THE

THIRTEENTH ANNUAL MEETING

OF THE

ASSOCIATION OF EXECUTIVE HEALTH OFFICERS OF ONTARIO

HELD AT THE

CITY OF OTTAWA,

ON THE

26TH OF SEPTEMBER, 1898.

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MINUTES OF MEETING.

The Thirteenth Annual Meeting of the Association of Executive Health Officers of the Province opened in the Private Bills Committee Room of the House of Commons, Ottawa, on Monday the 26th of September, at 10.30 a.m.

The President, Dr. M. McCrimmon, Palermo, occupied the chair.

The PRESIDENT: As it is time to open our proceedings, I would ask the meeting to come to order. The first item on the programme is an address of welcome. I, therefore, would call upon Alderman Wallace, Chairman of the Ottawa Board of Health.

Alderman WALLACE: Mr. President and Gentlemen, as Chairman of the Board of Health of this city, I am glad to meet the members of the Association of Executive Health Officers here. I hope that your deliberations will result in great good to the city of Ottawa, to the Province of Ontario and to the people at large. On behalf of the city I extend to you the warmest welcome. I trust

that you will find Ottawa and its surroundings pleasant and that you will enjoy your stay amongst us. I thank you for the honor done me in calling upon me, but as I am no public speaker, I can only again bid you welcome.

The PRESIDENT: We have also with us Dr. Robillard, the Medical Health Officer of the city, whom also we shall be glad to hear.

Dr. ROBILLARD: Mr. President and Gentlemen, I am not prepared with any elaborate remarks and feel that I must not take up much of your time. I am sure that the citizens of Ottawa are very much pleased that the meeting of this Association should be held here. Our people take interest in questions of health, as you will see when you examine our sanitary arrangements in the way of water-works, drainage, and other similar works. We certainly hope that your meeting here will be both profitable and agreeable. We may expect it to be so, not only from the fact that you assemble in the Capital of the Dominion, but also because you will meet here the members of the American Health Association, which cannot but enhance the value to all, of your visit here. So far as the citizens of Ottawa are concerned, I am sure we will endeavor to make your visit as agreeable as possible.

The PRESIDENT: On behalf of the Association, I desire to say that we appreciate very highly the kind welcome that has been extended to us. We hope and believe, that our meeting will be beneficial not only to ourselves, but to the city.

The SECRETARY being called upon to read the minutes, said: The minutes are practically contained in the Annual Report, and I have not made any special minutes. I move that the minutes as printed in the Report be adopted.

The motion was seconded by Dr. J. J. CASSIDY, of Toronto, and carried unanimously.

The SECRETARY: Certain changes have been made in the programme. This afternoon the first paper will be that of Mr. Horetzky, on the Treatment of Sewage, to be followed by Mr. Campbell's paper on the Influence of Pavements on Public Health. We

shall also have Prof. Shuttleworth's paper on the Influence of Street Pavements on the Occurrence of Diphtheria. The last paper for the afternoon will be that of Mr. McGill on Local Standards for Chlorine in Well Waters. Dr. Bryce's paper on the Duty of the Public in Dealing with Tuberculosis will be postponed until the evening. The two papers arranged for the morning session to-morrow, that of Prof. Shuttleworth on the Resistance of the Diphtheria Bacillus to Throat Disinfection, will be read by title, and the other, my own, on Some Recent Investigations into Air Infection, will be read at any time when opportunity offers. It has been thought better to arrange to have a session to-night rather than to-morrow morning, so that members of the American Health Association who are in the city may be able to attend and take part in the discussion of Dr. Bryce's paper. The meeting to-morrow morning will be of a purely business character, for the election of officers.

The PRESIDENT: Then delivered his annual address.

The SECRETARY: I would ask any who are interested in the work we are doing and who desire to become members to give me their names. Those who read our constitution will see that any who are interested in Public Health work may become either full members or associate members of the Association.

DR. BRYCE: I would suggest that we take a recess of ten minutes to get our register complete and make one another's acquaintance.

THE PRESIDENT: I am sure that that suggestion will meet with the approval of all, so I will leave the Chair for ten minutes.

After recess.

PROF. SHUTT: I listened with great pleasure to your interesting and comprehensive address, Mr. President. I would like to say one word on one of the topics touched upon, the water supply for farms. You rightly said that it might be well if the Government could see its way to devoting a part of the money now spent on farmers' institutes and so on to the work of educating the people generally in the principles of sanitary science. But this matter has not been wholly neglected by the Government. I have charge of the chemical work on the Experimental Farm; ten years ago, when the system

was instituted, we commenced the examination of well water for the farmers. We felt that though, from one point of view it might be thought to be outside the work of an experimental station devoted to the advancement of Agricultural proper, yet it was important that our farmers should be made aware of the danger arising from polluted water, both as affecting themselves and as affecting their stock, and, thus, the public health in general. With that in view we gave the farmers the privilege of sending samples to our laboratories for analysis, provided they carried out certain instructions, which were forwarded to them on application, and prepaid express charges, the analysis to be made free of charge. We have, in that way, over a thousand analyses of well water from various parts of the country from British Columbia to Prince Edward Island. The results of these analyses are tabulated in our annual report. I am sorry to say that the results are not very satisfactory as to the conditions indicated. I presume, however, that the large percentage of polluted water is possibly due to the fact that only those who have reason to suspect their water supply go to the trouble of sending samples for analysis. It is a fact nevertheless, that a very large proportion of the samples submitted have been found unfit for use. Not more than twenty-five per cent. could have been passed as pure and wholesome by any recognized standard of water analysis. This being an important matter, I have asked permission to say this word to show what we have done, and to say that we propose, for the present, at any rate, to continue this work. The object is an educational one, to awaken an interest in the rural people in this question, which, of course, we will all agree, is a vital one. The publication of the results of our work certainly has awakened an interest, and every year we receive a larger number of samples for analysis and of enquiries that show a growing desire on the part of our farmers to assure themselves of pure water supply. At first we found very little response to our efforts, but the growth of public interest is such as to encourage us to continue our work.

Dr. BRYCE: It seems to me that the reference in your address, Mr. President, to the necessity for centralizing the work in counties

is illustrated by the remarks of Prof. Shutt. Any one who thinks for a moment of the local conditions of water or soil, or, generally, of the geology and topography of any district, will understand that the analysis of the water from one well, say in the barnyard of a farm, will yield very different results from that of another even a short distance away. The difference between wells on two neighboring farms may be still greater. It has been quite evident, by what you have said, Sir, that, if we are to do the work Prof. Shutt is endeavoring to do, or that the Provincial Board is endeavoring to do, we must, so to speak, lessen our territory and centralize our efforts. Instead of analysis for the whole Dominion, dealing with the waters of a district four thousand miles long by three hundred miles wide, or with a district covering one Province with a length of two thousand miles, we must deal with small districts, such as counties. Take, for instance, the eighty square miles included in the ordinary township. It will readily be understood that the energies of one expert man could be confined to the district, and then there would be a lot of work which he could not by any means compass. As you know, in England, a sanitary survey has been carried on covering all the counties. One who examines the geological map of the country will readily understand the need for such a survey. Such a geological survey of each county from a sanitary standpoint is as necessary in Canada as in England. The discussions I have had with health officers in all parts of the country lead me to believe that we must have an expert officer in each district I will not say that such an officer must necessarily be appointed for each county, but for a district, and each officer must be trained from every standpoint, chemistry, biology and geology, for the work before him. His time should be wholly given to the work of sanitation, and to him subordinate officers such as inspectors or even township health officers, if it is thought necessary to have them, and veterinarians of the district would come for information on the matters that come before them. I can see that it is only a matter of time until the work of the Dominion, the Province, and Municipality must be left to officers of that kind, paid, I am not prepared

to say by whom, but paid in such a way as to secure the services of men who will cover the work now distributed very imperfectly among the Dominion veterinary inspectors, the Provincial health officers and the subordinate officers of the country who receive from nothing, as the President said, to $25 a year.

Dr. W. J. ANDERSON, Smiths Falls: I was much pleased with the President's address. It touches practical points that we are discussing in the town from which I come. The water supply has been a great grievance with us. I shall not deal with that now. But I may say that in the country there is great need of reform in this matter. If there is a low and swampy place on the farm, that is where the well is sunk to get water for the stock. As an instance of what is done, I may say that I was at a place where a wind-mill had been erected to pump the water from the well, and, on examining the well, I found that it had been banked up with manure. The cattle used the water from that well. It is a common thing to have a well in the barn-yard where the soakage from the yard runs into the water which is given to the stock. This cannot but be injurious to the cattle, and I regard it as a great source of disease in these animals. The existence of Hog Cholera is due to the neglect of similar sanitary precautions. These matters should be brought before the Farmers' Institutes and every effort made to impress them upon the minds of our Agriculturists as strongly as possible. I belong to two Farmers' Institutes, and at their meetings I have endeavored to show to the farmers that it is necessary to give the stock pure water, as it is to give such water to human beings. There is also the subject of ventilation, upon which, of course, one could speak a long time. The stock are huddled together in badly ventilated buildings, the result being, the spread, among them, of disease. In one case which was brought to my notice horses were huddled together in a livery stable, and several contracted cerebro-spinal fever and died. I told the owner to take his horses away, pull down the stable and disinfect it. He did so, with the result that the disease appeared no more.

The PRESIDENT: I may say, referring to the problem of water supply, that my idea was that somebody who had any intimate knowledge of the strata of the locality should locate the wells for those who wish to have them put down instead of locating them in the old fashioned way, laying down a log and letting the chickens run on it or sending a man around with a stick. Very often, in such cases if the water closet interferes, it has to be moved and the well goes down there. I brought the question forward in order, if possible, to have the present practice changed. If a better system could be carried out in our rural districts, we should have a better class of water than we get.

The SECRETARY: I have here a report that should have come up with the minutes. It relates to a committee of the Association which was appointed last year, consisting of Dr. Cassidy, Prof. Shuttleworth and myself, to carry out some experiments in the use of formaldehyde as a disinfectant. We have not done much practical work, but we wish to submit a report of what we have done and ask leave to continue the experiments.

REPORT UPON FORMALDEHYDE DISINFECTION.

Your committee has not been able during the past year to devote as much time as we would like to practical tests of the various methods of formaldehyde disinfection and it therefore begs leave to submit a short report upon the present state of the question and requests permission to sit again.

During the past year formaldehyde has begun to be used by health officers throughout the Province as a means of practical disinfection of houses.

In one municipality, Galt, whose Health Officer is present to-day, one of the methods of converting methyl alcohol into formaldehyde gas has been used. He will be able to personally state his experience. In practically all the other municipalities where formaldehyde disinfection has been adopted, the Sanitary Construction Company's machine has been used. These have been Ottawa, Picton, Berlin, Port Stanley and one or two others. To a certain extent tests of the

efficiency of this machine has been made in disinfection in Ottawa and in Picton. Swabs exposed in rooms undergoing disinfection have been afterwards sent to the Laboratory of the Provincial Board and tested for living bacteria.

In the Ottawa samples growths were obtained after exposure. In the Picton samples no growths were obtained.

In regard to the Sanitary Construction Company's machine this criticism may however be offered. In unskilled hands it has been apt to get out of order and the exit pipe has become plugged with paraformaldehyde and in one or two instances explosions have occurred.

The methods of formaldehyde disinfection which are in use at present are as follows :

1st. The production of formaldehyde by the partial combustion of methyl alcohol. This method has given good results in some hands but very poor result in others and is open to the objection that there is a considerable waste of material and it is difficult to contrive the conversion of the alcohol into the aldehyde so as to get the greatest possible yield of the latter. It has largely given way to the methods which use the 40% formaldehyde solution.

One of them which has been extensively experimented with and used in Europe is the Trillat autoclave. In this apparatus an attempt is made to obviate the troublesome tendency of the gas to polymerize by adding to the solution a neutral salt such as calcium chloride and a pressure of $3\frac{1}{2}$ atmospheres is used. Some exceedingly favorable reports have been published in regard to this machine, but in other hands it has not given such good results.

Your committee hopes to be able to make some tests with one of these autoclaves at present used by the Hospital for Sick Children in Toronto. It would have been tested before, but has got out of order through plugging with paraformaldehyde.

The Sanitary Construction Company's machine has been alluded to.

Another method has been suggested by Aronson, of Berlin, and has been used somewhat. This uses the paraformaldehyde compound

in tablets and vaporized by the action of an alcohol lamp. Some tests of this made in the laboratory of the Provincial Board has given good results in superficial disinfection, but it is open to the great objection of expense.

Another application is by the use of 35 per cent. formaldehyde in alcohol with menthol added, the so-called Holzin. This in some hands has given good results, in others it has proved unreliable.

Finally the Chicago Board of Health has published some experiments which if confirmed promise a very cheap and convenient method of disinfection, and it is along this line at first that your committee proposes to work during the winter, viz, by suspending in a room a sheet soaked in 40 per cent. formaldehyde solution.

Apparently from the published results of a large number of experiments there is an uncertainty about the action of all these machines. In careful hands and under perfect conditions each one of them will give good results, but when conditions are unfavorable none of them can be absolutely depended upon.

Your committee proposes to take up the question of the sheet disinfection and to try the Paraform tablets, the Sanitary Construction Company and the Trillat apparatus during the coming winter.

Dr. ROBILLARD: As the name of this city has been brought before you in this report, I may briefly describe the method followed by us. The formaldehyde gas generator was used, with a forty per cent. solution. We left the swab wrapped up in a loose cotton rag or simply on a piece of paper on the bed subjected to the action of the formaldehyde gas. Not having used the instrument myself—it was used by the sanitary inspector—I could not be positive, of course, that the quantity would be sufficient. Mr. Mackenzie has already told you that the test of the swabs sent from here for examination was not satisfactory. So far as appears from the facts we have, it does not seem to have been fully determined that with the gas as it is now used the forty per cent. solution would be strong enough to insure the positive destruction of the germs in the time specified in the directions for the use of this instrument. I have listened with much

pleasure to Mr. Mackenzie's report, and I hope he will continue to investigate the question and that he will reach a satisfactory conclusion.

Dr. WARDLAW, Galt: I have listened to the report with much pleasure. We have used formaldehyde in several cases of diphtheria in Galt. We used the Indianapolis machine, the name of which I do not know. After using the formaldehyde, we left the room closed for from eighteen to twenty-four hours and then opened the window and allowed the air to enter the room for twenty-four hours. I did not send down swabs. Had I known that this question would come up, I would certainly have done so. I will send them down in other cases. In every house where we have used the formaldehyde we have had no return of the diphtheria with one exception. Under the old method we have had frequent returns. In the one case I have referred to, the return was probably due to the carelessness of the lady of the house. The room was closed up, but, unfortunately, they forgot to take away a pet canary that was there and they opened the room to take the bird away. When the room was opened the canary was found dead, but, on rolling up the blinds, several flies were seen as lively as ever. I would like to have heard the results of the experiments with formaldehyde in Berlin.

The SECRETARY: We have had no swabs that had been exposed, but the secretary of the board of health, writing about it, said that they had no returns in any house where formaldehyde had been used. The only objection they raised was that difficulty with the machine. I think they destroyed three machines through their plugging up. I think there are practical difficulties in all the methods used. Practically all the methods have been patented in some country. The Trillat Autoclave has been patented in France, and the Paraform tablets of Schering in Germany. In every case the maker claims more for the machine than the machine will do. Where the maker says to leave the room closed twelve hours, it is better to leave it closed twenty-four hours, and it is better to use double the quantity of formaldehyde stated in the directions.

Dr. BRYCE: There is one method which Mr. Mackenzie did not refer to but which I saw described in some of the German and English papers, and which, in talking with one of Parke, Davis's men I find they have been experimenting upon. In the German experiments a spray is used with very satisfactory results. I learned from Parke, Davis's man that, in order to make a fine enough spray they had to take one of these aspirators which the soap men use and put on a number of atmospheres, and it really was going to be altogether too expensive to distribute with such force as would reach all the corners of an ordinary room. We will be glad to learn, as I hope we shall learn, from some of the gentlemen of the American Health Association, a committee of which has been investigating the matter, something that will add to our knowledge of this important disinfectant.

The PRESIDENT: If there is no further discussion on this subject we will pass on to the next. I will call upon Dr. J. J. Cassidy to read his paper on Inspection of Meat for the Local Market.

Dr. CASSIDY read his paper on this subject.

The PRESIDENT: I think that before we take up the discussion we should hear Dr. Harbottle's paper on "Meat Inspection."

The SECRETARY: Dr. Harbottle is, unfortunately, not present, and I have not his paper with me, but I can give a summary of it. The Secretary gave a brief synopsis of the paper referred to, after which the subject was declared open for discussion.

Dr. BRYCE: Dr. Hall, of Chatham, has made some attempts to have an abattoir in his town, and I think his experience will be of value to us.

Dr. HALL, Chatham: I am very much interested in this question, and am certainly a convert to the view that a public abattoir where animals are to be slaughtered for food purposes should exist in all cities and towns. Two or three years ago I commenced an effort in the City of Chatham to bring about the establishment of such an institution. I encountered a great many difficulties, some of which I may point out. We raise a great many cattle in the County of Kent surrounding Chatham, and do a considerable export

trade. Many cattle are slaughtered in the county and the carcases are placed on sale in our public market. As soon as the abattoir was spoken of, farmers who are in the habit of slaughtering animals at their own places, perhaps twelve miles from the city, raised very serious objection. They thought it would be much against their interest to be obliged to drive their animals into the city and have them slaughtered there subject to an examination. They, therefore, opposed the abattoir scheme. There were also the small butchers who bought inferior cattle, such as were not fit to ship out of the country. We have a great many of such butchers in the city and they raised a great row. We have in the county a number of animals affected with lumpy jaw, and we have brought parties into the police court and had them fined for offering the meat of such animals for sale. These people rose in rebellion when the abattoir was proposed. Another objection urged is the length of time that would have to elapse between the driving of cattle, say, twelve miles, and the slaughtering of them. To have the meat what it should be, it is really necessary that the animals should be allowed to rest after being driven so far before they are slaughtered. Not to make too long a story I may say that the people affected have raised such opposition to the establishment of an abattoir that we are just as far from success now, apparently, as ever. Still, I hope to see it established. I certainly have no intention of giving up the effort.

The PRESIDENT: Dr. Fee, of Kingston, might tell what progress is being made in his city.

Dr. FEE, Kingston: No advance has been made towards the establishment of an abattoir. We have there only two slaughter houses. But many animals are slaughtered in the surrounding country and the meat brought into the market and sold in quarters. The establishment of an abattoir has been advocated by the local board, but they have met just such difficulties as Dr. Hall has described. There is also the financial difficulty. To put up such a building as would be required in Kingston, would cost a good deal of money. I strongly believe that the public abattoir is the proper thing. The cattle would be slaughtered there before the eyes of all the

butchers and an examination made by some competent person appointed for the purpose. We should then be able to buy meat knowing it to be not of an objectionable or injurious character.

