REPORT

OF THE

FIFTH ANNUAL MEETING

OF THE

ASSOCIATION OF

Executive Health Officers

OF ONTARIO

HELD AT OWEN SOUND.

AUGUST 19TH TO 21ST, 1890.

TORONTO:
PRINTED BY WARWICK & SONS, 68 AND 70 FRONT STREET WEST.
1891

PROGRAMME.

FIRST SESSION—TUESDAY, AUGUST 19th, 1890.

3.00 P.M.

Opening Prayer: By Rev. J. SOMERVILLE, M.A.

Address of Welcome: By Chairman of the Local Board and of the Local Committee.

1. Dangers from Pit Wells: By H. VAUX, M.D., Medical Health Officer, Brockville.
2. Diseases of Animals in relation to the Public Health, and the Duties of Health Officers in relation thereto: By T. V. HUTCHINSON, M.D., Medical Health Officer, London.
3. How can we best secure and maintain a wholesome public and private supply of Dairy Products: By O. J. SHOWELL, Esq., Owen Sound.

The discussion on these papers will be opened by J. Ryall, M.D. Medical Health Officer, Hamilton.

At 5.30 p.m. the Association will adjourn to carriages and be driven to the Waterworks and other points of local interest.

SECOND (CITIZEN'S) SESSION.

7.30 P.M.

Prayer: By Rev. Mr. HOLMES.

1. Address of Welcome: By the Mayor, W. A. McLEAN, Esq.
2. President's Annual Address: By E. GRIFFIN, M.D., Brantford.
3. Physical Education, its needs and how best effected: By J. J. CASSIDY, M.D., Member Provincial Board of Health. *The discussion thereon will be introduced by Hon. Chas. Drury, Minister of Agriculture and Health, Rev. John Somerville, and C. N. Hewitt, M.D.*
4. Isolation of Infectious Diseases: By J. D. MACDONALD, M.D., Member Provincial Board of Health.
5. Prevention of Disease by Inoculation: By C. N. HEWITT, M.D., Secretary State Board of Health, Minnesota.

A musical programme will be interspersed with the evening's proceedings.

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FIFTH ANNUAL CONVENTION

OF THE

EXECUTIVE HEALTH OFFICERS OF ONTARIO.

The Fifth Annual Convention of the Association was held in Owen Sound on Tuesday, Wednesday and Thursday, Sept. 19-21, 1890. As will be seen from the list of members found at the end of this report, a most representative attendance of the members of the association was present. The proceedings developed much local interest and several of the sessions were largely attended by the general public.

FIRST SESSION—TUESDAY AFTERNOON.

The President, Dr. Egerton GRIFFIN, of Brantford, called the meeting to order at 3 o'clock.

The Rev. Dr. FRASER of Leith, opened the proceedings with prayer.

Addresses of welcome were then made by the Local Board of Health and Town Council, represented by the following gentlemen :

Rev. Archdeacon MULHOLLAND, Chairman of the Local Board of Health, said : Mr. President, and gentlemen of the Association : On behalf of the Board of Health I extend to you a hearty welcome to the town of Owen Sound. Had you visited Owen Sound at the time I first arrived here, and if this were your second visit, you would marvel at the progress made in the interval. Where the station of the C. P. R. now stands, with its six miles or more of

railway work was then a sportsmen's preserve for duck and snipe shooting. Some years ago we attained our majority and became a town, and we hope ere long to attain the majority—the population—which will entitle us to become a city. (Applause.) We hope from the progress made in railways and shipping that we shall yet be called the Liverpool of Canada. We have the best harbor on the lakes, as vessels of any burden can float there with perfect safety. Owen Sound is yet to be a great and populous city. This is not the dream of an Irishman. The Scotch are proverbially cautious, but we have some Scotchmen who also believe that in the near future we shall have here a very large city. (Laughter and applause.) It is our endeavor to make it not only a very large city but also a healthy city. I understand that in whatever city or town you visit you make the sanitary condition of that place your special work. We hope, therefore, that you will not only inspect our system of waterworks, but give us your opinion as to whether we should carry it on on the same lines or not, for an opinion coming from such a body will be highly beneficial to us. We purpose this afternoon to take you out to inspect our waterworks and also to visit Inglis' Falls. I again give you a hearty welcome, or as they say in my dear old Emerald Isle, "*Cead mille failtha.*" (Applause.)

Mr. S. J. PARKER, President of the Board of Trade was next introduced, and heartily re-echoed the welcome of the Archdeacon. The town was now in a transition period, and the matter of sewerage was a most important one. It was a question with many whether laterals of the sewer should be run into the river. He trusted that the Association would pronounce upon the systems of sewerage and waterworks without fear.

Mr. ROBERT MCKNIGHT, Registrar of the county, and a member of the Local Board of Health, also extended warm greetings to the Association. The Local Board had been doing its best to see that the sanitary interests of the town advanced with the general progress of the town.

Deputy Judge MORRISON said that he availed himself gladly indeed of the opportunity of extending to the visitors a cordial

welcome to Owen Sound. He recognised in the present gathering another evidence of the progress of the town. He never had a more pleasant duty to perform whilst mayor in the previous year than that of inviting the Association to Owen Sound. (Applause.) He felt sure that by the discussion of the various matters coming before the Association the town would be much benefited.

Mr. MATTHEW KENNEDY, as a member of the Local Board of Health, also joined in the words of welcome. The members of the Association were regarded as experts in their line, and so the Board and the citizens of the town expected to benefit by their presence and deliberations.

PRESIDENT GRIFFIN—Although I am not an Irishman I claim to be a Canadian, and as a Canadian nothing gives me more satisfaction than to see the promise of the opening up of a great city on this bay. (Applause.) I believe you have a right to prophesy a great future for this town, a town which I confidently believe will be an ornament to the great empire which we are building up.

The minutes of the previous convention were then read.

On motion of Dr. Rae, seconded by Dr. McLellan, the minutes as read were adopted.

Dr. Coventry, of Windsor, then read a paper on "The construction of public sewers on a revenue basis," the discussion on which was deferred until all the papers on the subjects of sewerage and sewerage disposal had been read.

This paper was followed by a paper entitled "How can we best secure and maintain a wholesome public and private supply of dairy products," by Mr. Showell. A discussion on this paper followed and was opened by Mr. T. Macfarlane.

Mr. T. MACFARLANE, Ottawa—I really did not appreciate the nature of the paper that has just been read until Mr. Showell had proceeded with it for some time. I had at first begun to doubt whether it would be proper for us to discuss it. But there are some points in it which have an interest for us. It is perfectly true that the Danish system

of dairying is the one which produces the best butter, an article which takes the highest place and commands the best prices in the markets of the world. And there is no doubt that butter of that sort would be better for the health of the people of Canada. But I do not think that the medical men present will claim that disease is greatly caused by the use of impure butter. However, I can assure Mr. Showell that we have not anything in the way of adulteration in our Canadian butter. (Applause.) The Department of Inland Revenue the other day published the results of the analyses of over 200 samples of butter, the object being to find out if the law which prohibits the manufacture of or traffic in anything of the nature of oleomargarine was being carried out, and these investigations detected nothing in the way of imitation or adulterated butter. Oleomargarine may be sold in the United States or Europe, but not a pound is sold in Canada at the present moment. (Applause.) For this the people of Canada have reason to be thankful to their legislators, more especially to the farming representatives, who strongly insisted that nothing of that sort should be permitted in Canada. This law does not exist in Denmark. An agitation is now going on there for what is called "clean land." They want their land to be free from the very suspicion of any imitation or adulteration of butter. And it will be well for Canada when she begins to produce butter for the foreign market, to see to it that the Act against oleomargarine is maintained, and that nothing containing foreign fat is permitted to come into this country as butter. The procuring and selling of good milk has, of course, a great deal to do with the securing and maintaining of good health. I would like to point out that efficient machinery now exists in Canada for the inspection of milk; that we have now certain arrangements by which the health officers and the people generally can easily avail themselves of in the procuring of good and pure milk. The law has been amended of late in a great many particulars, and the prosecution and conviction of people guilty of selling adulterated milk has been greatly facilitated. We find that large cities and towns appoint their inspectors of food, and that under this adultera-

tion Act they can inspect milk and prosecute those who attempt the sale of milk that is not up to the standard of quality. But in cases where a milk inspector is in doubt he can very readily send his samples to the Department of Inland Revenue and have them analysed at the following very low rates.

For one sample	$2 00
" two "	2 25
" three "	2 50
" four "	2 75
" five "	3 00
" six and over	50c. each.

There is thus no need for him beginning a prosecution against a milk dealer which may end in failure. We have also the Provincial Health Act, and the Inland Revenue Department supplies instruments and information so as to enable health officers to test the milk and stands ready, as I have already said to test samples of milk at very low fees. I shall always be willing to give any information on this point to any of my colleagues of this Association.

