves up very much into this—that I have only generalised, and not particularised; and that I have advanced a tissue of fallacies, to put it mildly, in almost every statement I have made. I did not intend to speak upon the sewage question. I purposely avoided every expression of the sort; and I did not intend to bring up the general question, not deeming this the place in which it should be discussed. It put me in mind that a good many years ago, when I was a very young man, and had the honour to lecture at the Geographical Society upon a pet subject of my own, about the opening of the Atlantic and Pacific Railway, it was immediately met with, "Oh, you are attacking the Hudson's Bay Company!" And so it was impossible to open up this subject, without bringing up the everlasting irrigation scheme. I shall not reply to that question at all; it is a totally distinct subject from the one I have the pleasure of bringing before you. I have

* General Syngo said that fire would alone destroy the germs of disease; but an ordinary fire will not do this. Experiments have shown that a considerable percentage of gases passed into and through a furnace fire, escaped unconsumed up the chimney and into the open air. The powder in a gun-chamber is never all exploded, so that fire must be relied upon with some reservations.

endeavoured purposely and carefully to abstain from seeming to be the advocate of any particular mode of dealing with any particular thing. I do not admire making scientific Associations the advertising mediums of commercial adventure. There are places and times in which it is quite appropriate to go into these details. Therefore, I endeavoured to ground my work first of all on what I considered an immovable basis—that law of creation which Mr. Rawlinson good-humouredly twitted me for referring to.

The first broad statement I make, then, which he would call a fallacy, is, that the agency of fire destroys the germs of infection. You are capable of judging for yourselves whether that is a fact or a fallacy. The next statement I make is, that water spreads those germs of disease. You are capable of judging for yourselves whether that is a fact or a fallacy. I go a step further, and I say that the most ingenious contrivance for spreading germs of disease is found in making water the vehicle by which you distribute them. I go a step further, and I say that the most pernicious application of that dissemination that you can hit upon is letting the emanations into your houses. I go one step further, and I say that the most mischievous application of that admission that you can make is to let them in in diluted quantity into your bed-rooms, and I am perfectly convinced, by the evidence obtainable to us all, that there is a good deal of matter for grave reflection in the fact that Dr. Gordon brought so well before us that the very grossest accumulations of dangerous matter left an unappreciable amount of direct injury, and that you could not trace the effects of this matter to any particular cause. That, however, is going into medical ground that I am not competent to speak upon, and I should then have to argue *Homœopathy versus Allopathy*. I had a dog of my own poisoned, and and he ate so much of the poison, and so greedily, that he was not any the worse for it. My little pet dog was poisoned at the same time, and, being a very dainty feeder, died of it. I can just as well reason from that that there was no deleterious substances in the poison. There are distinct occurrences from which it does not do to generalise, but there are other principles that never vary, on which you may safely build, and I have endeavoured to distinguish between those two. Following the statements I have advanced, I shall content myself by leaving the decision in your hands, not to be given in my favour, or against me, but for you to form your own judgments as to whether it is true that fire is an instrument that is destructive of the germs of disease, and that water is a disseminator of them. I do not know whether you would wait to reflect much upon whether heat or cold are the most desirable things to surround yourselves with in this climate, but that was another thing. I ventured to say that it was more desirable to have our dwellings underlaid, with means of warming them, than with the means of wetting them, and letting in bad smells.

Mr. Rawlinson said, if you could only go on fouling water for ever, it would flow on, finding its own legs and arms and wings, and so on, and would never injure you. Unfortunately, there is a limit to the globe, and I do not know how water is to go on for ever, nor am I aware how water on a low level is to flow on to a higher one without artificial aid. I avoid entering in detail into all these things. I do not know that the chief point that I advanced before you has been at all touched—the propriety of dealing with infected matter in hospitals by the agency of fire. And I also say that there is a vehicle, not resting on my testimony, resting on actual experience, resting on the testimony of medical officers in official situations, that it is a perfect carrier—I started with that. The gentlemen who have been kind enough to come here and have learned nothing, were no doubt aware of these facts before; but they have not particularly called your attention to the circumstance that there is the strongest possible testimony of medical men in the city of Glasgow that it is there found to be an efficacious arrangement. That was not an arrangement—I happen to know the particulars—sought by any particular agency; it was sought by the town itself, and was pressed upon an agency working there, and the separation that Dr. Gordon has pointed out should be universal in all military hospitals between infectious and other cases, is there an actual fact. It is in the Small Pox Hospital that this charcoal application is made; it is also in the Convalescent Hospital; and seeing it with my own eyes, being thoroughly convinced of its perfect efficacy and extreme cleanliness and suitability, I was struck with this, and wished