Dr. HUTCHINSON, London: We, in London, have had some experience in this matter. We have been fighting for the abattoir for three or four years, and now we have a by-law prepared to cover the cost of the building. We believe that the abattoir will be self-sustaining, if we can get it established. There is some opposition on the part of the butchers and the farmers, some of whom bring meat to market from places as much as thirty miles distant. It is almost impossible to detect some kinds of bad meat after it is placed on the market. We have had some parties brought up and fined, and I must say we have, of late, not seized nearly so much meat as before. To pay the expenses of the abattoir, a small fee will be charged for the slaughter of each beast, and none will be allowed to be slaughtered until after examination by the veterinarian.

Dr. BRYCE: As we have the Chairman of the Ottawa Board, who, we know, has been endeavoring to settle the question of the tuberculin test, he may be able to tell us something of interest with regard to the abattoir question.

Mr. WALLACE: It made me smile to hear the gentleman from Kingston say that finances were low. In this city we are troubled in the same way. We have no public abattoir here, but an effort is being made to establish one, and I hope it will be successful. I think it is a very necessary thing for such a place as Ottawa. I trust to see an abattoir established not later than next year.

Ald. GARROW: We feel the need of an abattoir here, and only the consideration of finance has prevented its establishment.

Dr. WARDLAW: The gentleman who have spoken have all been interested in the cities; but the rural and village population must also be considered. We have villages all round Galt, and meat is brought into Galt from five counties. Unless the abattoirs are to be general the effect of them will be to secure the best meat for the cities leaving the bad meat for the people in the country.

Dr. BRYCE: Dr. Wardlaw must not forget that the bad meat is produced by the people in the country.

Mr. McGILL: I am glad there is a movement in Ottawa in favor of the establishment of an abattoir. I will undertake to find, within an hour's walk, small slaughter-houses surrounded with the most shocking conditions. I can show pigs wallowing not in mire but in blood—a desperate condition of things. I can quite sympathise with the objection raised by the small butchers and by people who bring meat into the city. I am strongly opposed to the passing of any legislation compelling people to make changes, with which changes they are not strictly in sympathy. In cities and large towns, the people should be educated to the desirability of having meat slaughtered under conditions which shall insure safety. I think, that in the cities there would be no difficulty. Immediately the butchers began te find that it made a difference in selling meat to treat the matter from the point of view of the purchaser, they would see the advantage of having the cattle slaughtered under conditions of cleanliness and health. With reference to the difficulties under which country people would labor, it is the part of the townspeople to initiate movements of this kind and to educate the country people, in the direction of more cleanly and wholesome practice. Such a movement, initiated in the city, would soon spread to the country. The same is true with regard to the supply of drinking water. It is in the towns and cities that the water supply can be very carefully looked after. There has grown up a public opinion as to the importance of this subject and we find that now, even in the country places, much more care is being taken, than formerly, to secure purity in water supply, a thing never thought of until recent years. It is very satisfactory to me, as a citizen of Ottawa, to know that there is a probability of securing a public abattoir, which I consider a real necessity.

Dr. BRYCE: Those engaged in municipal matters know that the objections raised from a commercial point of view are the great difficulties in this reform. These objections are the ones which have kept our Government, and notably our Federal Government qui-

escent with regard to instituting a general system of inspection in the export cattle trade. Curiously enough it was just this commercial aspect of the case which, in 1881, when the Germans prevented American bacon from entering that country, that brought about reform through the establishment of the United States Bureau of Animal Industries. In 1884 pleuro-pneumonia had becom quite prevalent in the Chicago district, notably in Illinois, The disease appeared in England, and American meat was prohibited from entering in the live shape. The United States appropriated half a million dollars, to stamp out pleuro pneumonia. Prof. Salmon, who, I trust, will be at this meeting, undertook to deal with the matter. He had to meet all the difficulties arising from lack of education on the subject among the people. But he proved his own *raison d'etre* and, by tireless work, succeeded in stamping out the disease. The people have found the results in themselves well worth the cost, but they have found additional advantage in gaining free entry, except so far as duty is concerned, for their hogs to the German market. As Dr. Cassidy has pointed out, they undertook the establishment of a registered abattoir, the owners of which agreed to allow the Government inspector to inspect every carcase intended for export. They went further and, in connection with these abattoirs in such cities as Kansas City and elsewhere, they established laboratories in which portions of every hog were examined by trained microscopists for the presence of trichinæ, thus meeting the one objection Germany had made. The process is simple, yet it is effective by reason of the great care exercised. Each specimen is examined in the morning and then left to be examined in the afternoon, in case the morning examiner may have failed to find the trichinæ. The result is that American hogs in enormous quantities are exported to the German market where pork is used very largely. This is not the case with Canadian hogs to-day, as Dr. Cassidy knows the German Consul in the city of Toronto has come to our Board and asked, if there was not a way by which a Government certificate could be given showing that Canadian hogs were free from trichinae, and we had to tell him that it was not possible. In London, we know, there is a large

packing house engaged in the export trade. The managers are willing and anxious to send Canadian hog products to Germany, but without a Government certificate this is impossible. So, while the Canadian trade in cattle has not increased and the export of hogs has practically stood still within the last six or seven years, the American trade has increased at least twenty-five per cent. So, curiously enough, we must look to these commercial considerations, as the means of bringing about the changes we desire. I think it is not creditable to Canadian commerce, that neither under the old Government nor, now that the new Government has been in power for two years, has anything been done to systematise the inspection of Canadian meat for export. As Dr. Cassidy's paper says, though thousands of cattle were exported, only some six or seven animals in all were seized at Montreal and slaughtered. In the American abattoirs almost one per cent. of the 35,000,000 of animals have been condemned. The Americans are getting credit for their honest dealing with their customers, and they are getting the money as well.

The PRESIDENT: We have with us now Dr. Linsley, Chairman of the American Public Health Association. Perhaps he may have something of importance to tell us.

Dr. LINSLEY: As I have heard but little of the discussion and am not sure that I understand the subject, I beg to be excused from expressing any opinion at present.

Dr. BRYCE: Dr. Durgan, City Health Officer, who is present, might tell us how successful they have been in this matter.

Dr. DURGAN: I understand from the latter part of Dr. Bryce's remarks, the only part of the discussion I have heard, that the inspection of abattoirs and meat is under consideration. My knowledge of the subject is not a wide one, but I can speak of our experience in Boston. The inspection is partly done by the Federal Government officer. Under him, there are in each establishment a corps of inspectors by whom all the meat for export and market is inspected. The greatest difficulty we have found is in the inspection of pork, which is shipped in large quantities from our section of the

country. An embargo was put upon our pork by France, Germany and Italy, but, owing to our present trustworthy inspection, that embargo has been raised. The number of cases, in which trichinae are found in the pork, is found to be in proportion to the amount of meat that is raised in and about the cities. Some sixteen or seventeen per cent. more is found in the pork raised about the cities than in that which comes from the west, where the meat is made from corn out of doors. It has been a matter of difficulty for a great many years, to dispose of the pork that is made in the cities.

Dr. LINSLEY: Is that because the animals are fed on carcasses?

Dr. DURGAN: I have no doubt that a large proportion of the cases of trichina arise from feeding with garbage. In our own State, Massachusetts, we have forbidden the use of this swill with milch cows, and our next step, I hope, will be to forbid the use of it for pigs.

Dr. BRYCE: Would Dr. Durgan please explain the system of inspection of meat for the local market.

Dr. DURGAN: Legally my board of health has charge of the inspection of live animals, meat and provisions generally for local sale. We place at the abattoir one good man for the inspection of both the live animals and the meat, and all the viscera are held for his view, before being thrown away. Most of the animals slaughtered in our abattoir are neat cattle—very few hogs. The inspector is authorized to condemn any meat which, in his judgment, is unfit for food. We do not condemn the whole carcass where there are but slight lesions, but where the disease is general the whole carcass is destroyed. There is a Federal Government officer who sees the meat, but condemnation by him is secondary to condemnation by the local officer. With provisions about the city, we have another officer who is authorized to go into any provision store, packing house or other place, where foods are kept or dealt in, and order anything to be disposed of which, in his judgment, is not fit for food. Next to tuberculosis in the neat cattle, that which we most carefully guard against, is actinomycosis. This we do not condemn, if only in the initiatory stage. We condemn the animal, when the disease has

existed for a considerable time, so as to affect the whole system. Where it is only local and has been of short duration we condemn only the part affected.

Dr. CASSIDY: I have been much pleased with the opinions, mostly commendatory, of the recommendation made in the paper for the establishment of an abattoir in the City of Toronto, from which I come, in order to bring about a more thorough inspection of the local meat trade. I incidentally mentioned that the American Government, in order to retain the European trade, had established, under the Bureau of Animal Industries, a very effective system of inspection of the export trade. I do not say that it would not be perfectly right to satisfy even the over-critical people of the wholesomeness of the meat sent to Europe, and thus disarm all criticisms and retain for the Americans the market which they have had for so many years. All the same, I think we can say now that, since 1891, when Prof. Salmon spoke on the subject in London, there has been distinct growth of opinion founded upon scientific observation in favor of allowing the use of meat slightly tuberculous. I believe Prof. Salmon said that nothing tuberculous should be used for human food, and all the carcasses affected must go to the rendering tank. If only the commercial reasons are considered, I think that may be a perfectly legitimate position, as tending to raise the export trade of the United States above criticism. But from what Prof. Bang, of Copenhagen, and Dr. Nocard, of France, say, there is reason to believe that it is not necessary that absolute strictness should be observed, so far as the public health is concerned. In Germany they have rules which Prof. Bang fully endorses, based upon the fact that even when the tuberculin test shows that the animal is infected, subsequent examination of the viscera may show only a few tuberculous lesions. When you consider the great value of animal food to working men, you see that it would be too bad to send to the rendering tank meat, which, while affected, is not unfit for human food. I think that, even in America, the cry is beginning to be raised, that science has gone a little too far, and that it has no right to go further than the conclusions which it can perfectly

establish. But if we wish to have inspection for our local meat trade, the first necessity is to provide abattoirs, and if we hope to persuade the people that they should send cattle to abattoirs for inspection, we must show that we are not going to have a vexatious system of inspection, one that will send to the rendering vat carcasses of animals which are only slightly tuberculous. To do otherwise is to arouse opposition and defeat the object we have in view. The inspection should be systematic, accurate and thorough, but not such as to arouse unnecessary opposition. The difficulties pointed out by Dr. Wardlaw and Dr. Hall, are economic difficulties. But when science knows its own mind and can say distinctly that such and such cattle are unfit for human food our position will be stronger. If we believe that any animal having tuberculous lesions must not be used for food let us say so; if we think it not necessary to go so far, let us state how far we will go. We then come down to the concrete and are no longer dealing wtth general principles.

At one o'clock the meeting adjourned for luncheon.

Afternoon Session.

The Association reassembled at 2 30 p.m., the President in the chair.

The Secretary read telegrams from Dr. Pelletier and Dr. Lachapelle, members of the Quebec Provincial Board, expressing regret that they would be unable to be present until the evening meeting.

Mr. C. Horetzky, of the Public Works Department of Ontario, then read his paper on "Treatment of Sewage.

The President: Mr. Horetzky's paper is now open for discussion.

Dr. Kitchen, St. George: Will Mr. Horetzsky please state what becomes of the scraped sand?

Mr. Horetzsky: I propose to burn it in the furnace. I say that in the case of London, I can suggest some improvement in the matter of working. I would make the receiving chamber a drying oven as well. There being two chambers, you would close the sewage door of the one you do not use. I would have iron pipes—radi-

ators—to dry the coke by steam, and then run it up to the furnace. The two tons of sand scraped from the top of the first filter, in Reading, is carted away to the dump heap. But I would have a little tram road and have the scrapings shovelled into the car, and dumped into the furnace, thus allowing combustion to do the whole thing.

Dr. KITCHEN: Are you aware that in Hamilton they are using coal as a filter, and they pretend to say that it is of use afterwards to burn?

Mr. HORETZKY: Coke would be much more suitable. It would be more easily handled and would do the business better. Coal is a crystalline, smooth substance. How could it take up sewage

Dr. KITCHEN: Is the coke burnt merely to get rid of it or to make use of it for commercial purposes?

Mr. HORETZKY: It is burned to get rid of it and the sludge, but of course it has as high combustion power as other coke.

Dr. KITCHEN: Why could it not be used for commercial purposes? Why not sell it?

Mr. HORETZKY: There is no reason, except that I think people would not care to buy coke with about fifty per cent. collected sludge adhering to it. I think it must be regarded as an item of expense to burn it, just the same as it is to provide ferrozone where it has to be used.

Dr. KITCHEN: You could run a dynamo with it.

Mr. HORETZKY: Yes, it could be used to get up steam. But in London it is not intended to use steam, except that you would require a little boiler to run radiators for the coke ovens.

Ald. TAYLOR, London: Do I understand Mr. Horetzky to disapprove of the land disposal scheme?

Mr. HORETZKY: I do. I disapprove of my own recommendation of three years ago, as compared with this latest discovery.

Ald. TAYLOR: What system is in operation in Glasgow, Scotland? Is it not the McDougall system?

Mr. HORETZKY: I believe they have a chemical system there; it may be the international system. That is not as good as the lime and alum precipitant system, in my opinion. We have stopped it in all public institutions except one.

Ald. TAYLOR: Is it the land system in Reading that you recommend?

Mr. HORETZKY: I recommended the land disposal system three years ago, as against the chemical precipitant system. I had good ground for what I recommended, because I have put in all the sewage disposal plants in the country, except one that Mr. Waring designed and the one at Berlin. So I knew what ferrozone would do. I knew what alum and lime would do. But now, since seeing this other system at work, I go back upon my recommendation of three years ago, most decidedly.

Ald. TAYLOR: Did you consider, when you and Mr. Chipman and Mr. Goodnough were there, that you were taking chances in putting London to a great expense?

Mr. HORETZKY: There was no chance about it, if you got suitable land. I took precious good care to say in my report: if you cannot get suitable land of a sufficiently high elevation, do not attempt it, because it will be a failure.

Ald. TAYLOR: They have got the land.

Mr. HORETZKY: Then it is all right.

Ald. TAYLOR: You speak of tiles in the filtering beds. What depth are they below the surface?

Mr. HORETZKY: I think that, in the case of London, the depth recommended was five feet below the surface.

Ald. TAYLOR: What effect would the frost of winter have upon them?

Mr. HORETZKY: No effect.

Ald. TAYLOR: Would the sewage be warm enough to resist the frost?

Mr. HORETZKY: If you have a good piece of dry land sufficiently drained, the frost will never affect it as a filter.

Ald. TAYLOR: Your partner in that recommendation approved of the land London procured. I refer to Mr. Chipman.

Mr. HORETZKY: If he did, very well; I have nothing to do with Mr. Chipman. I reported independently of him. I thought that the low piece of land at the Cove—I think it is called Farm B—was too low, and I took good care to so state to the people of London.

Ald. TAYLOR: The reports of each one are on file in London. The people of London would not take the land until all three agreed in recommending it.

Dr. BRYCE: If the discussion of the paper is now in order I would suggest that Ald. Taylor take the floor and discuss it. I do not know that this meeting is interested in discussing Mr. Horetzky's former recommendation.

Ald. TAYLOR: I did not know that I was out of order. I was asking for information before going on with the discussion.

Mr. HORETZKY: I am willing to answer any questions that may be asked.

Mr. VANBUSKIRK: I do not wish to discuss the case of London or any other place, because I think they are able to pay for their information and ought to do it. I have been surprised, however, at Mr. Horetzky condemning the land disposal system. I am under the impression that there is no system more perfect, provided you get suitable land.

Mr. HORETZKY: I did not condemn the land disposal system. I agree with you.

Mr. VANBUSKIRK: I understood you to put this Reading system ahead of it.

Mr. HORETZKY: I put the Reading system ahead of it in one way.

Mr. VANBUSKIRK: I am of opinion that there is nothing better than the land system, if suitable land can be got. But, in regard to coke breeze for the removal of sludge, I believe that is about the best material for it in ordinary cases, though I believe also that, in the case of some large cities it would be impossible to work it. For

the ordinary town of Ontario, say from ten to twelve thousand inhabitants the removal of sludge with coke strainers would be the most economical system, and the best, in all probability. The system of removal of sludge by forced aeration is a development of the experiments at the Lawrence Mass., experimental station. It can be done easily, but it is expensive. In most cases you have the expense of pumping the sewage and always the expense of pumping the air. I have forgotten the figures of the cost of forced aeration in the removal of sludge, but it is about three times the cost of straining through coke. There is no doubt the chemical methods are useful in some cases. I do not believe that any one system could be said to be the best for every place. Conditions differ so much that it is almost impossible to lay down a rule that will be applicable to all towns and all institutions. Each case must be worked out, on its merits, and it requires a man of considerable experience and knowledge of the subject to work it out properly and well. I have seen some articles on the Pennsylvania works by one of the associate editors of the "Engineering News" whom I consider one of the best men in the United States. In an article in that paper he stated that the purification obtained by straining through coke was about equal to what they have obtained at the Massachusetts Experimental station by straining through six inches of coke over a bed of gravel—that is, about forty-five per cent. I do not pretend to have personal knowledge of this matter. My advice to any town considering this question is to steer clear of patent methods. But even that advice I hardly care to give for nothing. There is another method of filtration that Mr. Horetzky has not touched at all. It has been in use in England for the past two years in several places, and experiments have been carried on in the same methods for the last year and a half in Massachusetts. This system involves the use of what are known as bacterial filters. The sewage is run into the filter and kept there for a time and then run out. It would seem at first view that that would not purify it. It is only purified when it has become impregnated with bacteria. So, in place of the dead sand filter, which gives the best purification we have a shower bath on porous material, and the sewage is held in it until the bacteria have time to

do their work. The principle is the same as the sand bed, but the method is slightly different. In the sand bed, depth is given so that the sewage will be in the body of the filter for a sufficient time, in the presence of air, to insure nitrification. In the bacterial filter or digester the sewage is held for a time. The filter being of porous material, its capacity is much greater. The capacity given by Gibdin is twenty million gallons a day, with a purification of seventy-five per cent. The experiments at Lawrence, Mass., show 900,000 gallons per day, and a purification of eighty per cent. They are still carrying on the experiments there. Of the plants of this kind in England, the most noted one is at Sutton, in Surrey. There, they have also a chemical precipitation plant where they use lime, and they are getting rid of it. Half these wage is treated in the old way, and halt in these filters, two in number. The sewage goes through one filter, and, from that into the other, both being worked in the same way. The sewage is kept two hours in the first filter and two hours in the second filter. The reports state that not only is the liquid purified but the sludge also. All that is done before the sewage goes into the first filter is to force it through a screen.