Dr. BRYCE, Toronto:—In endeavoring to lead the discussion along a broader line, in the matter of the health of the household, it is well to consider the various stages through which the milk has to go, before reaching the consumer, and we need not be surprised if we find occurring, cases of diarrhœa and other diseases which have been found difficult to account for. It will often be found in towns of the size of Owen Sound, for instance, that the milk supply is brought in from the surrounding country. The majority of the council members of these townships are generally farmers, and they do not feel that they should supply inspectors. Each farmer's own cleanliness is therefore what has to be depended upon so far as the condition of the milk is concerned. The milk is generally fair during the summer, but in other seasons of the year when the milk is placed in dark and stuffy cellars it is liable to

absorb unclean odors and bacterial forms, and produce diarrhœal and other troubles. But assuming that the milk is brought to town in a tolerably clean condition, what is generally done with it? There are some ladies present who may be the innocent sufferers of the carelessness of others, although they themselves may be careful. In Toronto the milk generally comes in on an evening train, when it is sold to dealers by the can, who distribute it to their customers in the morning. These dealers take the milk home and frequently put it in the driving shed or stable, where it is left until morning. Now, we have heard and know of milk absorbing readily the flavor of anything there is near it having an odor. Dealers, too, will take a measure which has been used already, thus rendered unclean, and dip it into the milk can, and in that way there is another chance of disease spreading. Then the milk is sometimes placed in the cellar, or on the cellar stairs, and left there among vegetables and other things for a day, or perhaps two days. There is also a great danger of milk being taken from cans imperfectly washed. Bad well-water is often used for washing the cans; the weather is warm and hot water is not convenient, and so disease is spread still further. The Board of Health of this town should therefore appoint an intelligent inspector, as Dr. Griffin will show is done in Brantford, and as Dr. Hutchinson will tell you is done in London. Send your inspector to the dairy or the farm, and if these places are not clean and fit for the handling of milk, he should stop such persons from selling milk. It may be said that the law does not permit you to inspect milk in another municipality. But the law does permit you to prohibit the bringing in and selling of such milk. In the case of scarlatina or other contagious diseases, the vessels may be the means of spreading disease to other places. These matters, I think, are along the line of the question introduced by Mr. Showell.

Mr. R. McKnight—Is there no instrument at the hand of the health officer or milk inspector by which it can be ascertained if bacterial life prejudicial to health is present? The gentleman who has just spoken has said that it is out of the power of the inpector

to inspect wells and farms where the disease is suspected. I have always understood that the function of the inspector was to ascertain if the milk was adulterated with that most common adulterant, water.

Dr. GRIFFIN—It is easy, very easy, to distinguish if water has been added by means of the lactometer. There are other instruments used, but none, I believe, which would make the legal prosecution certain of success. Mr. Macfarlane has advised methods which have been approved of in the United States and elsewhere. But there is no difficulty in the question that Mr. McKnight has raised. The use of the lactoscope and the lactometer will enable you to approximate very closely to the amount of cream, and thus give you a pretty correct opinion of the value of the milk, yet not so absolutely correct as to ensure success if you went into a court of law and a clever lawyer examined you as to the exactness of the test. There may be an inspection as to whether the stables are kept in a proper condition, the premises clean, and the milk generally fit for public use. In Brantford the inspection of milk has produced a moral effect upon the community, and since it was adopted four years ago, I think there is hardly a man who dares to water his milk. The speaker instanced the case of a man who was very successful in handling milk, who went from neighborhood to neighborhood getting it, and who travelled a mile or two further from town for his milk so as to avoid the risk of losing reputation and custom from handling milk from sick cows kept nearer the city. But the people who owned the sick cows, who were considered very good, pious people, thought that a little milk from sick cows would not amount to much in so much other milk. (Laughter.) Another bad practice, and one that needed to be stopped, was the keeping back of the strippings. We are publishing a list of these examinations, stating that by the lactoscopic tests there are such and such results, and the effect is something remarkable. People look for these reports and will not deal with any man who is adversely reported upon. Good skimmed milk is sold at ten cents a gallon, while pure milk is sold at twenty; but our good skimmed milk is as good as much of the milk that is sold

elsewhere. I have examined some of that milk and it has given 1¾ or 2 per cent., while some of the milk sold by the regular dealers has not gone much over 2 and 3 per cent. Instruments might very well be supplied larger towns so as to confirm the accuracy of the lactoscopic tests and aid in the prosecution.

Dr. HUTCHINSON, London—I believe that Mr. McKnight's enquiry was as to the detection of bacterial life in milk.

Dr. BRYCE—In the present condition of bacteriology it could not be carried out by any of our skilled men except by a very long drawn out process. The daily biological examination of milk is out of the question. That being the case we will have to revert to that careful sanitary supervision which will be within the power of every municipality. There is no doubt at all as to the need and the benefit of an inspection of milk. Such inspection is absolutely necessary to prevent the spread of contagion, and actual daily supervision is needed if the best results are to follow. Dr. Griffin has clearly shown the benefits of such inspection. There is a need of actual dairy supervision in the matter of the ordinary germs of putrefaction, let alone of disease. As beer will not be good beer except the exact conditions are observed, neither will milk be good milk except under similar conditions.

Dr. MCLELLAN, Trenton—A biological examination being out of the question, an inspection as to the quality of the milk should be insisted upon. In Trenton we are now pretty well able to tell who sell the milk, and the inspector, a veterinary, reports to the health officer the results of his examination of the wells, etc. If a dealer is reported against by the inspector, he is given warning that he will be prosecuted by the local board of health if he sells any more of that milk before remedying what was adversely reported against. The effect has been very good.

Dr. COVENTRY, Windsor—This subject is being somewhat enlarged from the very able and interesting paper which has been read. Another phase of the matter has come up, namely, the moral effect of the examination of milk upon milk dealers. It has the effect of restraining them from adulterating the milk just as the policeman's baton will restrain people from breaking the law; yet there are law breakers in the community with whom the policemen have to deal,

and there are law breakers who need a more frequent and vigorous application of the baton and who are hard to keep in order even then. I visited an establishment the other day that was rather a novel one. A man named Towers, of the city of Detroit, buys milk indiscriminately from the country all around. His agents go out with collecting wagons and pick it up. It is all put into one vat and distributed to his customers. He found it a hard matter to deal with those who supply him with milk. Some watered the milk a great deal and some a little, but in a majority of cases the milk did not contain a great amount of butter fat, and he felt that he was paying a good deal of money without getting full value for it. He tried to examine it and keep tally of it, but it was no use. Then he invented a very ingenious machine. It consists of a series of tubes which he fills with milk. These tubes are larger at the bottom than at the top. When the tubes are charged with milk, some chemicals are added, sulphuric acid being the principal one, and they are placed in a centrifugal machine with a great many revolutions, and left revolving for seven or eight minutes. This process enables him to read off the graduating tube the exact amount of cream, and thus he can find the amount of cream in each can. He has a book with the man's name and number on, and there is a corresponding number on the can, and so the work can be done without a great amount of book-keeping. He pays for the milk in proportion to the amount of cream or butter fat he finds in his tubes. For milk showing only 2 per cent. of cream so much a gallon, and so much more of cream so much more per gallon, and no matter how much water the farmer puts into the milk, he gets paid only for the amount of cream found in it. (Laughter and applause.) He finds that in addition to the moral effect of an occasional report to the health office, that he has to handle just so much water for nothing.

Mr. MACFARLANE—The valuation of milk according to the amouut of cream it contains is not a new matter. In Denmark and Sweden they have actually perfected a system whereby all owners of factories or partners in factories pay only according to the amount of cream or butter fat the milk contains. That is one reason why the Danish butter is so good, and commands so high a price.

Mr. MCKNIGHT—Is it not a fact that the prime reason why the

Danish butter commands so high a price in the English market is the fact that that butter can be placed there in a fresher condition?

Mr. MACFARLANE—There is some salt used in the manufacture of Danish and Swedish butter, but there large quantities of butter are offered to the dealer at once, and he prefers to purchase large quantities of even slightly inferior butter rather than small quantities that are not of uniform quality.

Mr. KEOUGH, Owen Sound—One reason why Danish butter has so great a foothold in the British markets is that a dealer in Liverpool can telegraph for a supply of butter, and in a couple of days he will have it. It is the same with their bacon and other products. I would like to know if it has been decided that oleomargarine is prejudicial to the health? I was in Scotland a few months ago and found that a company of Scotch farmers had put up an oleomargarine factory and were turning out thirteen hundred-weight a day. They were purchasing the fat from Chicago.

Col. COLE, Brockville—Mr. McKnight has struck the key-note regarding Danish butter. My wife and I, when in London, asked why the butter was so devoid of salt, and we were told that it was to suit the taste of the people of London for fresh butter. We will have to change the taste of the people before we can supply them with butter in any large quantity.

Mr. MACFARLANE—Regarding the effects of oleomargarine, it cannot be said that there is a great deal of danger to health from using these fats instead of butter, but it is an adulteration, the same as when a grocer sells ground peas for coffee. (Applause and laughter.) But apart from the question of injuriousness, it is safe to say that oleomargarine has not the same beneficial effects upon the constitution as butter. There are certain acids found in pure butter, suitable for our constitutions, that cannot be found in these foreign fats.

After the discussion the meeting adjourned, when the members were driven in carriages to inspect the source of the water supply of the town, and other points of interest, among them Inglis' Falls, a most romantic and beautiful spot about three miles out of town. The water supply was found ample and apparently of excellent quality, and the members of the Association expressed themselves as much instructed and pleased with the trip.

SECOND SESSION—(EVENING SESSION).

The convention resumed business at eight o'clock, the proceedings being opened with prayer by the Rev. Mr. Holmes.