it to be extended to other hospitals, and in fact it is from that visit I may probably date whatever I have had the opportunity of bringing before you now.

Colonel Murray dwelt strongly upon the impossibility of not polluting water. Water was given first for drinking and next for washing, and you cannot wash, as he justly said, without polluting. But he did not sufficiently dwell upon the distinction between *corruption* and *pollution*. The *corruption* of water I hold to be unpardonable, and its *pollution* inevitable; by the corruption of water I mean putting into it matter that makes the water itself putrescent—putting it in unnecessarily. There are accidents that might happen. For instance, that you can corrupt water by other agencies than the particular one that has been so largely brought forward, I suppose is a thing no one would attempt to deny; but that you should increase your difficulties wantonly is quite another thing, and that you cannot deal with them in detail is an unproven thing. I do not think I should be justified in saying it is a proved thing that you can, but I can prove, if I may trespass not much more than two or three minutes more upon your time, that there is not the difficulty in the matter that may be supposed. We are dealing with hospitals, barracks, and so on; the incidents to them are pretty much the same as in ordinary life. The solid outcome from the human body can be dealt with very satisfactorily as far as that is concerned. The liquid portion of that outcome can also be treated by separation in a manner that is feasible and not very complicated. I need not dwell upon the details of doing that, because it is incidental to the charcoal treatment. I do not dwell upon the objections made to dry earth, because I did not at all speak about it; it is a thing I condemn myself under all except some very exceptional circumstances. I believe it to be the best thing for movable camps, but to bring it forward as a thing that would act from the basis on which I have placed it, that of destroying disease, I hold to be utterly untenable.

You next come to kitchen waters, which are very offensive, but you can strain them through a medium until it deprives them of offence and leaves them to go off in a pure form. I believe a great many persons who think water carriage is necessary, imagine we want to turn all the water into charcoal, and, as Colonel Murray says, want to wash in it. It is not that; it is to deliver the water in an innocuous condition, and this can be obtained by filtration, either mechanical or other, and the water passes off harmless and pure. That would be a matter which others may deny, but as it is capable of demonstration, I shall not reason about it—you can set it up and see whether it can or cannot. But I do not think there is anything necessarily in the character of a fallacy in saying that if you separate the ingredients of house or barrack life in this way, that you find the difficulty disappears. So eminent an authority as Sir John Hawksley has expressed what is tantamount to the same opinion. He has stated broadly the converse of it—that what you can do in detail you cannot do in bulk. You cannot apply to a population of 5,000,000 what may do for 1,000. Kitchen water is most offensive and troublesome, but by intermittent filtration it can be purified. It is a thing that can be tried. It requires two tanks only, put side by side in the kitchen; cover them with a tray of charcoal, pour your contents through this charcoal, let it go through the first receiver, and then, by an intermittent syphon action, let it run off. I know it has been done for a year under my own cognizance, and that it answers perfectly. Washing-water and scrubbing-water is a mere question of mechanical filtration, and therefore the difficulty disappears there also.

I have the satisfaction of not pleading for anything that I have found out myself. I cannot, therefore, be misled by self-love; it is only that the weight of evidence to my mind inclines in this direction. I am, therefore, glad to have had the opportunity of bringing it forward here, and hope that as much weight as may be deserved may be attached to the difficulties that have been pointed out to be in the way of the adoption of this system, and also to those facts which Mr. Rawlinson has pointed out as fallacies, of which I leave you to judge whether they are facts or fallacies.

The CHAIRMAN: I am sure you will all return your thanks to General Synge for his lecture, although he may not have shown that there is a great deal in the subject. We certainly owe him our thanks for the trouble he has taken in coming here.