The SECRETARY: I am glad Mr. Horetzky was able to read his paper. I know he is suffering from illness, and, up to half an hour ago hardly expected to be able to read. I think his position is mainly this—the position of every sanitarian—that the ideal method of getting rid of sewage is land filtration, but, where proper land filters cannot be had it is possible to adopt some of these other schemes in which more rapid treatment of the sewage takes place. In considering which scheme is to be adopted, one great point is the disposal of the sludge. It seems to me that this is the great question, and that the method of burning it, without making use of it, is an exceedingly wasteful method. A great quantity of nitrogen is lost in that way. But, as yet, there seems to be no method, unless that which Mr. VanBuskirk has described should prove successful, to bring about nitrification so that the material can be used to fertilize land and thus use the nitrogen which at present is wasted.

Dr. Bryce: We are apt to overlook the important point stated by Mr. VanBuskirk, the practical difficulty of applying a system under all circumstances. Now, we have in the Province, as we all know, probably the most perfect system in the world—that at the London Asylum. Dr. Bucke's paper on this subject will be presented at the meeting of the American Public Health Association, which opens here to-morrow. You will learn from that paper how one man who gets something like $20 or $25 a month, assisted by some working lunatics, does work, the gross profit of which, without referring to the expense, is about $2,000, reckoning the vegetables raised at wholesale rates. The land used is about four or five acres, about two-thirds of which is used for crop, the rest being occupied with ditches. It would not, in my judgment, be a wise thing to expect a municipality which is governed by a body, the personnel of which is subject to constant change, to work this system to the same advantage. Local conditions are also very important. There is everything in being so placed that the sewage flows by gravity. Take, for instance, the only large sewage disposal farm in the Province—that in Berlin. The ground is bad, in that it is more or less clay, and, to have the bed more level, they had to have the nitrogenous material removed. With fourteen acres they have not been able to dispose of the sewage satisfactorily, largely because, up to this year, they have left the work to one old man with a hoe. They did not spend on the management of the fourteen acres as much as $500 a year. The result was, of course, what we would expect—the beds grew hard in the sunshine, and the oxidation of the sewage in the soil became impossible. It became practically putrifying sewage in areas an acre or more in extent. The municipality just below has been patient, or there would have been trouble long ago. That is not a fair trial of the system. The soil must be worked so as to admit the air. In the case of the London Asylum this is done admirably and perfectly. Owing to the nature of the soil and the arrangement of the ditches, they work the surface of the soil with a rake weekly. But the ordinary conditions of a municipality prevent the successful carrying out of such a method; they are better fitted for some mechanical process under

which a man is paid to do the work, that work being of such a character that its effects can be seen day by day. These conditions could be best fulfilled by some such system as Mr. VanBuskirk has described. If, in addition to that, you choose to use sand beds for further purification, well and good. After the first course of filtration, I believe, the true economical method is to assume that the effluent has a value, and to put that on the sewage farm. In this way a comparatively limited area could be treated efficiently and so as to get the nitrogen out with the best results in the actual growing of a crop. We shall not reach the solution of the difficulty until we realize, as they do in London, that sewage has a positive commercial value, and that that value can only be got out of it by agricultural operations in which nature plays her part.

Ald. TAYLOR: I may explain that the reason why I put the questions I did to Mr. Horetzky is that we are largely and practically interested in this matter in London. I was surprised at Mr. Horetzky saying that he would go back on his previous recommendation. What London wants is the best, but at the same time, not an expensive system. Now, with regard to the London Asylum, there can be no comparison between that case and ours, because the whole revenue raised by the city through taxation would not pay the wages of the army of men required to work their system. We are told that a few of the inmates help to work the land. One passing the asylum grounds will see the people there like flies, working with all sorts of implements—shovels, trowels, dippers and so on, working the sewage into the soil. The effort seems to be, to put as much labor as possible upon it. No municipality having to pay wages could stand such expense. As to the profits, I am surprised to here the statement that vegetables to the value of $2,000 were raised upon this land. I venture to say that if the gardener planted both sides of it he could not raise half that amount. More than that, the people there are rather particular what they use, and you could not induce them to use the vegetables raised on a sewage farm, if you gave them the vegetables for nothing. The people have come to the conclusion, after careful inquiry and consideration, that the system at first proposed, the land

disposal system, would not answer the purpose. Whether they are right or not I am not prepared to say. But we all know that the winters are severe sometimes, and I do not see how any sane man can say that sewage, after being carried a distance, when run through a pipe on to the land, will not freeze. There are three systems spoken of by Mr. Horetzky, and the people do not know which to accept. I have seen documents from engineers of high standing in England approving very strongly of Mr. McDougall's system, Though it goes by his name here, it is more widely known as the international system. It is in use, I believe, in Glasgow, Scotland, for the disposal of at least a portion of their sewage, and works very satisfactorily. I am not advocating this system as against the others, and I am quite ready to believe that some system will be devised which will be better than any of them. However, it is evident that Mr. McDougall believes in the system, as he offers to give the city a guarantee. He offers to leave in our hands a portion of the money and to put up a strong guarantee, making a total of fifty per cent., to be forfeited in case the system does not work as he has represented. We have had no such offer as that from the others. Mr. Chipman, who, with us, has been co-equal with Mr. Horetzky, still contends for the farm system. But we are not prepared to accept, as yet, any of these systems. Perhaps something better will turn up. It seems well worth our while to wait a year, at all events. Of course the river had done duty for a long time, and done it without injury to any one, but an action was entered against the city by a rival village, and judgment was obtained compelling the city to seek some other system.

Dr. BRYCE: I think we should hear from that "rival village."

Ald. TAYLOR: That village is now a part of the city, and those who speak for the city speak for it also.

Dr. BRYCE: I thought the reference was to Chatham and that we should hear from Dr. Hall, if aspersions were being cast upon the size of his town. We have with us the city engineer of the city of Ottawa, who, I am sure, will be ready to tell us of the experience of the city in this matter of sewage disposal.

Mr. SURTREES, City Engineer of Ottawa: I have nothing to say concerning the system treated of in the paper. We have a good river here.

Mr. A. McGILL, M.A., B.Sc., Inland Revenue Laboratory, Ottawa: Read his paper on "Local Standards for Chlorine in Well Waters," which was then declared open for discussion.

Prof. SHUTT: As I explained this morning, we pay attention, in the Experimental Farm Laboratory, to the quality of water in farm wells. Mr. McGill and I have talked this over several times, and I have had in mind an investigation of wide and far reaching character, such as Mr. McGill has brought before you. I trust that we may have the co-operation of the society and other bodies to secure its collection, a vast amount of data. There are, however, several things we should be made aware of, while taking up this work. I believe that the plan Mr. McGill has in mind is that the collection of samples throughout a township should be undertaken by the township authorities and that these samples should be sent to one of the government laboratories. So far so good. But it is just as important that we should have information as to the local conditions. We all know that it is impossible to diagnose the water from the chlorine alone. The data Mr. McGill has outlined would be of exceptional value if, at the same time, we had a knowledge of the character of the soil, the height of the water level and so on. I have had an experience of over twenty years in this matter, and it seems to me that in very few places in the country could we obtain samples which we could believe, before we analyze them, were of undoubted purity. We could not be sure, wells being sunk within a certain distance of contaminated sources that we were getting the quality of the underground stream of which Mr. McGill speaks. It would be necessary to take the spring water of each section where it happened to come out, or to sink wells and from them obtain the samples. The country varies very much in the depth of the soil and the formation of the underlying strata and this fact, it seems to me, is as important as the other. I had an example, only a week ago, which emphasises what I have mentioned. A man had a well, perhaps ten

or fifteen feet deep in a barnyard. The well went dry every summer, and he thought that by going lower he would probably strike more water. The water he had had was of the nature of soft water, and, I suppose, must have received a certain amount of drainage from the barn-yard. But the chlorine did not go more than seven parts to the million. He sunk further and got a flowing well the water of which goes about one hundred of chlorine to the million being, of course, more or less of the nature of a saline well. Though I warmly support what Mr. McGill has said, I want to add a word of warning that we should not do anything that would tend to strengthen the belief that water can be sufficiently tested by the use of a little permanganate and so on. I do not think that, except in most unusual circumstances, it is possible to diagnose the nature of a well without knowing its surroundings. That is not saying a word against the advisability and desirability of carrying out such a scheme as Mr. McGill has proposed. I only mean to say that it must not be thought that we can close up a well on the determination of the chlorine alone. Where organic matter returns as free ammonia, it points to the presence of sewage contamination. But in its contact with the air it passes through the soil, nitrification takes place and it is fully oxidised. But the chlorine remains the same in both instances. Ten or fifteen parts of chlorine might be present with sewage which was only partially decomposed, or it might accompany the remains of organic matter which have been rendered perfectly harmless. So, with the other data, we need to have the environment of the well, and the construction and depth of the well itself

The SECRETARY: I have listened with much interest to Mr. McGill's paper and to the remarks of the gentleman who has just preceded me, because in our laboratory in Toronto we have paid considerable attention to the chlorine question. In getting samples for bacterial analysis we get enough to make the chlorine test, and I have frequently made that test in the hope of obtaining information to assist me in reaching a conclusion as to the nature of the water. I must say it has frequently helped me, especially when dealing with

samples from different wells in the same locality. The best example I can cite is that of the City of Brantford. The public water supply there, is practically an underground supply, which comes through a pipe in a gravel bed about twelve feet below the surface. It is popularly supposed in Brantford to be the same as the river water but filtered. The analysis however, shows it to be a ground water. Its chlorine is about eight parts per million, but the wells in Brantford run all the way from eight to seventy parts per million. I have determined the chlorine, I suppose, in over fifty wells and have also made bacteriological examinations, usually finding the two go hand in hand, pointing to the fact that the local ground water is contaminated by local sewage. The wells there, practically all go to the same depth If it is on the hill it is a deep well and if on the level, it goes down from twelve to fifteen feet. It is an ideal situation for using the chlorine test to detect bad wells. But, in Meaford, for instance, it seemed impossible to establish a normal chlorine standard, and, to a certain extent, we should require geological data to help us out. I think, however, that, in the vast majority of cases, that would not be necessary, if we had a sufficient number of analyses and sufficient information as to the depth of the well and the flow, and whether there was a slight water supply or an ample one. Of course unless regular borings were made, we could not get the geological data. I do not think that the Geological Survey could give them to us except for very few sections of the country. As to the possibility or necessity of the complete analysis, I agree with Prof. Shutt that, while the complete analysis is better than the partial, even the complete analysis, without the information as to the surroundings of a well, will not help us much further than will the chlorine and bacteriological tests. I am not inclined to draw a conclusion either from the quantitative bacteriological examination or the chlorine test, or even from the chemical analysis alone. In that connection, it may be mentioned that some investigations were made in Breslau about two years ago by Prof. Flügge. He caused chemical examinations to be made by his assistants of the wells in Breslau. He made an independent personal examination of every well that was analyzed.

He classified the wells according to this examination, and his assistants classified them according to the chemical analysis. The result went to prove that personal examination was by long odds, the best way to ascertain whether a well was good or bad. A single bacteriological examination will not help us out, but if we had systematic work of the character Mr. McGill has referred to for the whole Province or the whole Dominion, we should begin, at any rate, to have a standard for our ground water In some of the European towns they have had such a standard for many years, and they know when there is growing pollution, and when that pollution is disappearing, owing to the data they have I certainly hope the work Mr. McGill has referred to will go on and that it will receive the support of all the analysts of the country.

Dr. BRYCE: Two months ago I was at Rat Portage and what I learned there illustrates what has already been said in this discussion. There was an outbreak of typhoid through the using of polluted water, the source of supply being wells in different sections of the town. Determined, if possible, to find the worst well in the town I went with the local officers to get samples of water. We got two sets of examples, one for bacteriological and one for chlorine examinations. In a forenoon's work, we took samples from ten wells, and I made notes of the superficial appearance of each well with probable cause of pollution in any adjacent privy, manure pile and so on. These were all from wells on one side of the valley which runs south westerly through the town. In the afternoon I took samples from wells on the other side of the valley. The morning samples I sent to Dr. Bell, in Winnipeg, for bacteriological examination, and he was good enough to examine them within twenty-four hours, the time necessary in order to get good results. Not wishing to impose on him too much, I sent the afternoon samples to Mr. McKenzie. They reached him on the fourth day, too late for good results from this bacteriological examination. He, however, made the chemical and chlorine analysis of all. The first thing that struck me was that wells in this valley not more than a quarter of a mile distant from each other showed quite differently in chlorine. One

would show ten to fifteen and another thirty-five to fifty. I concluded that those with high bacteria plus high chlorine were undoubtedly receiving organic pollution. Putting these data alongside the notes I had taken, I was able to reach definite conclusions and suggested to the local authorities the closing of certain wells. As to the afternoon samples, we found the average of chlorine to be thirty-five. Without bacteriological analysis, I could only conclude that those having chlorine above fifty and shown by my notes to be dangerous-looking had better be closed. When the factors of the problem vary so much within a quarter of a mile, it is easy to see how necessary it is to have all the data possible before reaching a conclusion.

Mr. McGILL: Commenting upon what has been said I would remark, first, that while you may have chlorine without sewage, you cannot have sewage without chlorine. In the case of any single well no one would dream of condemning it on the strength of one fact. Before the well is closed, we must not only suspect it to be a bad well, but we must know it to be bad, and in order to know that it is bad, an analysis must be made The fact that a well is high in chlorine will not justify the closing of it, but it will be a reason for making further analysis. And what Dr. Bryce has said as to circumscribed areas with different chlorine values, is no doubt, quite true. No doubt there are areas of a quarter of a mile square in which there are marked differences of chlorine value. But I do not believe that that is characteristic of the country on any large scale. Where you find a large arable country like that I examined last week, extending perhaps twenty miles in one direction with a level suface and soil pretty much of the same character, the probability is that over that area there is a normal chlorine value in the ground water proper. If you pierce the subjacent stratum, you get a different chlorine value, but one also that is, within limits, fixed. It would probably be represented by a lower number than the other, but it would be constant I do not believe that any hard and fast line of demarcation could be made where the chlorine passed from twenty to two hundred. But, give me an area of twenty miles square,

apparently the same above ground and containing 600 or 700 wells and, with samples of not more than six ounces to make the chlorine test, and information such as the owner can give as to the depth of the well and the nature of the soil penetrated, I will undertake to complete a map which will indicate whether any given well derives its supply from the first, second, third or fourth stratum, and will circumscribe areas on the map which will be of the greatest possible value to one owning a well in the locality and wishing to know whether the water is fit for use or not. Of course I cannot give you illustrations of broad investigation, but I hope to do so next year. I believe that the examination I shall make will prove that my theory will hold water. I think I know how to go to work to obtain the data which shall establish or explode my theory. It would be too much to expect any individual or society to go to the expense of collecting well water samples from a very wide area. But I believe that in every township council in Ontario and in the other provinces there can be found inteligent men who will see the value of obtaining for their township such information as can be obtained in this way. The cost of obtaining samples from 600 wells in a township would not be more than ten cents a well. I have reason to say so, because, on Thursday, I myself collected 66 samples in one day, and it was not a very long day's work at that. And I was a stranger in the locality. A person with local knowledge could work much more quickly. I believe that townships could be induced to take up this thing, and, at their own expense, collect typical samples to enable a chemist to prepare a map such as I have suggested. As to the rest of the work, the government has laboratories here, and, in one or other of the departments the work could be done. I believe it would be worth while for a township to go to the expense of getting an independent analyst to make the chlorine test for the wells within its borders. But, until samples come in much more numerously than they have done, I shall be glad to place my own services at the disposal of any township that will collect the samples with the necessary care and furnish the other information that is necessary.

Mr. A. W. CAMPBELL, C.E., of the Ontario Good Roads Department was then called upon and read his paper on "What Influence have Pavements on Public Health."

Dr. CASSIDY, in the absence of the writer read Mr. E B Shuttleworth's paper on "Influence of Street pavements on the Occurrence of Diphtheria."

The SECRETARY: I have listened with great interest to Mr. Campbell's paper. We needed some paper of that kind in this Association. This is the first time that this question of the influence upon health of city pavements has been taken up. From a bacteriological standpoint there can be no doubt there is a great difference between the block pavement as laid in Canada, and the asphalt. The blocks must be decidedly the more unhealthy. I think that the results given by Mr. Shuttleworth are not of such great value since he has not mentioned the population. The results he gives St. John's Ward and Yorkville are practically the same. But St. John's ward is thickly populated and ought to show a higher number of cases of Diphtheria if the pavement had no influence in the matter.

Ald. TAYLOR: As Mr. Shuttleworth's paper deals with typhoid, I would ask if there has been a record kept of the cases of typhoid before the opening of free libraries in this province and since. I may say that in 1894, the year before the free libraries were opened in London, 52 cases of typhoid were treated in the General Hospital, and in 1897, 118 cases were treated.

Mr. SURTEES: I fully agree with the paper of Mr. Campbell, except that I think he is not strong enough in his condemnation of the block pavements. He reads us the opinions of the Detroit officer and of the officers in London, but I think the facts justify us in opposing the laying of block pavements on sanitary, as well as on other grounds. I was in Detroit when they were laying block pavements there, and, in four or five years those pavements have rotted away. When they proposed to lay block pavements in Toronto they sent a deputation to Detroit to examine them. I told one of the Aldermen that if they laid block pavements they would be making a mistake. But he made one point which I had not thought of

He said: You could not get the people of Toronto to go to the expense of putting in a first-class roadway. You have to make a beginning; but, directly the people are used to a good pavement they will never go back to mud roads. There is a good deal of truth in that. But that is the only thing that could be said in favor of the block pavement. This city is making great progress in the paving of the streets, not only in macadamized roads but in asphalt. We spent over $400,000 in roadway improvements last year. This year, we shall probable spend $250,000. I do not think there is a city in Canada having the quantity of permanent sidewalks that we have. We have already over fifty miles of artificial stone sidewalks, and, this year, we shall have nearly sixty miles. I regard the old wooden sidewalks as detrimental to the public health. One can hardly come to any other conclusion when one sees the rottenness and the fungous growths exposed when an old sidewalk is torn up. The wooden sidewalk has a life of six or seven years, and, allowing the artificial a life of only twenty years, we find they will be cheaper. I would appeal to this association to assist us to get a first-class road. We have not a thoroughly satisfactory material yet. Asphalt is considered good, but it is expensive. On wide streets we pay $12 a foot frontage. That is a pretty big tax upon property, but it is likewise too heavy an expense to be put on the general fund. I think macadam made with a proper class of stone, syenite or granite, which we can get in this neighborhood is the road I should prefer all things considered. But it should be laid with the care that is shown in laying asphalt and the same amount of money should be provided to keep it in repair. Asphalt unless it is kept clean, is not a good road. For the three miles that we have here it costs $4,000 to keep it clean. With half the money spent on a first class macadamized road, there will be a greater satisfaction. One point that Mr. Campbell, in my opinion, did not make sufficiently clear is the difference between the wooden pavements in European countries and in Canada. In London they have subways for water and gas mains etc., and under the blocks they have two feet of concrete from kerb to kerb. The blocks here are laid on inch boards, or perhaps, only

in sand. In London the blocks are renewed every two or three years and, in the meantime wherever the slightest defect is seen, new blocks are put down. But, I think I would advise that wooden pavements of any description be not favored. From a sanitary point of view they are not satisfactory.