The SECRETARY read a telegram stating that on account of the illness of the wife of W. Chipman, C.E., that gentleman would not be able to be present but that his paper would be forwarded. Letters of regret at not being present were also received from Hon. Charles Drury, who was detained on the prison commission, and Dr. Ryall, of Hamilton; Dr. P. P. Burrows, of Lindsay; Allan Macdougall, Sanitary Engineer of Toronto; John Miller, Deputy Minister of Education; Mr. G. E. Vandusen, Picton; Dr. Tye, Chatham; Dr. W. Oldright, Toronto; Dr. A. Robillard, Ottawa; G. McNeill, Sanitary Inspector, Ottawa; Dr. M. J. Kelly, Brantford and Dr. D V. Walmsley, Elmira.

Mr. W. A. McCLEAN, mayor of Owen Sound, was introduced and warmly welcomed by the Association. Among other things the mayor complimented the Association upon having already done wonders in the way of sanitary reform, considering the facilities at its disposal. It had set people thinking as to the way in which the interests of the health of the municipality ought to be directed. Owen Sound had already been influenced for good. Four years ago, said the speaker, Owen Sound had not one single yard of sewerage, and now we have nearly three miles. A few years ago we had not a single drop of water, except what was pumped from wells, and to-day, with what is already constructed, and what is being completed, we have about ten miles of water pipes. We have one of the most magnificent harbors on the great lakes. We have a shipyard turning out vessels unequalled by any on the lakes. Educationally, too, the town takes high rank. Four years ago our population was 4,000, now it is 8,000. Our assessment four years ago was a little over $1,000,000, now it is over $3,000,000. I wish to extend to you the warmest possible welcome to our town. (Applause).

The PRESIDENT—On behalf of the Association I represent, I desire to return to you my cordial thanks for the manner in which the mayor has extended a welcome to us. He said he hoped it would do

us good, and it has done us good already. We never expected to see such progress and advancement as you have made here within the past few years. There need be no doubt as to the future of Owen Sound. It has great advantages in a sanitary way. One of the matters of first importance in a town is good water, and anyone who has seen your water supply to-day, must feel that you are in a safe condition in this respect.

Dr. MACDONALD—There is hardly room for any more remarks. The mayor has expresseed very kind words. He has said that we came here to do good and to get good. I may say that as yet we know very little of that branch of medicine we are here to study—the sanitary branch, preventive medicine. A friend to-day said that science is advancing. It is not too much to say that in the past humanity has lost many benefits which may yet be recovered by the human family. Prevention is better than cure, is an old saying, but is becoming year by year, not only a proverb, but something in every-one's knowledge and practice. There are many diseases which can-not be cured. They can be avoided only by the practice of preven-tive measures, for though you may get into the doctors' hands with them, we cannot do for you what we would wish. Owen Sound has greatly advanced. In the times past I used to hear the Archdeacon spoken of as a missionary in the backwoods of Owen Sound. (Laughter.) We were charmed with the scenery, and also with the excellent accommodation for supplying the city with water. It is a grand thing for you that you have a large quantity of the purest water coming out of the rock at so great a height, so that by simply laying the pipes you can get it into your houses. The future of the town is, I believe, all that the President has said. I am very happy to be able to have the privilege of returning thanks to the mayor and to you for the kind reception you have given us, and for the countenance we have met with since we came here.

The President then delivered his annual address, after which a paper was read by DR. J. J. Cassidy, of Toronto, on "Physical Educations: its Needs and How Best Effected," which was followed by a paper entitled, "Isolatiou of Infectious Diseases," by Dr. J. D. Macdonald, of Hamilton.

The PRESIDENT.—In view of the lateness of the hour it has been deemed best to postpone discussion until to-morrow on the two papers read this evening. To-morrow a number of papers will be read on the question of sewerage, which will be of interest to the people of Owen Sound.

The SECRETARY.—The reason our distinguished friend, Dr. Hewitt, Secretary of the Minnesota State Board of Health, has not been with us is that he has spent a few months in Europe, and that on his return his duties are so pressing that he is unable to leave at present. He is an able medical man, a brave soldier, and a capital story-teller. He is indeed a clever and entertaining gentleman, as you will perceive from his letter. The secretary then read the letter of Dr. Hewitt.

The SECRETARY.—Touching the matter of vaccination referred to in the letter, you will remember the case of the Montreal anti-vaccination doctor, who coming west on a visit, was compelled to strip and be examined with a view to vaccination, when it was found that he himself had been recently vaccinated.

During the evening several ladies and gentlemeu contributed selections of vocal and instrumental music of a very pleasing character, which added much to the success of the meeting.

After a duet had been sung by Mrs. Cooke and M. E. Cooke, the meeting adjourned.

THIRD SESSION.—WEDNESDAY MORNING.

Carriages were in waiting early in the morning, and the members of the association were taken on an inspection of the sewerage system and a visit to the harbor. Upon their return the convention resumed sittings.

A paper upon "Dangers from Pit Wells," was read by Dr. Vaux, of Brockville.

Dr. A. Cameron, of Owen Sound, then read a paper entitled the

"Owen Sound Sewerage System," which was followed by a paper on "What shall we do with Sewage?" by Thos. Macfarlane, chief analyst, Ottawa, and a paper by Dr. E. Griffin, of Brantford, having the title "Sanitation in Brantford."

The following discussion grew out of the question of local treatment of sewage:

Dr. HUTCHINSON—I would like to bring the London sewage question before the meeting. London is now in the throes of litigation. We are no sooner out of one law suit than we are threatened with another. London has a splendid natural system of sewerage, but we will not be allowed by the townships adjoining to drain into the river. With regard to the dry earth system, London passed a by-law a few years ago enacting that no more of these pits should be put down, but that those already in should be permitted. We have now what is called the odorless system—or it is supposed to be odorless. But we are now shut out from emptying into the river, and Alderman Taylor and myself would like to know what we are to do in London.

Dr. MACDONALD—How deep are the pits referred to?

The PRESIDENT—From five to twelve feet.

Dr. MACDONALD—You can never expect to get these thoroughly cleaned. It was recommended that no pit should be more than a foot in depth, that it should be frequently cleansed by the caretaker of the school, and that dry earth should be thrown into it every day or two. A cleansing of these deep places is impossible.

Ald. TAYLOR—Dr. Hutchinson has given to you what is to us a knotty question, that is, the disposal of sewage. We have in London the purest of water, and the most plentiful supply to be found in all Ontario. Our soil is of a dry, sandy nature, and, as you are all aware, our death-rate is about the lowest of any place in the province. We are now experimenting on the sewage question. We are considering what is called the Conder system, with sulphate of iron. But while we are experimenting we have a County Crown Attorney who is experimenting to get it into the courts. We are

experimenting for the city; he is experimenting for the Crown Attorney himself. He is trying to get some one to lodge an information against the city, so as to get into the courts again. It is this one individual who is trying to involve the city in law and law expenses. The municipality he is working in behalf of is known as London West, a small corporation so heavy in debt now that they are anxious to come into the city. We are here principally to get some information from this intelligent body that we may bring back to London. I do not think that there is any danger from the discharge of the sewage into the river at London. There is a freshet twice a year, and a dam which keeps all matter until the spring and fall, when it is flushed out. We are so located that it is impossible to have filtering beds. Our engineer has made an estimate on it, and it would cost (the first outlay) $250,000, and the expense of running it would be $20,000 annually, and we do not want to lay so heavy a burden upon the ratepayers if we can avoid it. We hope that this matter will be considered by you here, and that Dr. Hutchinson and myself will be able to bring back a favorable report.

Dr. COVENTRY—The method pointed out by the President and Mr. Macfarlane of dealing with the solids, is not so difficult a question as that of dealing with the other parts of the sewage of towns and cities. The great trouble after all is the dealing with the liquids, which become the most offensive and foul smelling. When you have extracted the solids, what are you going to do with the liquids unless you throw them back into the soil for nitrification? In the case of Owen Sound, those of us who have looked around have not failed to observe its unique position, but it is difficult to say what can be done in the way of irrigation. London has a fine agricultural country, and the soil is well fitted for a system of that kind, and although it means the expenditure of much money, yet there is a great deal to be gained from it, even if it is not a financial success. One municipality has a good case against another if such municipality pollutes the stream above to the detriment of the public health or comfort of those below. It is not a question of the law of a municipality, the law of a Legislature, or an Act of Parliament. There is a law above that; there are the rights belonging to mankind, rights that the higher courts of England have recognised for a long time, but more particularly of late. And they are very emphatic

in their judgment in this matter, that where one municipality has polluted the water or air of another they must abate the nuisance. It is simply a wholesale nuisance arising out of individual nuisances. It is a question that cannot be adjudged by expediency; it should be dealt with on broad principles. Each municipality must work it out as best it can. They should not look to us for a deliverance on this point. Medical men here may be divided on this point of difference between London and the adjoining municipality, and a mere majority of opinion would not be of much value. It would not be well to commit ourselves to any one particular line of action with our necessarily crude knowledge of local circumstances. The present system of sewers should not be considered a loss altogether, for if, in the future, the separate system is adopted, sewers of their calibre will still be needed to carry off the rain water and the surface water of the town. There is a great hope that the gentlemen who have the matter now in hand will require very little help from such an organization as this in order to make a satisfactory disposal of their sewage.

Ald. TAYLOR—I omitted to state that the town of St. Marys is sewered into the north branch of the Thames, while the town of Woodstock is sewered into the south branch, and both of these are discharged through London. Yet London is the only place to which exception is taken. In the summer season I can see herds of cattle standing in the stream near London, and our city has to suffer from that. The military school now drains into it, and the government has offered to pay $10,000 to the city, placing that sum in the estimates for the present year, to assist the municipality to make a trunk sewer of what is known as Carling's creek, and to carry the water in the same place that we are now being prosecuted for entering. So the municipality is not the place that alone wants the favor, though we are suffering from the wrong-doing of other places. On the matter in dispute between the city and London West, the last named municipality was so divided over the matter that it was only by what the lawyers call a "snap verdict" that the case was decided in their favor. There has been but little sickness and but a very low death-rate in London.

Mr. MCKNIGHT—A good sanitary engineer would be of benefit to London and other places.

Dr. BRYCE.—We all recognize that London is the chief city in the west, and while it is true that there are other towns polluting the Thames above London, it has not been stated that towns further down, like Chatham for instance, would be troubled with the present pollution, plus the sewage pollution of London. But such, unfortunately, would be the result of permitting London to send its sewage matter into the river. It is quite clear that in the larger cities sanitary engineering demands that the water system be adopted. The average consumption of water per head in New York is 100 gallons, and in Toronto 60 or 70 gallons, and we must dispose of that water. Now if we have a considerable quantity of water, economy of time and money demands that we must dispose of it by some combined system, and the best we know is the water carriage system. The government had a prevision of the difficulty in London and saw clearly the need of the city when it established at the asylum an object lesson. When Mr. Horetsky reads his paper we will understand the year's practical results with the sewage, and I think it will be shown that a sewage farm is one of the possible ways out of the difficulty. If I am not mistaken this matter of London was reported on by Dr. Oldright and Professor Galbraith, and they suggested that a plan for the whole city can be adopted similar to that carried on at the asylum. Ten thousand dollars a mile would put down a system of separate sewers, with all the adjuncts, manholes, flushing, etc. We cannot allow, as far as the law permits, and as far as it places upon the Provincial Board of Health the duty of seeing that the streams are not polluted—we cannot admit for a moment that one of the largest streams in the west can be polluted because London is a city that is growing rapidly. Stratford and St. Marys are polluting the river, but they have really no system yet. When they submit their system this question of the disposal of sewage will come up. In Owen Sound a main sewer can be constructed that would deliver into a large body of water. The water supply is so high up that this could not pollute it, and as the sewage could be delivered so far down on the coast you have the matter practically settled here. Dr. Coventry has also shown what can be done with the old sewers, but I cannot imagine that they are not so situated but that they might be utilised in the new system. Let us see what new system might be adopted. What is known as the separate system is the

keeping out of the rain water—*i. e.* from the roof and from the surface. Waring tells us that in the drainage of a street with lots 25 feet wide, each having its house, some 4,500 feet of six inch pipe will not run more than two-thirds full when every one of these houses is discharged into it. That system has been adopted in the town of Brockville, contracted for at an average cost of $8,000 or $9,000 per mile, and there they have a large amount of rock cutting for every thousand yards. But I believe you would have very little rock cutting here. With a main of 24 inches and six inch pipes for laterals, ten miles of sewerage at $5,000 a mile would cost but $50,000, and with a main of two miles going down the coast, you would be at an expense of only $70,000 for the town. Get an engineer who is used to working out the separate and other systems and he can easily tell you what the cost will be. London has got itself into trouble, and I hope it will never get out of it until it gets the sewage discharge out of the river. I have the interests of London at heart, but I have also the interests of Chatham at heart, and Chatham does not want London sewage to be poured into its river. There are possible schemes, without much expense, of lifting the waters for carrying down a mile or two. The house sewage can easily be lifted, and by a couple of windmills to the coast.

Col. COLE—Looking at your Owen Sound sewers, it seems to me that you are storing up an experience similar to that of Brockville during the past few years. You are attaining a splendid growth, and now you are in the position that Brockville was in before we adopted the system we have at present. We had constructed large stone sewers, and permitted everyone to put into these sewers anything they chose. But, although the St. Lawrence river has a strong current, there is an eddy in it, and most of the matter kept in the eddy, and not moving away, became a festering sore to those adjacent to the river. Our attention was called, owing to the increasing death-rate, to the necessity of adopting some better system of sewage. We sent to Col. Waring to come to Brockville, and gave him the length of sewer we wished to construct, with the point of outlet. Some $60,000 was the outside limit that we thought we would be able to carry in a by-law. Col. Waring gave us a report based on those conditions. We afterwards changed the outlet and raised the amount for construction to $100,000. Mr. Pierson was invited to

look into the matter, and Prof. Galbraith, of the School of Science, was also consulted, Mr. Chipman being our local engineer, under whose superintendence all the work has been done. The result was that we decided to have our outlet at the lower and east end of the town. The pipe was laid into the swift current in a depth of water of forty feet. The contract price for laying it was $4,800, and the contractor cleared about $2,000, but everyone was pleased with the quality of his work. Our local men, however, learned a good deal from this. Our main sewer for quite a long distance is an eighteen inch one, fifteen inch succeeding that, and twelve inches following. This sewer has to go all along the front and around west of the town. It has been constructed out of a general tax, but all other sewers are built on the frontage tax system. It costs about ninety cents a foot on each of the side streets, which enables many of the poorer people to get the benefit of sewerage. Our medical health officer recommended the council to have sewers built on certain streets on sanitary grounds, and if the people did not come in to protest against it in sufficient numbers the sewer was constructed. In only one case did a sufficient number of ratepayers come in, but they were there almost to a man. But that was the only case. A deputation from Peterborough came down recently, and in examining the operations of our flush tanks we found that the sewers were nearly as clean as when built two years ago. In the flush tank there is a siphon working automatically. This siphon is of cast iron, with a pan at the bottom arm. The tank fills up from a pipe connected with a water pipe. When the tank is full it fills the pan, and the water being heavier drops down, and immediately the whole supply starts to rush out the six inch pipe. Our main sewer communicates with this iron pipe going out into the river, and we have put an iron collar on it, and can flush it thoroughly. We are all well pleased that in Brockville we have adopted the separate system of sewage, and would advise the board of health and the Council of Owen Sound to come and see that system before making further movement in the way of sewerage. I do not think that the present stone sewers will be lost. We reconstructed one of our stone sewers as a storm sewer, and will as far as practicable use all the old sewers for that purpose.

Mr. MACFARLANE—It must occur to almost everyone present that all the towns in Canada are not so favorably situated as Brockville.

It is impossible to bring the St. Lawrence in front of every town and village in Canada. The system of Brockville is admirable, and the discharge takes place in the very centre of the river St. Lawrence. The matter discharged is taken away, and the volume of water is such that there can be no offence to any town below. The same thing occurs in Ottawa, and in spite of all the epidemics of fever in that city, we have never heard of any family using water from the river below the city having been affected by the sewage contained in it. I have been much pleased in listening to the paper by our President. I have learned a good deal from it. Before a town comes to any decision on this matter, they should not only see the excellent system of Brockville, but also the admirable system of Brantford. The system of sewers to be introduced into Brantford is, I understand, not to remove excreta, but mainly the slop water?

The PRESIDENT—Although we prefer to keep the sewage separate, public water closets would be allowed to attach.

Mr. MACFARLANE—If that is permitted you will have the fecal matter introduced into the river and trouble will follow. We are face to face with this in the case of London. There the water carriage system has been largely introduced. But there are also a large number of pit wells there, and for such cities as use them I would say that deodorizing by peat dust or dry earth is the system to adopt. You cannot expect the people of London to abandon their system all at once, but there is nothing for them to resort to except the disposal of the sewage by irrigation. The expense of introducing water closets in a town is quite considerable, and has not been accomplished even in Brockville. There is no doubt that the solution of this problem of sanitation will be the adopting of the dry earth or dry peat system for the smaller towns, and the water system will be used only in cases where you cannot do anything else.

Col. COLE—Manure and all other matters allowed to lie on the surface are just as dangerous as privy pits. I think that the central part of Owen Sound could be much more cheaply sewered than the central part of Brockville. We had not only to carry out a pipe into the deep part of the river, but had a very hard rock to cut away. I think we would find the Brantford system of dry earth closets beneficial in the central parts of the city where the poorer people live who are not able to build sewers.

Dr. COVENTRY—In reference to the adaptability of the separate system, I would like to call attention to the town of Chatham. There they have no system of sewerage at all. The river rises so high there that it almost overflows the banks, and any system which ordinarily at low water would convey the water in the river, would bring it back into the cellars. And here is a case in which the separate system would be adopted in two ways. For storm and surface water sewers would be constructed running toward the river, and for house purposes they could be directed the opposite way, into the country, where irrigation could be practiced. In that way at all times they would have enough water to flush their sewers for drainage and have enough for house purposes. There is no doubt that the townships immediately below Chatham would object if the town of Chatham proceeded to establish a system of sewerage that would carry everything into the river. I know an instance where a township objected to that very thing, where a nuisance was being established, the objectionable matter passing along through the township in a slowly running stream. The nuisance was abated forthwith. It is well to consider this matter in all its bearings. What I wish more particularly to do is to impress upon health officers the utility of this separate system of disposing of refuse matter.