DR. BRYCE I understand that in laying wooden block pavements in England, they first submit the block to a process which draws the air out of the interstices and then pour over it chloride of calcium, and subsequently dip it into a bath of wood tar which thoroughly saturates it. I would like to ask Mr. Campbell what such treatment would add to the life of the pavement. The reason I ask is that in the house in which I happen to have lived for the last ten years, Chancellor Blake, who at one time owned it had had a bowling alley laid down. In making some alterations I was amazed to find that the square timbers, which had been soaked in wood tar were in a state of almost perfect preservation. In many parts they were absolutely free from rot. Where it had broken through and got fairly within the line of tar, of course, it had eaten in as a dry rot, but, wherever the tar had thoroughly soaked in, the wood was perfectly preserved. Of course, in the case of a pavement the tar on the surface of the block would be more likely to be worn off, and wherever this occured the fungous growth would go on. But if they could harden it by chloride of calcium, as I understand they can and then soak it in creosote or tar, I believe that the block would be given increased life which would be a decided addition to the other advantages which wooden blocks undoubtedly possess.

Mr. CAMPBELL : Many people from this side, seeing wood used to pave the main streets in British cities, are not satisfied, on returning, to see the cedar blocks discarded for more expensive material. They cannot understand why it is that wood pavements are not popular in this country when they give such good satisfaction elsewhere. The difference is due to the fact that the material for use in the old country is carefully selected, all but the best resinous wood being discarded, and is treated chemically before being laid. Also, as Mr. Surtees has pointed out, owing to the way the mat-

erial is laid, there is not the same absorption that there is here. As I have said in my paper, cedar block pavements laid as we lay them here are the most shiftless class of pavement that could be adopted and, from a sanitary standpoint, must be condemned as a menace to the public health. In Windsor, Ontario, they laid about $172,000 worth of cedar block pavement about ten years ago. Most of this must now be removed. Thus, before the payments for the roadway are completed, the people are called upon to provide others, and they want to know what material to adopt. Visiting Toronto and Detroit they see asphalt which, a couple of years after it is laid, is worn into holes and being torn up between the street-car tracks, must be renewed with brick or granite setts. In other cities they see vitrified brick in which are hollows and even holes, and they find the bricks worn round, making a rough and undesirable road. And so the people ask to have the merits and demerits of these pavements distinctly set forth and plain advice given them which they should use and how it should be put down. They are willing to bear the expense, they say, but they want to know how they can use their money to the best advantage. In the majority of municipalities, the people are sufficiently loyal to the best interest of their town to provide the money for pavements, if only they can have some assurance that those pavements will be good and durable. Now, no association has taken up this question as a whole. The engineers discuss it and differ very largely amongst themselves, the difference being due, in large measure, to lack of knowledge and lack of experience. In order to educate the people on this subject, some scientific organization should take the matter up and collect the information which is to be had from the experience of cities in Europe and elsewhere. I would like very much if this Association would undertake that work. If it did it would be as successful with regard to pavement as it has been with regard to sewage and water supply, which are only the forerunners of good pavements.

Dr. HUTCHINSON: I fully endorse what Mr. Campbell has said. The wooden block pavement is an abominable pavement. A few years ago, when it was a fad we put it down in London. It is now

rotten and smells vilely, and we are taking it up again. It is so bad that we will not even allow the blocks to be burned by the people: the board of health will not permit it. As a pavement, it is so rough that no one who cares for his horse will trot his horse upon it. I know Mr. Campbell's paper to be right, because it is in line with what I believe myself.

Dr. WARDLAW: We had Mr. Campbell in Galt to tell us about good roads. His coming there was due to the efforts of the bicyclists, who I believe, will do more to bring about the building of good roads than most of us. Under Mr. Campbell's advice we have laid the pavement on our side street. We used broken stone, limestone from the river bed and had the steam roller run over it It was fine at first but now the dust is blowing in clouds and the merchants are complaining. I would like to ask Mr. Campbell if there is any way to get over that.

Mr. CAMPBELL: I think that if broken stone is to be used you should use the local stone of the Guelph formation for the foundation, but I would advise the importing of a harder quality for the surface. As Mr. Surtees said, syenite, granite or trap rock can be cheaply obtained. In Galt, you could get your supply from Hagersville. You can get it as cheaply as we get it in St. Thomas, where we have a good many streets laid with it.

Dr. ANDERSON: So far as I know, block pavement is the most foolish that can be adopted. Smith's Falls is a good town and expects soon to be a city. We have there a few block pavements and they are a perfect nuisance. We have discarded that form of pavement altogether. At the last meeting of the town council we passed a by-law for the laying of concrete walks on the business street. We will do away with plank walks as much as possible, and hope to adopt the artificial stone walk more and more generally, believing it to be the cheapest in the end.

Dr. CASSIDY: I was asked by Mr. Shuttleworth to read his paper and you must take it as his utterance. I do not mean to say I am not prepared to endorse the views he expresses because I look upon the question of typhoid from a different standpoint from that

adopted by many others. I do not think that the condition of the road has much to do with it. It is communicated by contagion, and, therefore, the question of pavement has little to do with it. At the same time, I think there can be no doubt that the condition of the road must have considerable influence upon the health of the persons who live beside it. It seems reasonable to think that a road which contains such a large percentage of ammonia as found by Dr. Polack, to whom reference has been made by Mr. Campbell, must have a deleterious effect. Dr. Polack has written a monograph on the subject, which is referred to in the *British Medical Journal*. We, as sanitarians, can hardly be called upon to endorse a road having this characteristic, particularly in view of the unfortunate way it is laid in this country. As to such roads in England, I can only say that the 'bus driver beside whom I sat when driving about London, expressed delight with the wooden block pavement. It was an easy road for his horses, it was smooth and noiseless, and he considered it the best kind of road in London. Noiselessness is a strong point in connection with health. You must consider the nervous system, and, in its effects upon the nervous system a noisy road is deleterious. Speaking not as an engineer but as a citizen and one who has lived beside an asphalt road, I believe that, if we could get such a good wood road, and then if we could go down in our pockets and provide the money to keep it clean and keep it in repair, and if we would not expect it to last for ever, but would renew it say every seven years, the results would be satisfactory. It is true the road which was made the subject of Dr. Polack's experiments in Warsaw was made of pine blocks soaked in sulphate of copper. Still, it was found to have a large percentage of ammonia. We cannot discuss the question in all its bearings. The question of durability and the question of ease of traction are for the engineer to consider. We are interested in the sanitary condition of the road, and if we are satisfied that a road is not deleterious to the public health we should endorse it. If it possesses the other good qualities of smoothness, noiselessness and durability we certainly have the ideal road. I would suggest, if the meeting think

well of it, that we should appoint a committee to consider this matter and report at the next meeting. It may be that engineers and sanitarians can work together.

Mr. VAN BUSKIRK: It must not be forgotten that it is not enough to lay a road. All roads require constant care. Asphalt, stone or wood must be kept clean. Macadam requires less attention in this respect than others, but it must be frequently watered. It would be interesting to find out the cost of repairs and cleaning for the different kinds of roads. The cleaning in most towns is not properly attended to and, in the case of cedar blocks as laid here, cleaning is an impossibility. As laid in England it is possible to clean them, and that is a strong point in their favor.

Dr. CASSIDY: Acting upon a suggestion that has been made to me, I move that a committee be appointed by the Chairman to consider the questions brought before the meeting in the papers of Mr. Campbell and Prof. Shuttleworth, regarding them from the standpoint of health as well as of road construction and of the various interests involved, and report at the next meeting of the Association.

The motion was duly seconded and unanimously adopted.

The meeting adjourned until 8 p.m.

EVENING SESSION.

The Association met in the Russell House at eight o'clock. The President in the chair.

Dr. P. H. BRYCE, Secretary of the Provincial Board of Health, read his paper on "The Duty of the Public in Dealing with Tuberculosis."*

The PRESIDENT, in declaring the paper open for discussion said, I see a number of our American friends present. We are glad to have them with us and particularly invite them to express their views on the subject which has been brought before us.

Dr. BRYCE: To encourage our modest American friends, I would ask Dean Carey, who has come here from Kingston to seek membership with us, again to address the meeting.

* This paper is printed in the Annual Report of the Provincial Board of Health for 1898, and is omitted here.

Dean CAREY: It is not necessary for me to praise the paper that has been read, for all here must appreciate it highly. There are two special causes for this disease which would be well to touch upon. One affects the young girls in our schools. The strength of these young people at a time when they want more exercise and fresh air than the curriculum of our schools will allow, and their work is done in school-rooms that, as a rule are not as large and well ventilated as they ought to be. Another cause is that in the past, for one cause or another, physicians have failed to isolate tuberculous patients in their homes and in the hospital. In Kingston we are putting a wing on the hospital and the upper flat has rooms set apart for this disease. I would like to hear what medical men have to say with regard to these two points of over-taxing the strength of young girls and the necessity of isolating, even in their homes, those suffering from tuberculosis.

Dr. LEE, Philadelphia: I am very much surprised to hear the statement that has been made as to the large amount of aid given to hospitals in this Province. I had supposed that the Legislature of my own State, Pennsylvania, was the chief offender in this line. But, if we take the population and development of Pennsylvania, and compare it with those of Ontario, I think we shall find that the Legislature here has been doing more proportionately in the way of supporting charities than that of Pennsylvania. My conviction is that our Legislatures make a great mistake when they interfere with private and municipal charity. I believe that, in a certain way, they are helping to pauperize the community. I believe that the municipality is the unit which should attend to the care of its own sick poor, and not the State. But, when we come to the question of consumption we have an altogether different condition of things. We have a communicable, we might almost say contagious, certainly infectious, disease, and we have been led to believe that, by isolating those who are affected by it, we prevent it spreading. Here, I think, is a thoroughly legitimate opportunity for the State to render aid, not as giving charity, but as protecting its citizens. I believe that in such a case the State has a right to use the public

means to protect its citizens, especially to protect the health of its citizens. And if, by the establishment of sanitariums and the removal to them of the poor who become affected with tuberculosis, it can protect the large mass of the people from the disease, I think it may legitimately use its powers for that purpose. But the expression made use of by Dr. Bryce when, in speaking of the use of the money of the State in the administration of private charity he spoke of it as a phase of Socialism, I think, was entirely justified; and I think that at the present time we need to be carefully on our guard against the introduction of too much Socialism in our general governments.

Dr. CASSIDY, being called upon said: Speaking as I do without preparation, I fear that my remarks will be but crude. I have listened with great interest and pleasure to Dr. Bryce's paper. Any thing that Dr. Bryce gives us is the outcome of close observation and mature thought. Those who have to do with the development of charities and the application of medical skill to the relief of the needs of the poor know that in these matters he is an excellent authority. Still, each must consider the question from his own standpoint and in his own way. For my part, I am instinctively a Democrat. I believe in the rights of the individual to look after his own interest. At the same time, it must strike one that in the case of such a widespread plague as tuberculosis, which has been well called "the great white plague" of this continent, we may admit that the functions of the State should extend a little further than we have allowed them to do in other matters. In this and in all civilized countries the physician has done and continues to do his full share towards the public good in using his skill and knowledge freely for the benefit of the necessitous poor. If, therefore, he looks to the State to do a share toward keeping down such a plague as tuberculosis, it can hardly be said that he is going too far. The very commonness of this disease should stimulate scientific men to overcome it. We have diseases which come at certain seasons, we have diseases which affect particularly those engaged in certain occupations. But this disease we are now discussing is with us in all

seasons and attacks persons of every class If science deliberately says that it can prevent the spread of this disease, I think that it is perfectly legitimate to ask the State to afford the means to carry out a work of such vital importance. There has been great advance of late in our knowledge of this disease. In my time men were taught that it was a constitutional and hereditary disease. The idea of it being contagious was not considered in the days when I sat on the benches of a medical school. I believe that that had not even been mentioned by any authority at that time. Now a different conclusion is forced upon us by the facts observed by careful students all over the scientific world. The position we now take is that, given suitable tissue for the reception and culture of the bacillus tuberculosis, and tuberculosis will result. This fact and the proposals based upon it, such as those suggested by Dr. Bryce bring us face to face with many questions, which I must touch upon but lightly if I am to avoid trying your patience to too great an extent. Is the State to be the bread winner for every family whose bread-winner is sent to a sanatorium because of tuberculous taint? Is it to oversee the bringing up of the child so as to assure itself that the tissues of the adult shall be able to resist this disease? And, if not, how shall it avoid the odium of having failed to use its powers and to act upon knowledge which science had acquired? Good food is one of the first considerations if people are to be strong enough to resist this disease. Will you, then, carry out Socialism so far as to provide the citizen with food or to see that he is provided with it? That seems iconoclastic, but it seems also a legitimate conclusion from the paper that has been read to us.

But, I promised not to enlarge upon these points, I come now to some practical ideas, and I speak as a physician. The duty of the physician is, as much as in him lies, to attend to the prophylaxis of tuberculosis, giving to this all his learning, his skill and his courage. For it is not so much in learning and in skill that the physician is apt to be lacking as it is in courage to speak out. He knows that if he wishes to perform an operation successfully his own hands and his instruments and the body of the patient must be clean, and he

does not hesitate to take measures to that end. Why should he not follow the same principle in dealing with a case of tuberculosis? If he believes that this is a contagious disease, he should act upon that belief. Where he finds in a family a tendency to the disease, let him be guided by the dictates of medical science, and, if a case exists in the family, above all he should provide for the control of expectoration. All writers and observers agree that if the sputum of the tuberculous patient is destroyed one great source of danger of spreading the disease in the family is removed. They will ask: Are we to have cuspidors in every room? Yes, and they must be perishable ones, of material that can be burned. I think the iron cuspidor is a horrible thing. I had a patient threatened with tuberculosis whom I sent to South Carolina. He told me afterwards that the thought of the big iron spitoons in the rooms made him sick. Not only is this big spitoon horrible, but it is scientifically incorrect. Have cuspidors that are perishable or, at least, that can be cleaned. The big iron spittoon cannot be cleaned or disinfected. As to sanitoria we are yet in the initiatory state in this country. We have begun well, and Dr Bryce has told us that we are likely to do better. Leaving aside the question of Socialism, I think much can be done by private benevolence, and I think we all agree that this is one of the best ways in which that benevolence can be manifested. Of course, so far as Ontario is concerned, the State has shown itself most generous. No matter what our politics are, we must all agree in that, and I think it has received, and will receive from persons of all politics, credit for what it has done. But this need not limit private benevolence. We have rich men in this country, and why should not one or several of them establish a sanitarium as well as endow a college or build a hospital? Of course, I do not say that the results are certain to be as brilliant as we might like. I fear, from the nature of the disease, that the patient's residence in sanatoria must necessarily be long. I think that is the opinion of the best observer. Where a cure is sought by means of fresh air, careful dieting and prudent management rather than by medicine, you must expect that it will take a long time—a good many years. That

is why I, for one, would consent to the powers of the State being extended beyond the ordinary limits, and the money of the State used to assist in carrying on the sanatoria. There is another reason. You are sure to have a case of galloping consumption, which cannot be cured, sanitarium or no sanitarium, but which must be so dealt with as to prevent spreading the disease. So I come to the point with which I started, I believe in prophylaxis. The medical profession should use their power and influence, which are immense, to thoroughly instruct the people as to the means by which tuberculosis is spread, and the means by which its spread may be checked.

It seems to me, after reading the results of the experiments, that the danger arising from the coughing of tuberculous patients should be made known, and that they should be warned to take some precautions such as holding a handkerchief before the mouth in coughing.

Dr. PROBST: It seems to me that we do not dwell enough upon the curability of tuberculosis. We have been teaching the people that the disease is infectious, but we have not yet removed the impression from the public mind that it is necessarily a fatal disease. The physician often hesitates to report a case of tuberculosis to the patient and to the family because of the impression that that would be practically reading the patient's death warrant. In a case of infectious disease, such as smallpox, the patient is removed to the hospital devoted to the treatment of infectious disease. Now, how can we best present the argument in favor of removing consumptive patients to the hospitals referred to in the paper we have just heard? It seems to me that our strongest argument is that that is the place where the patient has the best chance to be cured. I would not urge it for the protection of the family, though that is undoubtedly important. We shall be stronger with the people if we can show that this should be done for the benefit of the patient. It seems to me most important that the diagnosis should be made very early in the disease. The question of the length of time the patient should spend in the hospital has been brought up. It depends, it seems to me, on the stage the disease has reached. If we insist upon and

emphasize the curability of the disease, we shall probably be afforded opportunity to treat it earlier. I was much interested in what we were told as to the effect of coughing. But I could not help thinking of the array of statistics published to show that healthy people might live in consumptive hospitals for years without fear of infection, if only the sputum was taken care of. It seems to me that there is a discrepancy between these figures and the statements that have been placed before us this evening.

Dean CAREY: I know of a case which illustrates what has just been said as to the curability of the disease. A gentleman living near Kingston had a son who was taken with consumption seven years ago. He was pronounced by local physicians incurable. He went to New York and the physicians expressed the same opinion. He reached Albany on his way home and there he met a friend who had been spending some time in the Adirondacks. He was persuaded by his friend to go and spend a time with him, and now he is almost perfectly well. The only condition of health is that he must remain there two-thirds of the time. If he returns to Kingston, he can only remain a month or so. It would seem that under right conditions, unless there is some difficulty, hereditary or otherwise, consumption can be cured.

Dr. GUYON, being called upon, said: I do not think there is any question about the duty of the public in dealing with disease. As a result of the spread of knowledge on this subject, we have now in all the New York street cars notices conspicuously displayed that spitting in the cars is prohibited by order of the Board of Health. This is the greatest advance made in recent times in the city of New York to prevent the spread of tubercular disease. In Philadelphia they go further and even forbid spitting on the streets. Of course if we instruct the people that it is dangerous to expose oneself to disease, we accomplish much. And, in that connection, I would ask you, Mr. Chairman, if you do not think we subject ourselves to some danger by remaining longer in the atmosphere of this room?

The meeting then adjourned.

TUESDAY, September 27th.

MORNING SESSION.

The meeting was called to order at ten o'clock, and immediately proceeded to the business of electing officers.

The following officers were elected for the ensuing year :—

President—Dr. J. J. Cassidy, Toronto.

Vice-President—Dr. Hutchinson, London.

Secretary-Treasurer—Mr. J. J. Mackenzie, Toronto.

Council—Mr. Van Buskirk, Stratford; Dr. Fee, Kingston; Dr. Robillard, Ottawa; Dr. Wardlaw, Guelph; Dr. Hall, Chatham; Dr. McCrimmon, Palermo; Dr. Sheard, Toronto.

The President nominated the following committee to investigate the sanitary aspect of street pavement :—Mr. McGill, Mr. Van Buskirk, Mr. Shuttleworth, Mr. Mackenzie, Dr. Bryce and Mr. Campbell, the latter to be convener.

After passing votes of thanks to the Mayor and Corporation of the City of Ottawa the meeting adjourned.