Dr. VAUX—In Brockville we absolutely refuse to grant permits for new closets. In two years we shall have the privilege of buying the water works from the company, and then we will be able to proceed more rapidly, but the town hesitates to induce too many people to take water at present, for we will not only have to recompense the water works company for all its outlay, but will also have to pay them 10 per cent for all they spend. There must be a very well systematized mode of collection and general management before a town can make water works pay.

The convention then adjourned until the afternoon.

FOURTH SESSION.—WEDNESDAY AFTERNOON.

The President called the meeting to order at two o'clock, when it was decided to proceed with the reading of the remaining papers on the sewage question.

Mr. C. G. Horetsky, C.E., Public Works Department of Ontario,

read a paper entitled "Results of a Year's Experience with the London Asylum Sewage Farm and the Precipitation Works at the Agricultural College, Guelph."

This was followed by a paper by Dr. P. H. Bryce, secretary of the Association, on "How Soils Dispose of Organic Matter; the Process of Nitrification."

Dr. C. McLellan, of Trenton, gave a paper on "How Deforesting has Affected the Public Health, and the last paper of the series was then read by Dr. T. V. Hutchinson, of London, the subject being "Diseases of Animals in relation to the Public Health, and the duties of Health Officers in relation thereto."

Dr. JOHN BARNHARD, of Owen Sound, a venerable physician eighty years of age, was introduced to the Convention, and made a quaint but bright and witty speech. Among other things he remarked that the object of the gathering, as he understood it, was to ascertain the causes of disease entering the human system and the various methods of preventing its spread. "I would like to say a word or two regarding the dissemination of and the cause of disease. Our secretary and other learned scientists have told us of the various cocci which have invaded society. Now, I believe that the chief cause of the dissemination of germs of disease in Ontario is the circulation of these dirty, ragged dollar bills. (Laughter). Bank notes may be valuable, but they contain much dirt and some of these cocci. Of course we may admit that the cocci are there, but we generally put them in our pockets all the same. (Great laughter). We know that these bills are in the pockets of all kinds of low and filthy people, and some diseases of a very peculiar sort are liable to be carried by them. Coppers, quarters and other monetary metals also act as mediums for the spread of disease. I attended a smallpox patient once and was paid in bills by the individual who was caring for him. I scarcely knew whether or not I should circulate that money. However, I thought it best to disinfect that currency before I handed it out to anyone. Bills suspected of having been in circulation amongst people having infectious disease should not be reissued by the banks." The speaker naively added: "I was wondering what I could say when asked to speak, and as I happened to have a few of these dirty bank notes in my pocket I thought I would take them for a text." (Laughter and applause.)

Mr. MACFARLANE—I would like to ask in connection with Mr. Horetsky's paper whether any attention was paid to the amount of the evaporation which took place? When land is irrigated we cannot expect all the water to go through the soil. A large amount of it—I think by far the greater quantity—is evaporated. It has been shown that by far the greater quantity of rain falling upon the earth evaporates into the atmosphere again. This is why comparatively little water reaches the drain pipes. All the water does not percolate through the soil. This question of nitrification is an old one. All the nitre and saltpetre that have ever been sold have been produced through a process of nitrification of organic matter. I am very much inclined to think however, that this process is not exclusively carried on by the action of the organisms described by Dr. Bryce. There is, indeed, too much claimed for the agency of these organisms. This microbe theory is being run into the ground. (Laughter). Other agencies are working, and other changes take place of a purely chemical nature. It is said to be the function of these organisms to develop oxygen and oxidize to nitrates the matters containing nitrogen. But very recently experiments have been made with regard to manures in the soil, and it has been found that when a certain amount of fertilizing material containing organic nitrogen is introduced into it the nitrates and nitrites disappear, a reducing reaction takes place, and it takes some time before the process of nitrification is resumed. It thus seems that the nitric acid disappears until the action of the atmosphere can again oxidize the nitrogen. Now in this reduction of nitrates and nitrites it cannot be said that it takes place by the action of these organisms described by Dr. Bryce; it is a different kind of a process. These changes in the soil can be explained just as well without assuming that they are exclusively due to the existence of these animals. I think there is a tendency to-day to attribute far too much to the activity and power of these organisms. If we are to have everything explained by the action of microbes, we will soon have them introduced into the leaden chamber, and we will have it said that the production of oil of vitriol is due to their agency. (Laughter).

Dr. BRYCE—I would not try to minimise the beneficial use of oxygen. I may say that the experiments which have run alongside to correct any presumptions which biologists might have with regard

to the action of bacteria amply show that without them there could be none of this nitrification. When oxygen is present this process does not appear co go on until microbes come in. Microbes appear to do the work as well as oxygen, and why should they not exercise influence as well as oxygen?

Mr. MACFARLANE—So might silica.

Dr. BRYCE—But silica is not organic matter.

The PRESIDENT—Regarding this matter of microbes I would like to say that there are good and bad microbes, and it may be that the bad microbes might be overcome by the good microbes. It is said that recently a microscopist discovered in a fresh specimen a typhoid bacillus boring into a piece of mucous membrane. It made an incision and was about to hide itself when two good, healthy microbes arrived, fell upon the intruder, dragged him from his hiding place and ate him. (Great laughter).

Dr. MACDONALD—May it not be that bacteria and bacilli and all these have always been here and will doubtless continue? It is said that there are more invisible than visible organisms. We can make no division of the invisible organisms; we cannot measure them. We would never have known anything about them but for the microscope.

Ald. TAYLOR—I am glad to hear that the London Asylum system of sewage disposal appears to be a success. It has been stated that bacteria were to be found in Carling's creek. If this be so it is because of the farm. There have been a great many hogs kept on the asylum farm, and the slaughter house as well as the pens connect with the creek and defile it.

Mr. HORETSKY—The sample of water I took was got from above the point you speak of. Carling's creek is of itself a filthy stream.

Ald. TAYLOR—No creek filth can possibly be worse than that which comes from a hog-pen and slaughter house combined.

Mr. MCKNIGHT—There was one paper read which everyone present last night appreciated, and I think many here now would like to hear a discussion upon it. I refer to Dr. Cassidy's paper on Physical Culture. That is a question which comes home to us all, both young and old, and I regret that there has not been a discussion upon it.

The PRESIDENT—Talk about it now.

Mr. MCKNIGHT—The paper is above criticism, except perhaps on

one point. I refer to the advantages and benefits arising from dancing. The reader of the paper might have opposition there, but he would hardly meet with any opposition to his other practical and valuable suggestions. There was also an able paper read by the Secretary and by the gentleman who preceded him (Mr. Horetsky). The object of these papers was, I believe, to dispel a notion which might exist in the minds of the people that these irrigation or sewage farms had disease producing effects. Such fears, according to these papers, appear to be groundless. But although both papers were able and scientific, I think they failed to show one thing, and one which I believe would be the strongest thing to induce towns to accept the system. That is, they failed to show that it would be profitable in a remunerative way. People in Canada not only look upon the health side of the question, but also to the monetary part of it.

Col. COLE—In the ordinary meaning of sewage disposal, it is disposing of it without any profit. If there be any return whatever, it might be put down to the credit of profit and loss, whether it be great or small. In Brockville we are at a great expense without any return, but we are satisfied with it. Yet if there were any method adopted by which we could utilise it on a sewage farm we would be so much better off.

Dr. CASSIDY—I was well aware when I expressed an opinion favorable to dancing that I was giving expression to views not in consonance with those of some others who regard dancing as out of the question. But the truth must come out. If anything I stated in the paper would be hurtful to the views, or even to the prejudices, of any class of people I would be very sorry indeed. I was speaking from the view of a lover of athletics. I do not mean to endorse dancing generally. I was careful to say in speaking of dancing "under proper conditions." Dancing by the vicious will be a vicious performance. Dancing under proper conditions will be a benefit not only to the young but also to the middle aged. A clergyman recently protested against dancing, and said that all the exercise necessary could be got in lawn tennis, base ball, croquet and other games. It occurred to me that some persons might not have lawns for tennis, but they might have a little parlor in which they might have dancing. One advantage of dancing is that it is an exhilarating exercise.

Dr. McLellan—I should like it to go abroad that the medical men have a decided opinion regarding dancing. For my own part I believe that there is no other exercise equal to dancing. But the trouble is that dancing is prosecuted at the wrong time, and often in the wrong company. But it should not be said that because a man is fond of sugar he should swallow a hogshead of it. The medical profession should pronounce the fact that dancing is the best exercise known.

Mayor McClean—It is difficult to find the proper conditions in connection with dancing. I wonder how these gentlemen would feel if they saw a gentleman with his arm around their daughter's waist except in a dance room? Why should there be liberties in a dance room that are not permitted in any other place? The proper conditions are seldom fulfilled in the matter of dancing.

Mr. McKnight—I think the mayor must have been at the dances in the old logging-bee times. (Laughter).