ANNUAL ADDRESS.

By Milton McCrimmon, M.D., Palermo, Ont, President.

Gentlemen of the Association,—As it has been the honored practice in past presidential addresses to review some of the phases of practical work which we as Executive Officers of Health are engaged, I do not purpose to depart from such a wholesome rule, but shall refer principally to some of the matters which as Medical Officers of Health and Health Boards in rural districts we are called upon to deal with.

Before doing so, however, allow me, gentlemen, to thank you for the honor you have done me and the representatives of the rural sanitary districts in electing me to preside over your sessions. While it is true that I represent the Boards and Officers of some seventy per cent. of the population, I can hardly claim to represent that proportion of the sanitary work done in the Province. As there is every stage of complexity in human society, from that of the roving hunter or trapper, almost daily moving his camp through an almost illimitable wilderness to that of a population density of some 75,000 persons to the square mile,—as in some of the larger American and Old World cities,—so necessarily sanitary work must become more complex if we are in any adequate degree to supply, by all the means which modern science has placed at our command, even a moderately wholesome set of conditions for man living under such artificial conditions, so far removed from those natural ones which rural life supplies on almost every hand in our settled and cultivated townships and villages Yet experience teaches us that in rural districts we may have in effect practically the worst conditions of urban crowding.

It has come within the experience of every rural practitioner and health officer to deal with outbreaks of disease in some old log cabin, where some poor family with the poor man's blessing,—a numerous family,—has become infected with contagious disease, such for instance as diphtheria or typhoid fever. Remembering the

limited air space, the small windows, the absence of means for ventilation, the superstitious fear of the olden time of fresh air in the sick room, and add to this a damp cellar, often with decaying organic matter and the decaying logs of a rotten foundation, and it is difficult to conceive of any urban conditions more likely to promote severe cases with more fatal results, than those described. Reports of outbreaks of diphtheria published in the annual reports of the Provincial Board of Health occurring in the frontier settlements of Parry Sound or Nipissing fully illustrate what serious results such conditions may produce.

A similar illustration of overcrowding in rural districts is not infrequently found in the country school-house. From time to time we see published reports of the prevalence of disease in city schools, but as illustrated by a recent experience of my own, infection may most readily and unknowingly be disseminated by school children.

We have noticed with pleasure the statistical evidence of a great decrease of typhoid deaths in the Province during the past fifteen years; and, apparently, this decrease has been most intimately associated with the closing of town wells and the introduction of a public water supply. It must be recognized, however, as a fact, that in rural districts there is still, as a rule, much ignorance as to the dangers of organic pollution of wells, and most crude means taken as remedies. It does appear to me, as a rural health officer, that where so much time and attention and money are being expended on Farmers' Institutes, the progressive Minister of Agriculture might spend a little energy on the farmer himself. How common it is for local sources of soakage pollution to the house well to exist, and the farmer's family exposed, with others who may get milk products from such farm, to a disease, the oprobrium of a community priding itself on being cleanly in its habits and customs.

This reference to the farm naturally leads up to the problem of healthy cattle. Speaking generally, Canadian cattle are healthy, and probably nowhere on the continent is cattle breeding so much studied or so generally understood. But it cannot be forgotten that just as we have seen that overcrowding or population density may

exist in the small houses of our rural districts, so may we have, and constantly do have, an intense population density for six months a year in our stables. Any, who know how stone stables are built, with every care for warmth, often almost without light, floors down on the ground and usually no effective drainage from them, will know what I mean. It would be unreasonable and illogical to expect that cattle exposed day and night in the pure outer air for seven months in a year can be placed in a stable, often with a cubic air space per capita less than for children in a house, though cattle have ten times the lung capacity, without soon becoming infected with any aerial contagion which may exist in some diseased animal in the stable. We have seen a prominent newspaper recently in its editorial columns refer to the fact "that the tuberculosis scare was about ended," while in a tone of banter, which can only be excused on the grounds of ignorance of the facts or those of political expediency, made light of the dangers which we, as medical practitioners, know attach to the problem of the spread of tuberculosis by meat and milk infection. It must be remembered that the cattle population of Canada is at least equal to the human population, and that the intimate relation between man and the domestic animals supplying his food is almost as close as that between residents in the same household.

Another point which I deem it proper to refer to is the need, with the increasing wealth of our country homes, to have people taught how cheap and easy it is for the sanitary conveniences, as the introduction of water to the house by windmill or by a pump placed in the kitchen, even though the well be several hundred feet away, and for the disposal of the refuse water and organic matter to be carried off automatically to the great comfort and health of all, but especially of the female members of the household. The absence of such, touches most closely not only upon the aesthetics of rural home life, but upon those slight influences which tend not only to maintain health, but to keep the boys at home by making it attractive. From what has been touched upon it need hardly be said that the work of the rural sanitarian is not over.

In some interesting statistics published in a report by Dr. P. H. Bryce at the meeting of the Provincial Board of Health in May last, it would appear that while Local Boards of Health may generally exist in most rural districts, yet as very few Medical Health Officers receive any salary and are supposed to do sanitary work only when directed by the Local Board of Health—while in most cases the members of the Boards get $2.00 a day and mileage—it would seem that many councils deem the power to make such appointments as another mark of esteem on the part of the Government in adding $2.00 more per diem to their remuneration as wise municipal councillors. While doubtless many rural Medical Health Officers do good work *con amore*, it must be said that under present condiditions the work cannot advance, and nothing less than at least one centrally situated County Medical Officer with inspectors under him in the townships will ever be sufficient to give us systematic and effectual sanitary work. How much such an officer might do in teaching the people matters relating to school hygiene, domestic hygiene on the farms and supervision and experimentation into the causes of epidemic diseases amongst animals I need not further illustrate.

But though we have not travelled very far in scientific public health work in rural districts, yet we have made a start. I think the trouble has been that as an Association we have been too modest. Every other Association applies to the government for grants to establish experimental stations, to publish extensive literature, to pay travelling teachers of agriculture, of apiculture, of cheese-making. We ask for nothing, and get it. It seems to me that it is high time that the attention of the public and that of the government should be brought to the need of funds, not only for disseminating a knowledge of sanitation, but for a wider experimentation into the causes of diseases.

The Provincial Board of Health Report for 1897 in a long article urges, by illustration and comparison, the need of laboratories for research. I take it that while much has been done with the facilities at their command, yet the Board must feel that the work is scarcely being touched.

And now, gentlemen, in conclusion I trust that further pressing home of subjects which this Association has before dealt with by you will be taken up in the discussions of the papers which are to be presented at our sessions. What I trust will be fully dealt with is the pressing upon the Government, whether general, provincial or municipal, the need for simplifying their organizations which cover really the same work and which cannot be separated. Dominion veterinary inspectors, Provincial tuberculin testers, municipal boards of health, and practicing rural veterinarians are daily having outbreaks of disease before their notice demanding attention, and yet which are really being neglected by all, for lack of system, and courage on the part of the several authorities.

Further, I hope that the Association will again urge that the Government will extend its laboratory facilities for the investigation of original problems, and legislation by which many rural boards of health existing largely in name only, should have their powers and duties concentrated under a county or district specially trained health official, under whom we may expect to see the general high standard of health, whether of man or animals, already existing still further improved.

For such objects we have labored, and believe the public has appreciated the work done; we look to them who are to be the beneficiaries to supply the organization and means for the ends which we feel sure we will see attained.

INSPECTION OF MEAT FOR THE LOCAL MARKET.

By J. J. Cassidy, M.D., Member of the Provincial Board of Health.

For a number of years, notably since 1884, the United States Government has enforced a system of inspection of all cattle, sheep, calves and hogs intended for export and interstate trade. The motive that prompted this action was founded on the commercial interests of the American people. As the meat industry, which ranks third in importance in the export trade of the United States, was threatened with serious opposition in Europe, it was deemed necessary to place it above all criticism or suspicion. Hence, through the agency of the Bureau of Animal Industries, extremely rigorous laws were, and are being, enforced in the work of inspection. Through the operation of this bureau 102 registered abattoirs, distributed over twenty-six cities in the United States, were established in 1896, and 35,917,479 animals were inspected, of which 89,399, nearly one-quarter of one per cent., were condemned.

Strange to relate, outside of these inspection centres the butcher may practically do as he pleases, and nothing prevents non-inspected meat from reaching the markets of the large American cities.

Canadian export cattle are not inspected according to the rigorous methods of the Bureau of Animal Industries, and they are not equal, either in weight or quality, to the animals sent to Europe by the American stock raisers.

In Toronto there is an inspection of cattle by an officer of the local Board of Health. The report of the inspector for the year ending October 31st, 1897, shows that the following animals passed through the market for export and home consumption :

Cattle	134,335
Hogs	211,486
Sheep	90,497
Calves	5,762
Total	442,080

Of the above, the inspector intercepted sixty-three cattle, which were affected with lumpjaw or other tumors. These were slaughtered and, if the disease was found to be entirely local, the affected parts only were destroyed. The carcasses of four cattle and one hog were cremated. Thirteen cattle, eighty-seven sheep, ten calves and 132 hogs, which had been killed in transit, were consigned to the rendering tank to be converted into patent manure.

Of the meat intended for the local meat trade of Toronto, part is derived from choice beef cattle; but, unfortunately, the entire supply does not come from such a select source. Even the carcases of animals which die of puerperal fever and pneumonia are bought and dressed for the market.

Again, there were in 1896 in the Province of Ontario 920,346 milch cows. Now, when animals of this class have become useless for dairy purposes, as the result of wearing out under high pressure, old age, or disease, they are sold to drovers, who scour the country looking for such material, and shipped to Toronto or some other town in the Province for slaughter and conversion into dressed beef and various kinds of sausage. Some of these cattle are sent to the regular cattle market and are there bought by butchers, while others are sent from the country direct to the little slaughter-houses in the city. It is quite likely that a high percentage of such dairy cattle are affected with tuberculosis, and some of them in an advanced degree. At present, however, no means are available to the consumer for discovering the existence of that disease in animals intended for slaughter. The owner of an animal may suspect that it is tuberculous; he may, in fact, have diagnosed that disease by the tuberculin test, but he keeps his opinion to himself and sells the animal in the local market to the best advantage. The condition of the city slaughter-houses is variously represented, an inspector of the local Board of Health stating that they are not nuisances, while a leading city veterinarian says they are extremely filthy and ill-kept, so much so that "if the people of Toronto knew the horrible surroundings and the disgusting conditions of the places where their meat is dressed, they would feel too nauseated to eat it."

If to protect ourselves against such neglect and wrong doing we admit that inspection of cattle before slaughter and of meat before marketing are necessary, we are confronted with the question as to what system will best fill the requirements of the situation. The answer is that in many places (more than six hundred in Germany) there are municipal abattoirs, in which it is required that all the slaughtering shall be done. The preliminary inspection of animals intended for slaughter, and the passing of the meat intended for the local market, are easily secured when the work is done at one place, but they cannot be done by the most efficient and energetic inspectors if animals are being killed in thirty slaughter-houses at one time. An abattoir is not a very expensive affair. It is stated on the authority of the Provincial Board of Health of Ontario, that an estimate of the cost of an abattoir and pens, 50 by 20 feet, calculated for a population of five thousand, according to Toronto prices would be $1,572 50. At the Western Cattle Market, Toronto, an abattoir has been erected at a cost of about $50,000 by a private individual. It is a substantial brick building, and is fitted with the needful requirements, including an excellent system of cold storage. The accommodation is sufficient to provide for the dressing of two hundred carcases of cattle a day, It may be used for a small fee by the city butchers. There is no inspection of meat. A simple examination of the cattle intended for slaughter and a subsequent inspection of the viscera and meat by a competent veterinarian, would make this quite a model institution—so much so, indeed, that the City Council might, if it were legal to do so, order the butchers to use this abattoir and close their slaughter-houses.

In Ontario an Act for the Inspection of Meat and Milk Supplies of Cities and Towns, being chap. 63, 59 Vict,, makes it optional for cities and towns to construct municipal abattoirs simply requiring that any city or town establishing an abattoir shall construct and equip it according to the regulations adopted by the Provincial Board of Health, and have the inspection of animals and meat carried out as provided in section 108 of the Public Health Act. It may be stated, *en passant*, that this Act would be more workable if

a section were introduced stating that " when an abattoir shall have been established in a municipality all the butchers shall be obliged to stop using their slaughter-houses; and all butcher's meat sold in the municipality shall have been dressed in the abattoir." So far not one of the 745 municipalities of Ontario has provided a municipal abattoir. The capital of the Province might be supposed to set an example by initiating this important reform; but, so far, the Tor- City Council, though requested to do so, has not taken any action in the matter. Certainly, however, if the people of Toronto wish to have the assurance that the meat served at their table is free from disease, their is no other method than to request the City Council to provide an abattoir, in which all animals intended for the meat market shall be examined before slaughter, and the meat inspected by a veterinarian before it is marketed. There are other important sanitary improvements which would follow the establishment of a city abattoir. At present there are about thirty slaughter-houses in the city. The offal and the blood at these places are collected every evening by a contractor, who removes them to an establishment where they are converted into a fertilizer. As these slaughter-houses are mostly situated in the suburbs of the city and the offal is removed every day, there is no malodorous nuisance in the populous portion of the city. From the standpoint of the meat trade, however, a city abattoir would offer superior advantages, in the interest of the butcher as well as his patrons.

It would do away with the poor, badly equipped, badly managed slaughter-houses, which in many cases are nuisances in their respective neighborhoods. It would make it unnecessary to drive cattle through the streets, a practice that blocks traffic, frightens people, and at times occasions serious accidents. It would give small butchers the advantages enjoyed by the wholesalers; they could use the facilities of the large slaughter-houses, which are superior to their individual establishments, and the cold storage system could be used by all, with economy to the dealer and advantage to the consumer in the increased wholesomeness of the meat. The offal and the condemned organs and carcases could be disposed of to better advantage

Moreover, it has been shown by repeated trials of this system that, instead of increasing the cost of meat, it tends to reduce it. A large system can be conducted by co-operation between butchers at less expense than when each has his own establishment. The European system of municipal ownership is undoubtedly most desirable. It has been found that the rentals from abattoirs are sufficient to pay the running expenses and to afford a reasonable return on the investment. The whole system is not only an advantage to the consumer of meats, but it subjects the butchers to no hardships whatever, and makes it more convenient and cheaper for them to conduct their trade. Although the butchers may be in favor of the seeming privileges which they possess at present, we feel confident that, after they have examined the question from every side, they will decide for an abattoir, *in their own interest* as well as for the advantage of their customers. Should this opinion be verified, we may expect to see established in Toronto a system of inspection, based on common-sense, not vexatious to those who have cattle to sell or expensive to those who prepare meat for the market, and such as will commend itself to those who wish to improve the public health.

THE MUNICIPAL MEAT INSPECTION OF BURFORD TP., CO. BRANT, ONT.

ROBERT HARBOTTLE, M.B., MEDICAL HEALTH OFFICER FOR THE TOWNSHIP.

GENTLEMEN: The municipal meat inspectiom of Burford Township is conducted under our idea of what the law should be, not what it is, but the good points of present Dominion and Ontario Acts are utilized. Every farm animal whose products are used as food in any part of his or her life is subject to inspection when the M.H.O. observes, or any reliable person informs him, preferably in writing, that a certain animal on a certain farm or road has any of the diseases mentioned in The Animal Contagious Diseases Act. The township pays the expenses of its M.H.O., also of a V.S if the M.H.O judges it useful to have the opinion of a V S. to satisfactorily examine any suspected domestic food animal owned in this township, also whatever is necessary to educate the owner of such animal on whatever contagious disease that animal has, giving him freely any information in books or laws, which he may read, besides answering his questions, giving him to understand that it is to his damage to keep alive such animal on his place, and that he cannot sell any of its products for food without subjecting himself to a heavy fine; that his neighbors and the public generally will report any transgression of human rights he may be guilty of, and that a bad name thus acquired will damage him for life; that he had better poison a person with arsenic or strychnine than with any one of those diseases communicable from food animals to man, for in the former case the party is soon out of misery, but in the latter it may entail years of sickness, cost and suffering before the person dies, and others may get it from him; that the animal cannot be sold off the place and valuable consideration collected therefor, notwithstanding any legal opinions to the contrary he may get and notwithstanding the printed opinion

purporting to be "conducted by D. McEacheran, F.R.C.V.S.," in the veterinary department of a paper, thus, "If, however, you made no inquiries of him as to the soundness of the animal, but relied on your own judgment, and he said nothing to mislead you, he may not be liable in law"; The business law, Burford Township M.H.O. department is running under is laid down in Leviticus xix, 14, to the effect that thou shalt not put a stumbling block before the blind. Judge Dartnell of Whitby decided a case to the effect that such animals need not be paid for, also allowing costs, forming a valuable precedent. Also we let the owner understand that the animal will soon die in the course of the disease, and is practically worse than useless to him or any one else, and that while he is allowed in cases of actinomycosis, tuberculosis and osteosarcoma, the only diseases so far, I have been called on to examine, and mentioned here in the order of their frequency, to sell the hide, the infected parts, if any, being cut out, provided he notifies the buyer in writing of the disease, the fat for soap grease only, the joints for neat's foot oil, believing that the heat used in the last two processes destroys infection, though so far only the hide has been used, and that the remainder of the carcass must be buried, the highest portion of it three feet below the surface of the ground so that the process of nature do not again bring it to the surface, as may be done by earthworms and other burrowing animals, etc.

To the above course one exception is allowed. Any party having an animal affected with actinomycosis is allowed to have it cured by a V.S. by operation or otherwise, but no product from it is to be utilized till two months after the veterinary surgeon has quit treatment, and then if found cured by the M.H.O. or V.S. appointed by him, the animal is reinstated as healthy, the costs of treatment and second examination being borne by the owner. We have had a number of such animals cured when the disease was young and located in the glands round the head. We believe the germs can enter a natural pore or orifice without the tissue being damaged, pass into the blood circulation and be caught in the first gland in its course, or set up trouble in the tongue glands, entering by their pores. Attention to

animal diseases for wholesale examination as above was first begun in this township in 1897. The public heartily now attend to it themselves at their own cost, except that for eight months of 1898 an animal affected with actinomycosis and one with osteosarcoma was examined at the township's expense and destroyed by the owners, I having heard of no other animal contagious diseases in the township so far. At first we had to cut our eye teeth with the threatened law and legal opinion, once an adverse V.S. opinion, the aim of sellers to make gain and not stand what should be their own loss, besides paying the buyer's loss, with the time used in the case posting the interested parties, etc.; but so far no seller has dared to collect, but has had to pay the buyer's loss of time, etc., except that in one case buyer's loss of time could not be collected as the first owner's affairs were said to be in a snarl.

We have been aided by the general public, the butchers who even detect diseases after killing the animal not surmised during its life, who inform owners of bad animals and refuse to purchase such animals; by the newspapers of the adjacent city of Brantford, town of Woodstock, etc., who publish freely information to the public; by the majority of owners of such animals; and once opportunely, in our first case of tuberculosis many years ago, by a subscription of $4, said to come from the employees of the Bank of Montreal; and last, but not least, by the veterinary surgeons. Our people are encouraged by the endeavor to capture the important meat supply of the neighboring city and towns, and the easy sale of meat now. I enclose a sample of the printed notice used, and think if other municipalities adopt our plan the question of animal contagious diseases will be solved without much expense to Government, which offers to test forms of tuberculosis free. Our township expense in connection with above meat inspection was about $36.25 in 1897, and very little this year.

ON THE MOST RECENT METHODS OF SEWAGE DISPOSAL NOW IN OPERATION IN THE UNITED STATES, BEING TO SOME EXTENT THE OUTCOME OF EXPERIMENTS MADE BY THE MASSACHUSETTS STATE BOARD OF HEALTH, WITH REMARKS UPON THEIR ADAPTABILITY (IN WHOLE OR IN PART) TO CITIES IN CANADA.

By Charles G. Horetsky, C.E., of the Ontario Public Works Department, Toronto.

Gentlemen of the Association of Executive Health Officers of Ontario:

At your tenth annual meeting held at Belleville, Ontario, in 1895, I read a paper upon methods of sewage disposal then used in some of the provincial institutions of Ontario.

In December, 1895, I was one of the consulting engineers with reference to the disposal of the sewage of the City of London, Ontario and then recommended a system of land disposal or filtration, my recommendation being largely based upon the successful working of the Brockton, Mass., plant then in operation, and upon the very doubtful success of several chemical systems visited upon a tour of inspection through the United States in October of that year.

Since 1893, further and most important discoveries in this direction have been made by the Massachusetts State Board of Health at their experimental station at Lawrence, Mass., where the last few years have been devoted to researches upon the capabilities of gravel and coke filters aided by forced aeration. A description of these experiments would be interesting, but out of place here, and can be seen in the different annual reports. It will suffice to say that the conclusions arrived at, offer a great incentive to the practical ingenuity of all those interested in the construction and maintenance of sewage disposal plants.

It has been demonstrated that filters of gravel of an effective size of 5.40 m. m. can produce a most satisfactory effluent, and

remove from 60 to 85% of the organic matter of strong city sewage, at the rate of 400,000 gallons daily per acre.*

Coke breeze (screenings from commercial coke) has also been found of immense value as a filtering and straining medium, and possesses the advantage of being fully as valuable for purposes of combustion after its use as a sewage strainer and sludge retainer, as before. This will be discussed further on.

As regards the forced æration applied to these experimental filters, pipes were passed through and within 6 inches of the bottom. A fan blower driven by electricity was attached, and, while the fan made 3,600 revolutions per minute, an air current capable of sustaining 3 inches of mercury was forced through the filters. By frictional loss the force of the current was reduced fully one-third.

In the experiments with the coke filters up to January 1st, 1895, the average rate of filtration was 260,000 gallons per acre daily for six days in the week, while the average removal of organic matter (albuminoid ammonia) and bacteria was 95 and 98 per cent. respectively.

In 1894 Col. Waring instituted experiments upon sewage purification aided by forced æration at Newport, R.I. These were continued during five months, from May till October, and the results set forth in a pamphlet, which also contains a synopsis of the chemical work and investigation carried out simul aneously by Mr. Geo. W. Ralfe, A.M., (Harvard).

The Willow Grove Park (15 miles from Philadelphia) Sewage Disposal Plant was constructed by Col. Waring upon the principles evolved by the Newport experiments. It is simply composed of a set of "Strainer" and "Ærater" beds $\frac{1}{8}$ acre in extent in all. The sewage applied daily is assumed to be from 60,000 to 100,000 gallons.

The resulting effluent at date of my visit on 6th Sept. was very good, clean, and odorless, and the most of it was in daily use for sprinkling the lawns and roadways at Willow Grove.

* In a sample of sand or gravel, the effective size is the maximum diameter in millimeters of the finer ten per cent. of the sand grains, or gravel.

I found, however, that the receiving well was clogged with hard compact sewage to the depth of 4 feet. This will have to be removed eventually by hand, as it cannot be pumped up.

The man in charge informed me that the plant had been one year in operation, and that the "Strainer" beds have to be over hauled every season (every six months), and the material washed and returned to its place. This, he says, occupies three men during a week.

As to the conclusions arrived at, by the chemist in charge during Col Waring's Newport experiments, they indicate that a "Strainer" tank can remove 40% of the nitrogenous matter in ordinary sewage, if this sewage, roughly strained and free from mud, is applied continuously, at a minimum rate of 3,000,000 gallons daily per acre; and that an "Ærater" bed one acre in extent, with nitrification properly established, and proper manipulation, will remove 95% of the organic nitrogen of a "Strainer" effluent, applied at a rate of at least 800,000 gallons daily. It will do so for an indefinite period, under, of course, proper conditions of working. This means that ¼ acre of strainers, and 1 acre of ærators (1¼ acre in all) will suffice for the treatment of the sewage of 10,000 people at the rate of 80 gallons per capita.

I have been unable to obtain the cost of the Willow Grove plant, now about one year in operation, which includes the pump house, pump, blower, masonry and concrete work, filtering material, and all accessories; hence, it is difficult, nay impossible, to compare it in the large and practical way with other methods which will be discussed further on; but, from my own actual observation, and the statements of the man in charge, I am of the opinion that the conclusions reached by the experimenters are quite in accordance with the actual working of this very valuable system of "Artificially Ærated Bacterial Filters" as claimed by the inventor.

I now beg to direct attention to the colored sectional drawing on the wall, which illustrates the actual working of Col. Waring's method.

Reverting to the Massachussetts State Board of Health experiments with coke, I now quote an extract from page 480, Report 1896, which sums up the immense value of this material as an aid to sewage purification, and especially as a sludge retainer.

"When coke breeze can be obtained, and the sewage given a preliminary treatment before sand filtration, by being passed through this breeze at a high rate in gallons daily per acre, the organic matter can be removed from the entire body of the sewage as completely as chemical precipitation removes them from the main body of the sewage.

"There is no resulting sludge liquor from this coke straining process, and the clogged coke can be removed from time to time and burned, the sludge being of course held by, and burned with it.

"During some of the experiments, 13.8 cubic yards of coke per million gallons of sewage filtered were removed, dried, and could have been used as ordinary fuel.

"By straining through the coke we have removed during 1895 fifty-four per cent. of the sludge (albuminoid ammonia) of the sewage.

"The latter has been strained at an average rate of one million gallons per acre daily, and the coke strainer contained from six to eight inches in depth of coke. The coke is known as breeze (screenings from ordinary coke).

"At the Lawrence Gas Works, where it is obtained, it is used under the boilers, and estimated to be worth one-fourth as much as the steam coal, or from $1.00 to $1.25 per ton; the amount used has been ten cubic yards per million gallons of sewage strained, and as a ton of coke occupies about 2.3 cubic yards, the sewage has been purified, to the extent given, at a cost for coke of $5.43 per million gallons of sewage strained, estimating the coke to be worth $1.25 per ton.

"By this method we remove the sludge from the entire body of liquid, and get rid of the concentrated sludge liquor which results from sedimentation, or any chemical precipitation process, and it

seems that the coke is as valuable for combustion after use in the strainer as before."

I may add that in the coke filter experiments of 1895 the removal of organic matter and bacteria, at a rate of 260,000 gallons per acre daily, for six days in the week, was ninety-five and ninety-eight per cent. respectively.

Now, sludge resulting from sedimentation or chemical precipitation contains ninety per cent. of water, the latter being separated from the solids by a most expensive and dirty method of pressing. Even then the resulting cake contains about fifty per cent. of water, and using the lime and alum precipitation process (probably the best) the pressed sludge will amount to eight tons per million gallons treated, equal to forty tons as swept from the tank. As one-half of the pressed cake consists of water, the dry solids are equal to four tons per million gallons of sewage.

In the Lawrence experiments above quoted, the sludge was removed by burning at a cost of $5.43 for coke per million gallons treated, while, in any chemical process, eight tons of semi-fluid, evil-smelling cake are produced at a heavy expense for filter presses, cloth and labor, and afterwards the problem of getting rid of this foul asset has to be faced, since it is utterly futile to think of selling this cake to farmers, and the further expense of carting it away must undoubtedly be taken into consideration. In England the cost of producing sludge cake may be taken, at the majority of works (according to Santo Crimp) at 2/6 sterling per ton; and the same authority states that although it is sometimes sold for a trifle, or taken away by farmers, the latter are as often paid to remove it. In the vicinity of large cities it has been dug into the ground, or spread out to dry, but however handled or disposed of, it is an undoubted nuisance; hence, any method of sewage disposal whereby the sludge difficulty can be eliminated entirely, must recommend itself to practical men.

In estimating the cost of sludge removed (per million gallons of sewage treated) by coke strainers, as against sludge pressing into cake, we have, roughly, taking the Lawrence prices of materials used:

By Coke Strainers.

Say 4½ tons of coke at $1.25	$ 5 62

By Sludge Pressing.

Pressing 8 tons sludge cake at 60c	$ 4 80
Carting away 8 tons sludge cake	
1,000 lbs. crude alum at 25c. per ton	12 50
1,000 lbs. slaked lime at $9	4 50
Required for precipitation of one million gallons of sewage	$ 21 80

Therefore is there much to be said in favor of coke as a strainer, as compared with any "precipitation" process; while the cost of buildings, tanks and the other accessories required in the last named process, will certainly counterbalance that of a furnace, drying ovens and chimney necessary for clogged coke combustion.

The Pennsylvania Sanitation Company of Philadelphia have taken advantage of the foregoing facts as regards the valuable properties of coke breeze and aerated sand and gravel filters in their sewage disposal plant erected at Reading, Pennsylvania, which has been in very successful operation for the last year and a half.

The population of Reading is about 80,000, as I am informed, but so far only about 25,000 people contribute to the sewerage system.

The average daily flow of sewage treated by the Philadelphia Sanitation Co.'s works during August last was 1,536,463 gallons.

These works comprise a very handsome pumping station situated at 6th and Canal streets. This station includes two large receiving reservoirs in which the coke strainers ars placed, two large pumps of 5,000,000 gallons capacity each, three 65 H. P. boilers, drying ovens and tall chimney stacks, which ventilate the receiving chambers.

A force main 7,200 feet in length conducts the strained sewage along the banks of the Schuylkill River to the filter beds. These

filter beds comprise an area of 25,000 square feet, or fifty-seven hundredths of an acre. One-half of this area is supported by an iron structure, and is at a level eight feet six inches higher than the lower half. The upper beds are divided up into ten compartments, each twenty-five feet by fifty feet. Iron pipes resting upon beams and girders, supported by iron columns, carry the filtering materials which consist of three different layers of broken stone and rather fine sand; the whole being two feet in depth. The surface of the filters is protected from wind, and the erosive action of the falling sewage by a slatted floor, removable for cleaning purposes.

The drawings upon the wall and the photographic views now exhibited, explain very clearly the system of the Pennsylvania Sanitation Company as constructed at Reading.

There is usually one foot head of water on the upper filters while in operation. The open grid-iron like bottom affords access to the outside air, and is, in fact a modification of the "forced æration" experiments of the Massachusetts State Board; further æration is obtained by the eight feet six inches rain-like drop of the effluent to the surface of the second filter which is of coarser material and about three feet in depth, and is ærated throughout by pipes and gutters. The effluent from the last filter emerges as a clean, bright fluid, quite sufficiently purified to enter any large stream or river, and certainly of a better quality than that of the Schuylkill into which it finally empties.

These works have been extremely well designed, and appear to me to be an excellent practical illustration of the Massachusetts experiments with coke and "forced æration."

The filtration area is rather circumscribed—a defect easily remedied.

Too much credit cannot be accorded the designer and engineer, Mr. John Jerome Deery of Philadelphia.

Bacterial and chemical analyses of the effluent from this plant has been made in Philadelphia, and these show high results, as the accompanying statement indicates.

Usually about one-half only of the filtering area is in operation, the other half being rested, ærated and cleaned. The cleaning

operation involves the daily removal of about two tons of the sand on the top of the filters which has become clogged by the organic matter still remaining in the coke-strained effluent. This daily loss of sand costs about $2 for the material alone.

Reverting to the preliminary operation undergone by the crude sewage in the receiving chambers at the terminus of the main sewer, there are two suspended layers of coke twelve inches thick through which the sewage must pass. The upper one holds back the coarse sludge, while the lower effects a partial filtration or straining of the sewage before it is taken hold of by the pumps. Every week the sewage is shunted from one receiving chamber to the other, and the clogged coke of the upper strainer is entirely removed, hoisted to the drying ovens, and finally consumed under the boilers as ordinary fuel. The weekly removal of clogged coke from the upper strainer is about five tons.

In my opinion the clogged coke should be removed at more frequent intervals and the coke should be, not commercial coke such as I saw, but breeze, or ordinary coke broken up into very small fragments. I believe the specification of the Sanitation Company demanded "breeze," but since the plant has been turned over to the corporation of Reading, several changes for the worse seem to have been made.

During last August the cost for steam coal was $72 for forty-eight tons. In addition to this sixteen tons of coke from the receiving chambers were burned. The total quantity of sewage pumped during that month was 49,180,368 gallons.

The cost of this plant has been given to me as under:

Pumping station complete with one pump and two boilers.	$59,000
The pipe line	31,000
Site for disposal works	7,000
Right of way	1,700
Iron structure for filters complete, including viaduct over creek and all accessories	62,300
Total	$161,000

As one-half of the upper filtering area is said to be generally out of operation for cleaning purposes, it follows that the daily flow of sewage treated (1,585,463) gallons passes through the upper filter at the rate of about 2,286 gallons per square yard, or 11,000,000 gallons per acre. Although this seems an enormously rapid rate, it must be borne in mind that the second filter below will pass the effluent from the first filter at only half the above rate, and that, with the large amount of æration obtained, not only by falling through the eight feet six inches air space, but through the last filter, very good results can certainly be looked for. As a matter of fact a very fair sample of effluent was collected by me on the 4th instant.

As regards cost of labour, it is safe to say that four men and a foreman could very well attend to the filters, although at present three foremen and eight men are employed by the corporation of Reading.

Careful examination and inquiry as to the operation of the Reading Sewage Works have convinced me that this practical application of coke straining and ærated filtration is worthy of the very serious consideration of the London, Ontario, authorities, who still have the vexed (and to them doubtless most perplexing) question of their sewage disposal before them.

On account of several conditions essential to successful intermittent filtration through land, which are not always obtainable, this plan is certainly far in advance of land disposal pure and simple, over large areas, as it is generally understood in Ontario, and which I unequivocally recommended three years ago. But this is in reality a land disposal system in a much condensed form, with but a fractional portion of the duty imposed upon it as in ordinary cases, by reason of the prior removal of the bulk of the sludge by coke combustion as already described.

Upon this account, and that of the reduced cost of construction and future maintenance, as compared with other proposed plans, I unhesitatingly recommend it now.

The Penn. Sanitation Co. of Philadelphia, have offered to construct a disposal plant at the outlet of the Cove Road Main Sewer, much upon the same lines as that of Reading, (the London works of course, to be a gravitation system), for the sum of $28,000. This is upon a basis of one million and a half gallons of sewage to be treated daily.

I have carefully gone into the plan proposed by them for London, and feel certain that, with certain modifications, which include receiving chambers, coke ovens, furnace and chimney, besides provision for burning the rakings from the upper filter, an excellent system can be constructed for the sum of say $33,000.

The Company would, I have no doubt, be glad to operate the works for one year, and guarantee a given, satisfactory standard of purity in the effluent.

The whole work necessary in caring for the filter beds, handling, and finally burning, the clogged coke, could be performed by four men and a foreman. The weekly cost for coke (the only material requiring renewal, besides less than a couple of tons of sand daily) would be about five or eight tons, the total weekly expenditure for materials for one week being five tons coke, say twelve tons sand.

The cost of chemicals alone, per week of seven days, would be, for the "International System," using 7 grains of "ferozone" per gallon of sewage (7 grains ferozone per gallon of sewage are not sufficient, as I have found by actual experience, 10 grains are necessary) and estimating the cost of ferozone at ½ cent per pound (which is 50 per cent. less than I ever obtained it for)—10,500 lbs. @ $52.50 per week, or $2,730 per annum.

So much for maintenance, now for the cost of construction by either of the three plans proposed for the City of London.

Land Disposal.

40 acres of land at $175	$7,000
Preparing ditto.	24,000
Siphon and other items	10,000
	$41,000

International Process.

Cost of construction as given..... $41,300

Plan now proposed.

Cost as given above $33,000

and the latter besides being less costly, possesses the inestimable advantage of being entirely free from the sludge nuisance.

The interests of the city of London can be protected by the Company's guarantee to keep up a certain standard of purity in the effluent during the period the works are operated by them.

The location of these works at the end of the Cove street sewer would of course obviate the necessity for a siphon as now proposed.

The city of Worcester, Mass., may safely be taken as a typical illustration of chemical precipitation for large cities, and the report for 1896 may be referred to, in which it is shewn that, for maintenance, and purification of one million gallons of sewage, the cost has been $10.52, 53.9 per cent. of the organic matter having been removed; and yet Worcester is thinking very seriously of constructing at great expense a filtration plant as an auxilliary to their present method.

The sludge from the Worcester works has always been found very difficult to get rid of, and when there in 1895, I saw very large areas covered with it to a depth of 12″ or 18″, small quantities of which the neighboring farmers could scarcely be prevailed upon to take away as a gift.

Enough has now been said on this head, and the method of precipitation as applied to large towns with its sludge concomitant, may be dismissed with a quotation from Col. Waring.

"The precipitation treatment buys and manipulates chemicals, coagulates the sludge, drains it, pumps it, handles it, and still has it."

It must not, however, be gathered from the foregoing remarks, that the writer has receded from his many previously stated convictions regarding "precipitation" methods.

There are, and always will be cases arising, where, in the absence of coke or suitable land, chemical precipitation will be found a powerful aid to the final filtration of sewage, either through natural or artificial media; and this applies particularly to the sewage disposal

of small communities, *e g.* as in some of our Provincial institutions, or other small centres of population.

Since reading the above, I have suggested a still further modification in the method proposed for London, which is to use only twenty acres of land for the final filtration of the sewage, after straining through, and retention of the sludge, by coke.

This is a combination of the Reading plan with simple land filtration, and would effect a saving to London in cost of construction of nearly $20,000, as compared with the original "all land disposal" plan and the chemical "International System."

Analysis showing removal of bacteria and organic matter from the sewage of Reading, Pa, by the purification process of the Pennsylvania Sanitation Company, 1110 Betz Building, Philadelphia, Pa.

BACTERIAL ANALYSES.