Mr. Armstrong—The subject of Dr. Cassidy's paper was a much wider one than that of dancing. I thoroughly agree with the position he has taken on dancing. As a means of physical culture it is said to be one of the best exercises in the world. I am informed that dancing is on the school programme in the old country, and I think it should be placed on the school programme here. Physical culture should become a branch of our school system just as history or geography or anything else. The sooner our medical men get the Minister of Education to have classes for physical culture started, the better it will be for the pupils. Physical exercises are now more or less voluntary. The trouble with most of our school gymnasia is that they are not under proper conductors, and the consequence is that injury often results instead of good. The tendency is for the gymnasium classes to strive after exhibition feats, and try to fit for racing and prize competitions. If a young man is strong in his arm for instance, he will be proud of it and will try to still further develop that to the neglect of the other muscles or organs. Every teacher should be taught to know where the weakness of each child is, and to recommend to the pupil how to develop those weak parts and restrain the abnormal development of that which is already strong.

Mr. McKnight—Another point touched upon by Dr. Cassidy comes home to Owen Sound with particular emphasis, and that is the develop-

ment of the art of swimming. (Hear, hear.) There is not a town in the province so favorably situated with respect to water facilities as Owen Sound is, and yet so deficient in the means of teaching our young people how to learn to swim or practice that art. It is a good exercise, and it is also a safeguard against accident. I believe the council should have some of our water front so equipped that the young people, both male and female, might learn the art. Our children must be carted a mile out of town before they can try the luxury of a bath. The youngsters who plunge off the dock are hunted by the policemen, and my sympathy is with the youngsters in this case. I hope that some action will be taken by the council in this matter. We might have swimming baths erected at a small cost, with competent instructors, and it would be a great benefit to the town.

Dr. CAMERON—I hope Dr. Cassidy will always uphold dancing as a means of physical culture. I do not mean the dancing of the present day. There is not much in it; it is simply sliding along the floor. I would go back to my country days, when we had physical exercise in our reels and jigs. There was not then that close contact with the other sex. I believe, also, that boxing is a splendid exercise for bringing into play all the muscles of the body.

The PRESIDENT—In answer to Mr. McKnight, I would suggest that boys may be allowed to bathe by using trunk hose, as is done in Brantford.

Mayor MCCLEAN—We have now under consideration a plan by which the boys can bathe, but not in a nude condition, in the river.

MEMBERSHIP OF THE ASSOCIATION.

The SECRETARY—I will take this opportunity of informing all present that members of Local Boards of Health are eligible for membership in our Association, and that others who are not actively engaged but who are interested in the work of sanitation can become honorary members, the one class paying $1 and the other 50c.

RESOLUTION *re* SEWAGE DISPOSAL.

Moved by Dr. COVENTRY, seconded by Mr. MACFARLANE, and carried "That the papers read before this Association on the disposal of sewage be referred to a committee to be named by the Chairman, with instructions to give the matter an extended examination, and at the next meeting of the Association report on the whole question."

The following committee was appointed, with power to add to its number : Drs. Coventry, Griffin, Macfarlane, Bryce, Mr. Horetsky, Col. Cole.

Dr. Coventry, in speaking to the resolution said : The more I went into the question of sewerage the more difficult it seemed to grapple with it, and I came to the conclusion that in order to have something that would cover the experience of other countries as well as the experience of our own, and in order to consolidate the literature of the subject it was necessary to have a committee of this kind, and I hope that in naming the committee due consideration will be given to the points requiring special attention—the chemistry of the subject, the biology of it, as well as the practical treatment. I would like to see also some legal talent upon this committee, some man or men familiar with municipal law, and above all, the name of some prominent agriculturist who might be added to it afterwards, and a report of this kind would be likely to cover the entire subject.

M. Macfarlane—I would emphasize the idea which has just been thrown out by Dr. Bryce, that this committee when named, should meet before the present convention dissolves and determine among its members what each would undertake to do in connection with the next meeting of the Association.

Literature and Appliances.

Moved by Dr. Rae, seconded by Dr. McLay, and carried, "That the Executive Committee be empowered to spend such portion of any funds in the hands of the Association as it deems proper in procuring for the use of the Association such scientific literature and appliances as may aid in the development of the practical work of the Association."

Dr. Rae—It will be obvious to all that a large amount of research is necessary in order to get up a paper for this Association, and it often demands a larger expenditure in the way of purchasing literature than individual members of the Association can afford.

The Secretary—There have always been the annual fees of say $25, which have now grown to about $125, as the local government pays for the printing of our proceedings. I think it would be well to spend some of our surplus in buying such works as will be of assistance to our members in getting up subjects for discussion.

Moved by Col. Cole, seconded by Dr. Rae, "That the Provincial Board be requested to have the valuable papers read before the convention, together with the discussion thereon, printed for the information of those interested in sanitary matters." Carried.

The meeting then adjourned to meet on Thursday morning.

THE BANQUET.

Arrangements made for the entertainment of the members of the Health Officers Association included a banquet at the Paterson House Wednesday night. The hour announced for commencement was 9 o'clock, but for some unknown reason it was 10.40 before the guests took their places at the tables. A magnificent bill of fare was provided in characteristic Paterson House style. After the table was cleared the toast list was taken up. Mayor McClean occupied the chair, while Messrs. S. J. Parker and James McLauchlin filled the vice chairs.

The toast list commenced with "The Queen," which was responded to with cheers and the National Anthem. "The Governor-General and Lieutenant-Governor" was heartily responded to. "Our Legislatures" brought speeches from James Masson, M.P., and Col. Cole, ex-M.P.P. Mayor McClean proposed the health of the Association, and Drs. Griffin, Cassidy, Bryce and Macdonald replied, briefly expressing their gratification at the reception they had received and the hope that their visit would be fraught with benefit to the town. President Griffin introduced the toast "The Corporation of Owen Sound," and Mayor McClean, Deputy-Reeve Kilbourn and 3rd Deputy-Reeve Armstrong replied. "The Learned Professions" were responded to by Rev. Dr. Fraser, Mr. John Frost and Dr. Brown. "The Local Board," coupled with the names of Ven. Archdeacon Mulholland and Health Officer Allan Cameron, M.D., elicited short speeches from both these gentlemen, who have been indefatigable in their efforts to make the meeting a success. Col. Cole replied to the toast of "The Army and Navy and Volunteers" in a pithy, patriotic five minute address. "Canada" was received with rousing cheers and the song "The Maple Leaf," and responded to by Mr.

McKnight. "Manufacturing and Mechanical Industries" brought Mr. Matthew Kennedy to his feet, and he left no uncertain impression as to the position Canadians hold in that field of labor. "The Press" was toasted heartily, and in reply Mr. T. McGillicuddy, official reporter, and Mr. J. H. Rutherford replied. The toast "The Ladies," to which was coupled the names of Mrs. D. A. Creasor and Miss Emma Scott, was replied to in their behalf by Mr. T. Macfarlane by an apt quotation from Schiller. "The Host and Hostess" brought the evening's enjoyable programme to a close. An innovation in Owen Sound banquets was the participation of the ladies, and all are united in the opinion that it is a good one.

Fifth Session—Thursday Morning.

The last session of the convention was opened at 10 o'clock.
The report of the Executive Committee was read and received.
Mr. Chipman's paper was received as read and ordered to be printed.

Election of Officers.

The election of officers for the ensuing year was then proceeded with, and resulted as follows:—

President .....Dr. J. D. Macdonald, Hamilton.
First Vice-President ....Dr. C. McLellan, Trenton.
Second " ....W. Chipman, C.E., Brockville.
Sec'y-Treasurer.....Dr. P. H. Bryce, Toronto.
Council—T. Macfarlane, Ottawa; Dr. J. Coventry, Windsor; Dr. J. J. Cassidy, Toronto; Dr. A. Cameron, Dr. T. V. Hutchinson, London.

Local Government Aid in Scientific Work.

Moved by Dr. Macdonald, seconded by Dr. Rae, "That this Association desires to express its gratification at the active sup-

port given by the Minister of Agriculture of Ontario to the work of this Association through the facilities for laboratory investigations of disease, as shown by the work of the Provincial Board of Health with regard to the moth pest, rabies, actinomycosis, etc., and this Association trusts that the government will make still further provision for carrying on this desirable and necessary scientific work." Carried.

Investigations by the Inland Revenue Department.

Moved by Dr. Vaux, seconded by Dr. Coventry, "That this Association hereby expresses its obligations to Hon. John Costigan, Minister of Inland Revenue, for encouraging the efforts of the laboratory branch of the department in facilitating the examination and analysis of milk and other foods, and respectfully solicits similar assistance in the investigations of the best methods of sewage disposal for the various towns and cities of the province."

Time and Place of Next Meeting.

Moved by Dr. Cassidy, seconded by Mr. Macfarlane, "That the time and place of meeting next year be left to the Executive."

Votes of Thanks.

Moved by Dr. Coventry, seconded by Dr. Bryce, "That the Association desires to express its sense of the kindness and hospitality shown by the Mayor and corporation, the Local Board of Health and the Board of Trade of the town of Owen Sound to the Association during its sessions in the town."

Moved by Dr. Macdonald, seconded by Dr. Hutchinson, "That the thanks of the Association be especially extended to the ladies of Owen Sound for the perfect arrangements made for the entertainment of the Association."

The Association then adjourned.

LIST OF MEMBERS.