Date of analyses.	Number of samples.	Different points during the purification process.	Bacteria per cubic centimetre.		Percentage of bacteria at different points as to number applied.	Percentage of bacteria removed.
			In applied sewage.	In water at each point.		
Oct. 9, 1896.	1	Crude sewage	27232.8			
	2	Sewage through the coke filter.	27232.8	19152.4	70.32	29.68
	3	After filtration through upper filter beds	27232.8	516.6	1 89	98.11
	4	After æration below upper filter beds	27232.8	126.0	.46	99.54
	5	After filtration through lower filter beds	27232.8	22.0	.08	99.92
Oct. 19, 1896.	1	Crude sewage	49867.3			
	2	Sewage through the coke filter.	49867.3	16542.7	33.17	66.83
	3	After filtration through upper filter beds	49867.3	232.6	.46	99.54
	4	After æration below upper filter beds	49867.3	82.2	.16	99.84
	5	After filtration through lower filter beds	49867.3	.2	.0004	99.9996

CHEMICAL ANALYSES.

Parts in 100,000.

Date of analyses.	*Number of samples.	Chlorides.	Total hardness.	Oxygen consumed in the moist oxygen process for determining organic matter.	Free ammonia.	Albuminoid ammonia.	Amount of nitrogen as nitrates and nitrites.
Oct. 9, 1896.	1	9.	15.54	3 947	.34	.14	.429
	2	6.4	15.54	2.187	.27	.09	.650
	3	6.4	16.095	1.125	.022	.02	.673
	4	6.4	16.65	.937	.019	.015	.787
	5	7.	16.65	.812	.010	.025	.984
Oct. 19, 1896.	1	6.5	16 095	16.000	.590	.730	.420
	2	6.5	16.650	4.000	.370	.060	.305
	3	6.5	16.650	2.000	.055	.025	.910
	4	6.5	17.760	2.000	.065	.040	.951
	5	6.5	17.760	1.800	.010	.055	.972

* The numbers are identical with those stated above for bacterial analyses, thereby indicating the different points from which were taken these samples.

REMARKS.—While the above figures speak for themselves, there is no reason for our not calling your attention to the remarkable reduction in the number of bacteria which the process seems to assure in removing, in the last series for example, over 99.99 per cent. of the bacteria disappear during the purifying process. The chemic study shows the enormous reduction of the free and albuminoid ammonias and the rise of the nitrites and nitrates, thus converting, to a large extent, suspicious compounds into salts of which we feel no anxiety.

Respectfully submitted,

W. M. L. COPLIN, M.D.
H. F. HARRIS, M.D.

Compiled from the Report of Doctors W. M. L. Coplin and H. F. Harris, Professors of Pathology and Bacteriology at the Jefferson Medical College, of Philadelphia. (Dr. Coplin is the Chief Bacteriologist to the State Board of Health of Pennsylvania.) The first analysis was made after the plant had been in operation only ten

days. The second analysis was made after twenty days' operation, showing increased efficiency with continued use. Attention is especially called to the remarkable showing evinced by the enormous reduction in the number of bacteria present in the sewage at the second analysis, from nearly fifty thousand to but a small fraction of one to the cubic centimetre.

CHEMICAL ANALYSIS OF EFFLUENT.

Parts in 100,000.

Date of analysis.	Appearance.		Odor.		Ammonia.		Chlorides.	Nitrogen.		Hardness.
	Turbidity.	Sediment.	When cold.	When hot.	Free.	Albuminoid.		Nitrates.	Nitrites.	
Feb. 13, 1897.	None.	Slight	Earthy.	Faintly.	.0480	.0142	5.76	.2400	.0030	32.0

Compiled from the Report of Mrs. Ellen H. Richards, Chemist of Massachusetts Institute of Technology, Boston, and to State Board of Health of Massachusetts.

THE INFLUENCE OF PAVEMENTS ON PUBLIC HEALTH.

Mr. President and Gentleman :—

In presenting to this Association a paper on the sanitary aspect of pavements, I have been actuated by a desire to obtain information, rather than to impart it. Ontario has so recently developed from a wilderness into the home of civilization and culture ; our villages have grown so quickly into towns, our towns into cities, and the advance of the various sciences has been so rapid that our people scarcely realize the changed circumstances, and the need of carefully directing their energies in meeting the demands of the times. In

my visits to different parts of the Province, I am constantly met by evidences of the good wrought by this Association. I find that in very small villages even inefficient drainage, cess-pools, piggeries, slaughter-houses and impure water supplies are not now tolerated as they were once, and that this is due to the work of your Association.

It is with considerable hope, therefore, that I have undertaken to briefly lay before you the subject of pavements and public health, confident that you will lend your assistance in aiding our knowledge of this as of other matters pertaining to perfect sanitation, and that where reform is needed, your aid will be afforded.

There is no one paving material which possesses every quality desired in a pavement to meet all conditions and uses. The ideal pavement remains to be discovered; but the features which should belong to an ideal pavement are so numerous and of such varying character as to render the search apparently a hopeless one. The ideal pavement

1. Should be cheap, and economical of maintenance.
2. Should be durable.
3. Should suit all classes of traffic.
4. Should offer little resistance to traction.
5. Should give a good foot-hold to horses.
6. Should be adapted to all grades.
7. Should have a good appearance.
8. Should not be muddy nor pervious to water.
9. Should be sanitary: that is, non-absorbent, not subject to decay, easily cleaned, not dusty, not noisy.

It is apparent then that, notwithstanding the importance of the sanitary aspect of a pavement, there are other features which must be considered. The primary intention of a pavement is to accommodate travel, and to provide one which will do this satisfactorily, which will be durable, cheap, of good appearance, healthful, and possess in the highest degree the other qualities enumerated, in view of the location, nature and extent of traffic, is the problem which presents itself to the paving engineer. Just as no absolutely perfect paving for every time and place has been discovered, it is doubtful

if any paving material now used should be utterly condemned. Each has its place in which, until the ideal universal pavement is found, it will be more satisfactory than any other which could be chosen under that particular set of circumstances of soil, climate, traffic, etc.

The purpose of this paper, however, is to treat of the healthfulness of paving in general, and of the sanitary aspect of commonly used paving materials; that is, asphalt, stone blocks, vitrified brick, cedar block, and broken stone (macadam), with respect to absorption, decay, ease of cleaning, dustiness and noise.

Of all these, cedar block has received the greatest censure on the score of unhealthfulness. Dr. O. W. Wright, a health officer of Detroit, is quoted as saying: "On sanitary grounds, I must earnestly protest against the use of wooden block pavements. Such blocks, laid endwise, not only absorb water which dissolves out the albuminoid matter that acts as a putrefactive leaven, but also absorb an infusion of horse manure and a great quantity of horse urine dropped on the street. The lower end of the blocks, resting on boards, clay or sand, soon becomes covered with a fungoid growth thoroughly saturated with albuminous extract and the excreta of animals in a liquid putrescible form. These wooden pavements undergo a decomposition in the warm season, and add to the unwholesomeness of the city. The street, in fact, might as well be covered a foot deep with the rotting barnyard manure, so far as unwholesomeness is concerned. Moreover, the interstices between the blocks and the perforations of decay allow the foul liquids of the surface to flow through, supersaturating the earth beneath, and constantly adding to the putrefying mass."

Cedar block has been condemned in similar terms by many others. On the other hand, Col. Heywood, Engineer of the City of London, England, has said: "It has been said that wood pavements at all times smell offensively and may be unhealthy; but although some city streets have been paved with wood for thirty years, no complaints that I am aware have been made to the commission on this head, and the inhabitants at all times have not only expressed

great anxiety lest the wood should be replaced by other materials, but have subscribed towards the cost of its renewal. . . I have at times noticed offensive emanations from it near cab-stands, but am unable to find further evidence of its unhealthiness. These remarks must be held to apply only to public streets open to the sun and air and traffic; in confined places and under some conditions wood might be objectionable. I have seen it decaying in confined places without traffic."

The one statement by the Medical Health Officer of Detroit refers directly to the cedar-block pavement as we understand it in this country. The other opinion, that of Col. Heywood of London, is expressed regarding the wooden pavement as laid in European countries. Between these two pavements there is a vast difference. Under European practice many of the pavements are of the Karri and Jarrah woods of Australia, which are thoroughly saturated with resins, are very hard and not subject to decay. They are sawn into brick-like blocks and laid on concrete. Where soft woods are used, they are also cut into regular oblong blocks and laid on concrete, and are saturated with cresote or treated with some other preservative process. Wooden pavements of America, however, represented by cedar-block, are of a very different order. The round blocks, of irregular diameter, are merely the untreated wood. These placed on a bed of sand are under the most favorable conditions possible for decay, being constantly exposed to moisture, air and warmth. With no preservative treatment, they are enabled to absorb to the fullest extent all forms of liquid street filth which, in the process of putrefaction, feeds on the organic matter of the wood. The surface, which quickly becomes uneven, retains a large quantity of loose matter subject to decay, the whole giving rise at times to noxious odors. The effect, were sufficient of such pavement used, would subject us to the conditions favorable to marsh fever. From a sanitary standpoint, the cedar-block pavement of this country would indicate a serious menace to health.

At the same time, while we are justified as a matter of theory in arriving at this result, there do not appear to be any statistics to

prove the conclusion to be a correct one. The death-rate of cities most largely paved with cedar-block does not bear any ratio to the extent of such pavement; nor does a change from cedar-block to another less absorbant pavement produce a noticeable effect on the death-rate.

In European practice, wood, more suited to a business street than macadam, affording a better foot-hold for horses than asphalt, less noisy than granite setts, is exceedingly popular in spite of its less sanitary character. In this country, however, there is an unwillingness to renew a wooden pavement when decay has rendered it unfit for further use, and this, coupled with the less careful method of laying, is the cause of the complete disrepute into which cedar-block has fallen.

Experiments have been made recently by a Polish scientist with regard to wooden block. The bacteriological examinations showed that, in specimens taken from blocks which had been in use for four years, and from a depth of one centimeter and two centimeters below the surface, there were at the end of five days, 650,000, 220,000 and 12,100 bacteria per gramme of wood. A later examination showed 1,200,000 colonies per gramme in the surface of the wood, and 8,600 colonies per gramme at two centimeters below the surface. An estimate, in terms of its nitrogen, was made of the organic matter absorbed by the wood, and indicated that the surface layer of wood contains more nitrogen than the most polluted soil. A comparative estimate of the pollution of the atmosphere was made by placing a definite quantity of sulphuric acid under a glass bell, on the surface of wooden and asphalt pavements, the result, as indicated by the quantity of ammonia absorbed by the acid, being much in favor of asphalt. The observations show that while a wooden pavement gives absolute protection to the soil and to the sub-soil water, there was considerable atmospheric contamination. The experiments were made on blocks of pine, preserved by impregnation with copper sulphate. Such being the case with a wooden pavement laid under European practice, there can be little doubt of the unwholesome effect of cedar-block upon the atmosphere. Further experiments of

this description, conducted by members of your Association, would doubtless prove instructive and profitable.

Broken stone or macadam would next arouse suspicion with regard to its absorpative qualities. There is this great difference between the two, however, that whereas a wooden pavement itself decays and affords food for the decay of other organic matter falling on it, the macadam does not in itself decay. With under drainage such as every well built macadam possesses, it should be little more than a good sewage disposal bed for the comparatively small amount of sewage which falls upon it. A macadam pavement can be scraped and swept, it is not noisy, dust can be subdued by sprinkling and on sanitary grounds appears to be an excellent pavement for residental streets where traffic is not excessive. For business streets, or for heavily travelled thoroughfares of cities, a harder surface is advisable.

With regard to absorption, there can be no objection to asphalt, vitrified bricks nor stone blocks. Asphalt is impervious to water, while the joints of brick or stone pavements are practically perfect so far as absorption is concerned.

To be sanitary a pavement should not be dusty. The dust of a pavement is not only an irritant, but carries with it the bacteria of disease which, from various sources, are a part of street filth. To prevent dust, the pavement must be so perfectly cleaned that a practically harmless amount is taken up by the wind; or if perfect cleanliness is not possible, dust must be subdued by sprinkling.

Unless perfectly cleaned, much more perfectly cleaned than is commonly the case in this country, an asphalt pavement is apt to be a disagreeably dusty pavement on a windy day in summer. This, indeed, is one of its greatest faults from a sanitary standpoint. Toronto has the reputation of being a clean city, with a well organized street department, yet even under these favorable conditions, a walk or drive down Yonge street on a warm windy day is a very trying experience. The smooth, hot surface quickly dries any matter falling upon it, a wheel passing over this dry substance grinds it to powder, and the result is that clouds of dust find their way into the eyes, nose, mouth, throat and lungs of pedestrians. Business men

in their offices are not safe from its attack as it drifts in through the open windows. The dust imbeds itself in clothing, fastens itself on other articles of food exposed in the shops, to be eaten finally by the purchaser. One case came to my notice in which a consumptive patient was ordered by his physician to leave Jarvis street, one of the best residence streets of Toronto, because of the dust which came from the asphalted roadway. These streets are swept by machines, and are hand swept by a corps of city employees, but are not, to my knowledge, flushed as are similar pavements in London and Paris and Ottawa and Montreal. Flushing and sweeping is the only method whereby asphalt can be freed from this unsanitary dustiness. The dust, however, is not a defect of the pavement so much as it is a fault in the method of cleaning.

Asphalt has, nevertheless, the disadvantage of being a very hot pavement. Its smooth surface, reflecting back the heat and light, is productive at times of sunstroke, and the glare is frequently painful to the eyes. This is most noticeable in closely built business sections where there is least circulation of air, where the sun beats down between brick walls; and is not so objectionable on a shady residential street with houses well apart.

Vitrified brick and stone block pavements are neither so dusty nor hot as asphalt since the surfaces are less smooth and assist in retaining in the joints the finer particles of dust. Sprinkling, too, is in a greater measure effective in subduing dust on brick or stone block than on asphalt, from the hot smooth surface of which moisture evaporates rapidly. A macadam pavement is dusty if not properly treated, but if scraped and swept, as are other pavements, the dust can be largely subdued by sprinkling.

Noisiness, if excessive,, is another unsanitary feature. A noisy pavement is jarring to the nerves, grating upon the sensibilities, and for either a heavily travelled business street or a residential quarter, a quiet pavement is much to be desired. Noise itself is not always unhealthy. It is doubtful if the workman in a boiler factory, or a railroad engineer or other employee, is much influenced by the noise incidental to his occupation. Both are muscular of body, constantly

taking vigorous exercise. But to the more sedentary men of business, whether at high nervous tension in his office or resting in the quiet of his home, a din, constant or intermittent, is a source of annoyance, and as such, is wearing on the nervous system. The most objectionable in this regard is granite or other stone block pavement. Vitrified brick is apt, unless great precautions are taken, to create a disagreeable rumbling. Asphalt, wood and macadam are the least objectionable with regard to noise. In any of these roadways perfectly constructed the noise comes from the contact of the two hard substances, the metal pavement and the steel tire. This objection will no doubt soon be removed by the use of paper or pulp tires and horse shoes. This introduction, together with the use of broad rims and axles of irregular length will also reduce the cost of maintenance to a minimum.

While we have this to say of the comparative healthfulness of different varieties of pavements there is another condition of matters common to too many towns and cities, in which the streets in fall and spring form a wilderness of mud and stagnant pools, and in summer are shapeless beds of dust. Many of them are made the receptacles of the refuse from private property which is left to disfigure the street, forming in spring and fall rivers of filth and cesspools of disease. They are left in a state of nature. Such streets have been regarded as a zero quantity, doing no particular harm, doing no particular good. Streets, however, which do no good, should do good, and therein lies this harm. A good street is a well-drained street, a well-cleaned street, and is a source of healthfulness to the members of the community. Streets should be the public parks, pleasing to the cultivated taste, adding to the culture and refinement of the people, and enticing them out to breath health and vigor, whether walking, bicycling, riding or driving. Passing along the city street we reach the country highway which, as a means of permitting the people of the city to leave the congested portions and to reside in the less thickly populated suburbs, form an important factor in securing public health.

INFLUENCE OF STREET PAVEMENTS ON THE OCCURRENCE OF DIPHTHERIA.

By E. B. Shuttleworth, Phar. D., F.C.S., Bacteriologist to the Toronto Board of Health.

Of late years there has arisen a prejudice against cedar-block pavements and the opinion has gradually gained ground, both amongst the laity and the medical profession, that such wooden roadways tend to the propagation and dissemination of disease. This has been frequently asserted with regard to diphtheria, which is claimed to be more prevalent on block-paved streets than on those made of macadam, brick or asphalt.

It is not the intention of the writer to discuss the reasons which have been adduced in support of the position that block pavements operate as predisponents to diphtheria, or as actual carriers of infection, but rather to ascertain whether this position is based on fact. To this end some observations have been made, and are herein submitted.

It may be explained that the rapid extension of the limits of the city of Toronto, some eight or ten years ago, necessitated the speedy construction of pavements, and cedar blocks were thus largely employed, and are still used. For this purpose, young cedars, from which the bark has been removed, are cut into six-inch lengths, and laid on end, resting on two inches of gravel, the interstices between the blocks being filled with the same material.

In making a selection of streets for observation the localities chosen were as nearly as possible alike as to drainage, elevation, and density and character of population, but unlike in the matter of pavements. The period covered included five years, from 1892-6 inclusive, and the cases of diphtheria tabulated were those of the official records of the Health Department. About forty miles of

streets, mostly cedar block and macadam, were included in the investigation.

On comparing fourteen equal lengths of streets, each running about 2,400 feet north from Queen street, and up to and in line with Gerrard street, it was found that on seven block-paved streets there had been 106 cases of diphtheria, and precisely the same number on seven streets paved with macadam. On fourteen lengths of streets, about twenty miles in all, running north and south and east and west, and of a distance equal to that between Queen and Bloor streets, there were 310 cases on block-paved streets, and 317 on those of macadam. On various short lengths the figures were twenty five for block-paved and thirty-two for macadam streets.

The totals of these give 441 cases for block-pavement, and 455 for macadam—figures which do not differ widely enought to warrant comparison.

The macadam portion of old St. John's ward comprises almost the entire area, and showed 209 cases, against 235 for the old Yorkville district, of which the streets are, with few exceptions, block-paved. These districts are in some respects alike, but differ in elevation, and character of soil and population, the advantage being with the Yorkville district. Nevertheless, as has been observed by others, dirt and diphtheria do not necessarily go hand in hand, and the old and apparently unsanitary ward is in the better position.

If to the previous totals are added the last results they stand at 676 for block-pavement and 664 for macadam. So far, then, as the present investigation has gone it appears that if character of pavement has an influence on the occurrence of diphtheria there is no practical difference between macadam and cedar blocks. Observations are being continued, and extended, and will be made the subject of a future paper.

There are not, in Toronto, a sufficient number of residential streets paved with asphalt, to justify conclusions as to this kind of roadway, but, as far as noted, it appears to exercise a slightly favorable influence, while unimproved streets—the so-called mud road—may be classed with the others mentioned.

PRELIMINARY NOTE ON THE DETECTION OF SEWAGE POLLUTION OF WELLS BY DETERMINATION OF THE CHLORINE OF CHLORIDES.