The following gentlemen were present :

Dr. E. Griffin	Brantford.
Dr. J. D. Macdonald	Hamilton.
Dr. J. Coventry	Windsor.
Dr. C. L. Coulter	Lindsay.
Dr. J. A. Robertson	Stratford.
Dr. J. B. Lundy	Preston.
Dr. J. J. Cassidy	Toronto.
Dr. P. H. Bryce	Toronto.
Dr. F. Rae	Oshawa.
Dr. J. A. Hunter	Everett.
Mr. Atkinson	
Dr. C. McLellan	Trenton.
Dr. T. V. Hutchinson	London.
Col. Cole	Brockville.
Mr. T. Macfarlane	Ottawa.
Dr. McLay	Woodstock.
Dr. Vance	Brockville.
Ald. Taylor	London.
Mr. Horetsky	Toronto.
Dr. Wallace	Alma.
Dr. A. Cameron	Owen Sound.
Dr. John Barnhardt	Owen Sound.
W. A. McClean, Esq., Mayor	Owen Sound.
Ven. Archdeacon Mulholland	Owen Sound.
Mr. J. M. Kilbourn	Owen Sound.
Mr. John Armstrong	Owen Sound.
Mr. A. J. Creighton	Owen Sound.
Mr. Robert Laylor	Owen Sound.
Mr. S. J. Parker	Owen Sound.
Mr. R. McKnight	Owen Sound.
Mr. D. Morrison	Owen Sound.
Mr. Inglis	Owen Sound.

THE ANNUAL ADDRESS OF THE PRESIDENT.

BY EGERTON GRIFFIN, M.D., BRANTFORD, MEDICAL HEALTH OFFICER.

Ladies and Gentlemen:

The PRESIDENT prefaced his annual address by the following words: The Secretary of the Provincial Board of Health, who has been the life and soul of this Association, and indeed of all sanitary progress in the province, has asked me to give an address along a certain line, and I shall take this opportunity to endeavor to to follow out his wish and speak to the point indicated by him.

The Association of Executive Health Officers of Ontario was organized in October, 1886, for the purpose of promoting the interests of the public health. It includes officers and members of the Provincial and Local Boards of Health, as well as other gentlemen officially or voluntarily interested in matters more or less directly related to this subject.

Our Association has secured the active co-operation of a considerable number of the best informed sanitarians in Ontario, and also invaluable assistance from a number of eminent scientific and professional men in this country and in the United States.

At the several annual meetings at Toronto, Woodstock, Lindsay, Brockville, and now in Owen Sound, many papers of great interest and value have been read and discussed, and much useful interchange of experience and opinion have taken place on a great variety of matters of profound consequence in relation to the public health.

After a brief history of four years, the Association is now firmly established and its influence and permanence are well assured. It has already effected much good, and it is now in a position to extend the range of its influence and usefulness, in promoting the objects for which it was organized.

While we congratulate ourselves on the happy position and prospects of this Association, and while we rejoice in the pleasure of meeting here in this delightful town new associates and co-workers, and especially in meeting again our old brother members and friends, we do so, nevertheless, with chastened and subdued spirits, because we have to mourn the loss of two of our most able and active members with whom we have hitherto worked so pleasantly and profitably.

Yeomans, of Mount Forest, and McKay, of Woodstock, were suddenly cut down in the very prime of vigorous manhood.

At our last meeting in Brockville, afterwards at the meeting of the American Public Health Association, in Brooklyn, and at the various places visited by some of us in search of sanitary information, we enjoyed their society and profited by their assistance, and we learned to value their ripe judgment and learning, their single-minded, unselfish simplicity of character, and their "kindly affectioned" dispositions.

In promoting the objects of this Association, the diffusion of information among the masses of the people is a matter of the first importance, and I propose to limit my remarks on this occasion to a few observations on some of the methods by which this may most efficiently be done.

More than three-fourths of the population of Ontario is purely agricultural, and nearly all of these are practically destitute of the first elements of sanitary knowledge. In villages and small towns the case is no better, and even in cities the bulk of the population are deplorably ignorant. In cities and in the larger towns, the influence of boards of health and sanitary inspectors may accomplish much, but such influences are, and will continue to be, for the most part, practically inoperative among the farming population.

The sanitary condition of the farmer's dwelling and its surroundings, the subject of house ventilation, of damp and unventilated cellars containing, perhaps, decaying vegetables, of rotten wood about old buildings, of an impure water supply by reason of drainage, above or below the surface, of barnyards or piggeries, or of house refuse, or by reason of the access of toads, worms or snails, or of the droppings of fowls or other domestic animals, the subjects of milk contamination and of the diseases of cattle in relation to human health and men, the subject of infectious diseases in the farmer's family, are all matters about which he must for the most part be his own sanitary inspector, and for the discharge of this office he ought to possess the elements of sanitary knowledge.

To diffuse even the most elementary information on these matters is, in my judgment, a most formidable undertaking.

Those who are familiar with the homes of the rural population

know that for the majority, the chief sources of literary information besides the bible, are the patent medicine almanacs, with occasionally the weekly country newspaper.

Having regard to the tens of thousands of dollars annually spent in Ontario alone for the free distribution of these patent medicine advertisements, it is clearly beyond our reach to accomplish very much by means of the distribution of sanitary tracts, etc. It is probable that patent medicine dealers would gladly assign to us a page or two of their publications for useful sanitary notes in return for a recommendation of their drugs by this Association. As however nine-tenths of all patent medicines are composed mainly of poor liquor combined with either useless, doubtful or dangerous drugs, it is apparent that such a method is not available.

There are nevertheless three great agencies capable of widely and effectively diffusing sanitary knowledge among the masses, to one or all of which, I think, we might properly and hopefully direct our attention.

These are the press, the pulpit and the school. Taken together, these agencies have the ear of the whole people, of all ages and conditions and in all localities.

The press has done something in diffusing sanitary information, and it is to be hoped that the increasing avidity with which such information is sought for will soon induce our leading daily newspapers to have a sanitary editor as well as a sporting editor. A small portion of the six or eight columns of space often devoted to base-ball, horse-racing, boating and pugilism, the greater part of which is usually read by the comparatively few, would suffice in a short time to diffuse an immense amount of the most practical and interesting knowledge.

But however necessary and valuable the agency of the press may be in regard to this matter, I believe the agency of the pulpit, if it were possible to secure it, would be of greater value.

In all enlightened christian countries, the clergy are the great moral teachers and guides of the people, they have a vast audience including all ages, sexes and conditions. They have the power if they were to take up this work, to spread with the greatest facility, a knowledge of many of these vital questions which immediately affect the health of the family, the community and the public.

This subject is undoubtedly directly within the legitimate sphere of christian effort.

The holy scriptures which are the formation of the christian religion, are not silent on sanitary questions. The diagnosis and treatment, not alone of leprosy, but of many other infectious diseases were in the hands of the priests, and the sanitary teachings in Leviticus are of the highest value down to the present day. The gospel of sanitation is founded upon cleanliness, and the greatest of the apostles has taught us the relation of cleanliness to godliness.

What a wealth of wisdom, and learning and eloquence has been lavished in myriads of volumes and sermons on controversial theology on different views as to the fall of man, the infinite evil of sin, the doctrine of the atonement, total depravity, baptism, predestination, eternal punishment, and so on. The vital importance of correct views on these grave subjects is very great, but I well know that there are thousands of people in this christian province who have from childoood been well instructed in these momentous matters, who are deplorably in need of instruction, as well as of exhortation and reproof in regard to matters of practical christianity relating to their duties and obligations to their fellow men.

I need not travel beyond my personal experience to learn that there are men, reputable members of christian churches, who adulterate food products consumed by tens of thousands, with pernicious ingredients, men who adulterate and deterioriate medicines for the sick, men who sell milk from diseased cows, and cows with ulcerous udders, and sow the seeds of tubercular consumption in their fellow creatures, men who sell swill milk for sick children and fever patients, men who sell ice from Ashbridge's bay and other reservoirs of filth, representing it to be pure, men who sell the meat of diseased animals, men who have surreptiously discharged sewage into the source of their neighbour's water supply, men who have for selfish reasons concealed infectious diseases and caused thereby death among their neighbors. There are also the eminent christian men forsooth who have amassed fortunes by the sale of pernicious intoxicants in the shape of patent medicines. Men who, for example, have sold in all the great cities of America, "Scotch Oats Essence,"

endorsed by judges and authors and divines as an unrivalled restorer of impaired nervous energy, a preparation composed essentially of morphia, and fitted to work ruin to its consumers.

There is also the man whom I personally have met, as I have nearly all of the others, but who, I am thankful, is not a resident of my city, who, clothed in purple and fine linen, occupies the uppermost seat in the synagogue—whose well appointed residence, and even the stable of his horses are equipped with all the latest sanitary safeguards, but who has tenants living in premises unfit for animals, with reeking and overflowing cess-pits which he has refused to have cleaned or abolished, although there is sewer connection near at hand, simply because "it will not pay."

These are examples of some of the men upon whose ignorance, selfishness and greed, the strong, pure light of the gospel might legitimately and profitably be shed.

You have, I am glad to find, at the head of your Board of Health in this enterprising and enlightened town, a clergyman of high standing, and having an earnest interest in all sanitary matters, and I earnestly hope that the time is near when christian ministers everywhere will be at the very front of every movement for promoting the interests of the public health.

The third great agency for diffusing sanitary information among the masses, and one which I think we should, without delay, make a strenuous effort to avail ourselves, is the public school.