By A. McGill, B.A., B.S.C., Assistant Analyst to the Inland Revenue Department, Ottawa.

1. While lakes and large rivers form the source of water supply for our cities and towns, farm and village population of Canada, constituting more than four-fifths of the whole, must look to wells to furnish water for domestic use.

2. It has long been known that the water of lakes and rivers is definitely characterized for each locality. We are able to state the average character of the St. Lawrence river, the Ottawa river, Lake Simcoe, or other great body of water, and to recognize at once any considerable change in the quality of the water by a chemical or bacteriological examination of it. This constancy of character is explained by the fact that the great size of the gathering ground for these large supplies makes it impossible that any ordinary change due to tillage, settlement, forest growth or decay, etc., should sensibly affect the whole body of water, however much they may influence particular localities.

3. That the underground circulation—utilized in wells—should possess more or less constant characteristics for definite areas seem reasonable enough too when we are led to think of it; but does not appear to have secured the careful consideration which I think it deserves. For a full discussion and explanation of the underground circulation I must refer you to an elaborate paper by Prof. Posepary of Vienna, a translation of which is printed in the Transactions of the American Institute of Mining Engineers, vol. xxiii, pp. 212 *et. seq.*

4. The following sketch is intended to illustrate the most important characteristics of ground water in its origin, and in its utilization by wells.

The sketch (which is an ideal section) shews an ordinary arable surface soil, of varying depth, extending from a hilly region on the left to a river basin on the extreme right. The porous soil lies upon a clay subsoil, which has an irregular contour, the result perhaps of denudation, perhaps of irregular glacial deposit. Under the clay is a permeable stratum of sand, gravel, etc., perhaps resulting from ancient weathering of the subjacent rock, which we may suppose impermeable.

Both the clay stratum and the permeable stratum beneath it outcrops on the hill side. The contour of the country surface is such as we may find everywhere. The whole forms a gathering ground of double character. The rain fall upon the upper portion of the hillside, and upon the surface 1—2 finds its way into the lower gravel and accumulates there under a hydrostatic pressure corresponding to the frictional resistance of the stratum and the amount of rainfall; while the rain collected upon the surface from 2, as far as the river bank, forms a second water-bearing stratum, separated from the fisrt by the clay. The upper level of this ground water will be higher or lower according to the season of the year. What may be taken as the average level of constant soil moisture (permanent wet) is indicated by the shading. This slopes gradually downwards toward the natural drainage line (the river).

5. My contention is that this ground water will be found to have an average character, just as clearly defined as the water of the river which is the vein to which the interstices of the porous soil are the contributing capillary system.

6. The diagram further explains why it is that neighbouring wells may show such diverse character as we find that they do. At B, F and K we have wells sunk into the ground water below the line of permanent wet. These are normal wells; they are filled with water to the level of the line of permanent wetness. In exceptional seasons they may run dry, this line falling below its average position. By digging the well deeper, water will again be found, and the character of such water will be only so far different from that which

ordinarily fills the well as the prolonged drouth may have affected the whole of the ground water; an alteration which it will share with the water of the river.

7. This uniformity of character in wells B, F and K presupposes, however, the exclusion of so-called surface water. The immediate effect of rainfall on the surface is to take into solution any soluble matter upon or near the surface, charged with such matter the water seeks a lower level until equilibrium of hydrostatic pressure is reached at the line of permanent wet. It is evident that each small area of surface having its own character, will give a special character to the rain which falls upon it. Thus a road, a barnyard, a manured field, a piece of bush land, etc., will give a peculiar character to the water soaking through them. For this reason, the wells at A and H, which are not carried down to the ground water level, cannot be expected to have the character of the ground water, nor need they be expected to be like each other. Such shallow wells will run dry whenever the ground water reaches its normal level, and it will be a usual thing for them to run dry except in wet seasons. Since they draw their supply from their own immediate vicinity, such wells may be very good or very bad; and they may change in character from year to year, and even from month to month

8. At C is shewn a well which is carried through a shallow, pervious stratum into a deep deposit of clay. Of course such a well is practically dry; nor will further deepening of the shaft secure a supply of water unless the shaft penetrates the clay and enters the lower water-bearing stratum. Then, indeed, since the head at 1—2 is higher than the surface at D, we shall have a flowing well for at least a part of the year. It is evident the character of this well will be identical with that at G, and with the spring at E. It is certain, moreover, that the water in D, G and E will be quite different from that in the wells B, F and K.

9. If we suppose the surface diagrammed to be cultivated soil, it is evident that the character of the ground water will change *as a whole* with the seasons of the year. This is a feature which it possesses in common with the water of rivers and lakes. It is true,

moreover, that the character of this water at any given time will vary at different points in the course from the hill side to the river. Soluble matters will increase as the river is approached; and the rate of increase will be regularly progressive if the country be level and the soil cultivated after a uniform fashion; so that if the value of a given dissolved substance—say chloride of sodium—be known for the points A and K, it can be approximately calculated for intermediate points.

10. As far as my experience goes, a majority of country wells in Canada are of the surface type. Many wells which draw their main supply from the ground water are nevertheless surface wells to all intents, since subject to immediate and frequent change due to local influences. Unless the surface water is kept out of a well by making the wall—above ground water level—of impervious material, it is evident that the well must be classed as a surface well. (See Bull. 51, p. 23). Next in number come the ground water wells; and if with these we include those already mentioned, which are partly fed by the ground water, we shall have probably three-fourths of all the wells in use. Wells, like D and G in the diagram, which draw their supply from deep strata are called spring-fed wells, or artesian wells.

11. As to desirability for domestic supply, the artesian well must take first place. These deep-seated waters are almost always originally pure; they are also likely to remain so, since they are unaffected by local causes. The objections to such wells are the cost of making them; the fact that they are not always to be secured, even at great cost; and the other fact, that they are often highly charged with salts in solution, so as to possess a mineral character. Sometimes they are charged with gases, as carbon dioxide or sulphuretted hydrogen. Next to the artesian well, the ground-water well is to be preferred. A well of this character may be had in most localities, and, as I have already said, the majority of existing wells are either actually ground water wells or could be made such by taking care to exclude surface water.

As to surface wells, they are always dangerous sources of supply. It is true that I have frequently found the water of surface

wells to be very pure, but the danger of contamination is very great, and the change from good to bad is often very sudden and unexpected.

12. The character of a well water as to purity or impurity depends upon the presence of recent sewage in it. By sewage I mean the soluble matter resulting from organic decay or waste, and particularly that having an animal origin; while the term recent implies that these waste matters in solution have not been yet fully destroyed by those processes of oxidation which constantly go on in the soil to which air has access; processes which are doubtless associated with microbial life. Recent sewage is characterized by the presence in it of organic nitrogen in the forms known as albuminoid ammonia, free and saline ammonia and nitrites; of organic carbon and phosphoric acid. Sewage which has undergone destructive changes, *i.e.*, changes by which its harmful character as sewage is destroyed, betrays its presence by the existence of nitrates (unless these have been again reduced—as in some deep well waters—to free or saline ammonia), and by the presence of chlorine in chlorides.

13. All ordinary sewage contains common salt. This is found constantly not only in human waste matters (solid and fluid), in household slops (dish water and food waste), in milk, etc., but in barnyard manure, and in animal waste of all kinds. It is not especially distinctive of recent sewage, for it remains, for the most part, unaltered by those agencies which destroy the organic contents of sewage.

14. The analysis of a water sample, comprising an estimation of nitrogen as free and saline ammonia, as albuminoid ammonia and as nitrites and nitrates; of carbon as organic and inorganic; of total dissolved matter, and of mineral dissolved matter; of phosphoric acid, etc., so as to determine with certainty the presence or absence of sewage in it, is the work of at least two days, and represents in money value from $10 to $20. These facts sufficiently prove the impossibility of analyzing the more than half million of wells in Canada. If any scheme could be devised by which it should become practicable to obtain a correct notion as to the purity of the wells of

our country, I think that such scheme should secure your interest and support. Such a scheme I beg to submit to you.

15. Wherever cultivable land exists a water-bearing sub-soil is to be found. Except in the cases where artesian wells can be obtained, the wells should receive—and I believe that the vast majority already existing do receive—their supply of water from this source.

16. This water-bearing sub-soil invariably rests upon a more or less impervious stratum ; the contour of which is very seldom strictly parallel to that of the surface of the ground for any considerable area ; but is, nevertheless, more or less conformable to it. The contour of this impervious sub-stratum, taken along with the topography of the locality, the underlying and also the out-cropping rock strata, etc., cause the existence of more or less well defined areas, each of them giving a definite character to ground water.

17. By an extended examination of the ground water wells of these areas in regard to chlorine in chlorides, the areas themselves may be plotted on a map, and their boundaries defined. An average chlorine value will be found for the ground water of each area ; and by the conformity of any particular well with this number its normal or abnormal character may be determined.

18. A very moderate estimate places the wells of Canada at half a million. The cost of collecting even small samples from such a large number of wells is beyond the means of any individual or organization likely to undertake the task. For each township (or other municipality) to bear the expense of collecting the wells within its own limits, seems, however, quite feasible. The municipality would receive very valuable information as to the average and particular character of its well water supplies, independently of any other municipality, while every analyst would be put in possession of information which would be of the greatest value in helping him to interpret the results of analyses.

19. Since making this suggestion I have learned that the State of Massachusetts has actually done for that State what I propose should be attempted for Canada. If it be asked : "Where could the work of analysis be done?" I might suggest that one of the governmental departments, having a chemical laboratory at its disposal,

should be asked to undertake the matter. The estimation of chlorine is one of the simplest and at the same time the most exact known to analytical chemistry.

20. With a view of making a start in this matter I have made a study of the chlorine results of analysis of 541 well waters collected throughout Canada—many of them from towns and villages. 446 of these analyses have been made in the laboratories of the Inland Revenue Department, and for the remaining ninety-five I am indebted to the courtesy of my friend, Mr. Shutt, of the Experimental Farm. Of the total number recorded

159	wells	contain	from	1	to 10	parts per million.
181	"	"	"	10	" 50	"
83	"	"	"	50	" 100	"
45	"	"	"	100	" 200	"
33	"	"	"	200	" 300	"
11	"	"	"	300	" 400	"
9	"	"	"	400	" 500	"
17	"	"	"	500	" 1,000	"
3	"	more than			1,000	"

21. Since these wells are most diversely situated, and many of them from towns or villages; since, further, most of them have been sent up for analysis because of suspicion attaching to them, it is evident that only the most general deductions can be drawn from these results. The following, however, are interesting:—

(1) More than sixty per cent. give less than fifty parts of chlorine per million.

(2) Very few have been passed as 'good' on the total results of analysis in which the chlorine is more than twenty-five parts per million.

(3) Twenty wells containing more than fifty parts per million have proved to be 'good' wells on the result of a full analysis. Of this number, twelve contained from 200 to 300 parts. These all came from one section of the country, and are very hard waters, with high inorganic solids. The others are of a distinctly mineral character. All are deep wells.

22. Natural inferences from the above is that the standard for ground water chlorine must be a local one. In order further to examine this matter I caused 112 samples of well waters to be collected on one day last week. They were all taken from the plateau forming the district in and about Stittsville, Richmond, Bell's Corners and Fallowfield in this county. Unfortunately it was impossible in the time at my disposal to procure all the desired information as to depth of well, character of soil, etc., as very suggestive results were obtained as follows :—

(1) At Stittsville there is very little depth of soil. In many places the rock outcrops. Towards the south there is a gradual descent to the large plateau which forms the township of Goulborne, and which is drained into the river Jock. The wells on this downward slope are mostly shallow and show from one to ten parts of chlorine per million. Two deeper wells (forty feet), show thirty four and forty-eight parts respectively, and evidently represent a different supply.

(2) Once in the plateau—the centre of which is Richmond village—we find the average chlorine rise to nearly 200 parts per million (such numbers as 206, 134, 232, 252, 220, 248, occurring).

(3) For the vicinity of Richmond itself a much lower chlorine number is found (*e.g.*, 14, 16, 34, 20, 12, 4, 18, 20, 18, 10, occurring in ten neighboring wells). These wells average about fifteen feet in depth, and no doubt reach the normal ground water.

(4) Among them are found wells of less depth, or sometimes of the same depth, but on slightly higher ground, which were dry when I visited them.

(5) While the average number for ground water in Richmond is therefore about 20, certain other wells gave 248, 84, 38, 52, 52, 116, 116, 50, 106, 68, 96, 104, 58 and 92. These wells were for the most part on the outskirts of the village. Several, however, were taken in the village itself, from wells whose surroundings suggested sewage pollutions. The transition from the local standard for the village (20) to that for the county (200) is well marked.

(6) That the chlorine should be high in this plateau is not a cause for surprise. The county is a comparatively old one and is highly cultivated. The chlorine comes from the manured fields, which everywhere exist. The local number for the village itself is not so easy of interpretation. It may be that the withdrawal of the village land from ordinary cultivation affects the water supply favorably; this is the most likely interpretation, since Richmond is a thinly peopled village, of large area, and containing therefore ample open spaces.

23. An analysis of the series of samples collected eastward of Stittsville, and about Fallowfield, Bell's Corners and Old Stittsville, gives general corroboration to my theory of well-defined local areas of constant character. But I must confess that the work yet done with the purpose of elucidating this our large question pales into insignificance when set side by side with the magnitude of the task itself. It is for the purpose of interesting you in the problem and of asking your active help in its solution, that I have brought it to your notice. I hope that by this time next year I shall have a great deal more data to place before you.

26 September, 1898.

SOME RECENT INVESTIGATIONS UPON AIR INFECTION

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Recent experiments upon the subject of air infection which have issued from some of the German laboratories have proved so interesting to me in reading, and seem so important from a practical sanitary standpoint that I thought it would be of interest to the members of the Executive Health Officer's Association if a short account of them were given at this meeting.

Although the question of air infection seemed to have been exhausted by the earlier writers, still there were certain contradictions between the results and between laboratory results and practical experience. To aid in explaining these contradictions, Flügge, of Breslau, thought it worth while to turn his attention again to the question and endeavor to throw some new light upon it.

We have generally understood that an exceedingly strong current was necessary to carry particles into the air from the surface of a fluid; a current sufficiently strong to produce active formation of waves and the breaking of these into spray. The conditions were such, however, as to preclude a careful measurement of the rate of these currents, and by more careful methods Flügge has shown that a rate of about four metres per second was necessary, depending of course to a large extent upon the nature of the limiting walls of the pool upon which the current was playing and the angle at which the current impinged upon the surface. Such a rate is, however, not so very great, almost that of an ordinary breeze.

It is doubtful, however, if these out-of-door currents are of any very great significance from a sanitary standpoint. The conditions of drying and sunlight are such that bacteria in the form of dust or enclosed in droplets of fluid will most probably perish before being carried very far. Especially is this so of the majority of pathogenic

forms which, it is well known, are much more liable to be destroyed by drying and sunlight, than the ordinary organisms of the dust.

When we come to consider the question of air infection and air movements in rooms and cars, the conditions are entirely different. Fluids holding bacteria in suspension are not exposed in rooms to currents as great as four metres per second. Even with good ventilation the air currants rarely rise as high as this, but, on the other hand, there are present innumerable slight draughts and currents, many of which it is impossible to measure, but which must play a part in the transportation of organisms suspended in the air. The rate of the inspiratory and expiratory current at the nostrils is about two metres per second, but this lowers very rapidly as we pass from the immediate neighborhood of the nostrils. A draught which can just be felt is about ten centimetres a second and the same rate of current will just cause a slight movement of a candle flame. All these are too slight for the possible action upon fluid such as an ordinary breeze would have in the open.

There are other ways, however, in which bacterial-holding droplets may be carried into the air, such as by pouring fluid from one dish to another; by the handling of moist, soiled linen, we may have the spraying of particles into the air. But Flügge has pointed out other and far more important ways in which the air may become infected, viz, by loud conversation, by sneezing and coughing.

We know quite well, of course, from ordinary experience that these acts may cause larger particles of saliva to be thrown into the air for some distance, hence the polite habit of holding the hand before the mouth and nose in coughing and sneezing, but I do not think that any one realized the extent in which the air might become infected by such acts. The general belief was, I think, that the real danger, aside from direct contact with the flying particles, was the fact that they fell to the ground and became converted into dust, and that in being swept up again by air currants they reinfected the air.

Flügge has shown by direct experiment that the particles of saliva may be thrown for several metres by the act of coughing

This was done by infecting the mouth with an easily recognized organism such as bacillus prodigiosus and then exposing agar plates at varying distances from the person who was coughing. He showed in this way that it might travel several metres.

His most important contribution, however, was that he pointed out, that, with the coarser more palpable particles, there was a spray of fine particles which were not visible to the eye but which were so small that they might float for a long time in the air and be carried up and down by the innumerable slight air currents which exist in an ordinary quiet room.

Experimentally it was shown that these minute droplets took about six hours to settle to the ground in a quiet room. These particles were so light that a current of less than a millimetre per second was sufficient to carry them for many centimetres in a vertical direction.

When we apply these observations upon air infection to the practical questions of infection in tuberculosis, diphtheria, pneumonia, whooping cough and possibly the exanthemata we see that we have a factor of extreme importance in the history of contagion. In diphtheria, pneumonia and whooping cough there is no doubt that the pathogenic organisms are present in the saliva.

In tuberculosis they may not necessarily always be there. It depends upon the state of the disease and the number of bacilli in the sputum, but Flügge was able to prove positively that bacilli were thrown from the mouth during coughing, by suspending a glass slide in front of a coughing tuberculous patient and finding them on th slide.

Since reading his paper I have on several occasions examined the saliva of phthisical patients, and out of four or five, I only found one in which I was able to discover a few tubercle bacilli, but still the danger seems very great, and I never hear a suspicious cough in street car, shop or room without wondring whether bacilli are not being thrown into the air.

Flügge himself is so impressed with the danger of tuberculous infection from this point that he thinks it the all important factor in the spread of the disease.

He points out, with perfect justice, it seems to me, that the factor of dust infection has been given too much weight. Tuberculosis sputum is not easily converted into dust. Its mucous character renders it slow in drying and causes it to cling tenaciously to the substratum upon which it has dried. Practically all the inhalation experiments which have been successful, have been made with sprayed sputum or sprayed cultures, not with dust. The demonstration of the infectiousness of dust rests, experimentally, upon the introduction of the material into the peritoneal cavity of a guinea pig, conditions totally different from those which obtain in an inhalation experiment, and, practically, upon the studies of Cornet and others upon hospital infection, where infection might just as likely have been due to the coughing of the patients, as to the rising of infected dust from the floor.

The practical sanitary application of these observations is the necessity of patients suffering disease of the respiratory tract protecting the air by always coughing into a handkerchief or cloth which might afterwards be destroyed.

Sanitarians have done a great deal towards educating the public as to the need of disinfecting the sputum of tuberculous patients and these observations point to another way in which the education of the public may go on so as to prevent the infection of the air by these minute virulent droplets which must be a source of extreme danger to those in the immediate vicinity of the patient.