Nearly all children in Ontario, spend some part of their time in the public schools, and it ought not to be difficult to indelibly impress upon their plastic minds, some of the most essential facts in sanitary knowledge. I would not propose to add a new study to the already overcharged curriculum, but I would provide a brief hand-book of sanitary knowledge for the use of all teachers, and I would provide for short lectures at the Normal schools, explanatory of the subjects treated of in such a book, and would require the teacher to give short explanatious periodically, of such simple facts as could be easily understood by children. This instruction would be facilitated by requiring the trustees to have posted up in all the schools, sanitary placards which would be published by the Educational Department. These cards would refer to the elementary facts in domestic and rural hygiene, such as isolation and disinfection in infectious

diseases, the dangers of impure water and impure milk, and milk from diseased cattle, of damp and filthy cellars and outhouses, the need of ventilation, and so on.

To illustrate the importance of this subject in relation to infectious diseases, I mention the fact given to me a few days ago by a physician now in Brantford, that in a rural school in the county of Brant, not long since, a single case of diphtheria, isolation being neglected, caused over fifty other cases, seven of which were fatal.

I commend this subject to the consideration of this Association, believing that it is desirable that action should be taken which might, perhaps, best be done by appointing a special committee to formulate details and bring the matter before the Department of Education.

The utilization of these several great means for diffusing sanitary knowledge, the press, the pulpit and the school, would undoubtedly result in laying deep and broad among the people the foundations of a popular sanitary education, which would, in due time, produce the most satisfactory results in diminishing the amount of preventible disease, in improving the general health of the people, and in reducing the annual death-rate in this province to the lowest attainable proportions.

DANGERS FROM PIT WELLS.

BY H. VAUX, M.D., MEDICAL HEALTH OFFICER, BROCKVILLE, AND MEMBER OF PROVINCIAL BOARD OF HEALTH.

Mr. President, Gentlemen of the Association,—The highest possible development of life in every part constitutes health. Chambers compares man's body to "a stately mansion made up of beauteous, but very perishable materials, all of which are always needing repairs to keep up the shapeliness and usefulness of the building."

There are two processes constantly going on in the living organism, having for their object the most active metamorphosis of the body possible, the destructive and the constructive, and upon their harmony and completeness depend the perfection of life which we call health. The materials required in order that the constructive process may be most successfully carried on are *pure air, pure water* and *pure food.*

I have been asked to speak to you to-day on the dangers to health from "pit wells," and how best to remedy the evils arising therefrom. Do they as they at present exist imperil those essentials to physical development to which I have just alluded, pure air, pure water and pure food? Whatever defiles the soil *must* more or less injuriously affect all three, that pit wells act thus injuriously we have the most abundant and conclusive testimony.

Dr. Wm. H. Ford, President of the Board of Health, Philadephia, says:

"Of all forms of evil contamination, that by excremental matter is the most frequent, the most dangerous and in practice the most difficult to prevent. This waste matter discarded by the human economy as no longer useful for its purposes, and even hurtful to its vital actions, is offensive and repulsive to the senses, nature intimating thereby that its removal and transformation should be prompt and effectual, and experience has demonstrated clearly by most ample and positive proof, the evil consequences of the neglect of this primitive sanitive principle.

"Nevertheless this deleterious refuse matter is frequently suffered to remain near dwellings and wells and to collect in cesspools and privies whence it passes by leakage or soakage into the surrounding soil, polluting the very foundations of habitations, and the air which is drawn up into their apartments through the basement floors. It trickles into the neighboring wells that furnish the water supply, and is exhaled from the soil in the form of gaseous vapors."

Dr. Simon in his valuable contribution, entitled "Filth Diseases and their Prevention," graphically describes this shocking state of neglect as follows:

"There are houses, there are groups of houses, there are whole villages, there are even entire towns where general slovenliness in everything which relates to the removal of refuse matter is the local habit, where, within or just outside each house, or in spaces common to many houses, lies for an indefinite time, undergoing fœtid decomposition more or less of the putrefiable refuse which house life and some sorts of trade life produce; excrement of man and brute, and garbage of all sorts and ponded slop waters, some-

times lying bare on the common surface, sometimes unintentionally stored out of sight and recollecting in drains or sewers which cannot carry them away, sometimes held in receptacles specially provided to favor accumulation as privy pits and other cesspools for excrement and slop water, and so-called dust bins receiving kitchen refuse and other filth, and with this state of things, be it on large or small scale, two chief sorts of danger to life arise: one, that volatile effluvia from the refuse pollute the surrounding air, and everything which it contains, the other that the liquid parts of the refuse pass by soakage or leakage into the surrounding soil, to mingle there, of course, in whatever water the soil yields, and thus in cases to occasion the deadliest pollution of wells and springs."

To a really immense extent, to an extent, indeed, to which persons unpractised in sanitary inspection could scarcely find themselves able to imagine dangers of these two sorts are prevailing throughout the length and breadth of this country, not only in their slighter degrees, but in degrees that are gross, scandalous, and often truly bestial, and I state this in unequivocal language because I feel that if the new sanitary organization of this country is to fulfil its purpose, the administrators, local and central, must begin by fully recognizing the real state of the case and with consciousness that in many instances they will have to introduce for the first time, as into savage life, the rudiments of sanitary civilization.

According to the report of the "River Pollution Commission in Great Britain," "about twelve millions of the country population derive their water almost exclusively from shallow wells, horribly polluted by sewage and by animal matters of the most disgusting origin. The common practice there, as in many places here, is to provide for the water supply and to dispose of the sewage upon the premises. In the little yard or garden attached to each dwelling two holes are dug in the porous soil. Into one of these, the shallower of the two, all the filthy liquids of the house are discharged, from the other, which is sunk below the water line of the porous stratum, the water for drinking and other domestic uses is pumped. These two holes are not unfrequently within twelve feet of each other and sometimes even closer."

"The contents of the filth hole or cesspool gradually sink away through the surrounding soil and mingle with the water below.

As the contents of the water hole or well are pumped out they are immediately replenished from the surrounding disgusting mixtures and it is not, therefore, very surprising to be assured that their wells do not become dry, even in summer, unfortunately excrementitious liquids, especially after they have soaked through a few feet of porous soil, do not impair the palatibility of the water, and this polluted liquor is consumed from year to year without a suspicion of its character, until the cess pool and well receive infected sewage and then an outbreak of epidemic disease compels attention to the polluted water. Indeed, our acquaintance with a very large proportion of this class of potable waters has been made in consequence of the occurrence of severe outbreaks of typhoid fever among the persons using them."

I do not think a more vivid or truthful picture could be presented than is drawn in the extract just quoted. Those of us who are engaged in the remedying of unsanitary conditions in our own country can bear testimony to the prevalence in many of our towns of just such a condition of affairs, and as my object is to show in as concise a manner as possible how privy pits and cesspools pollute our water supply, I shall not dwell longer on this part of the subject.

Pure air which is another essential to the highest possible developement of life, viz., health cannot be enjoyed when the air is loaded with pestiferous odors derived from oozings of cesspools and cesspits and leakages from badly constructed sewers and drain pipes. Unless cellars are rendered impervious by floors made of concrete ground air is in continual intercourse with our houses, especially when the temperature inside is higher than that of the external air.

Parke says, "when air rendered impure by effiuvia from cesspools penetrate into houses, and especially into bedrooms, it certainly causes a grossly impaired state of health, especially in children. They lose appetite, become pale aud languid and suffer from diarrhœa, older persons suffer from headache, malaria and feverishness, there is often some degree of anaemia and it is clear that the process of aëration of the blood is not perfectly carried on. In some cases decided febrile attacks lasting three or four days and atttended with great headache and anorexia have been known.

The air of sewers passing into houses aggravate most decidedly the severity of all the exanthemata and may also produce pneumonia (Parke).

"That it will give rise to enteric fever is proved almost beyond a doubt. There are several cases on record in which this fever has constantly prevailed in houses exposed to sewage emanations either from bad sewers or the want of any, and in which proper sewerage has completely removed the fever. Many of these cases occurred before the water carriage of typhoid was recognized, but yet the connection between the sewage emanations and the fever seems undoubted. It is only right to state that this connection is as energetically denied by some, as it is insisted on by others; many German writers especially positively deny the possibility of specific disease being conveyed through emanations from drains or cesspools.

The old adage, that the knowledge of a disease is half its cure, is one which will hardly hold good in the solving of the problem of how best to deal with the evils which have been briefly outlined.

Tables have been constructed and estimates arrived at showing that a population of 1,000 persons would pass in one year 25 tons of solid fæces and 91,250 gallons of urine. This is one of the lowest estimates. To dispose of this large amount of filth as rapidly and completely as possible is one factor in the problem, to finally dispose of it so as not to cause a nuisance is another.

It is evident that no one system can be suitable for all places and that local considerations must necessarily influence the selection of the plan.

To supersede the old fashioned pit wells and cesspools two plans are in common use. One the water carriage system for the immediate removal of excrementitious matter, the other for temporarily storing it in suitable receptacles, dry earth or coal ashes being daily used as an absorbent and deodorizer so as to prevent putrefaction and the production of offensive gases.

When sewers are properly constructed and managed, and there is no difficulty in dealing with the sewage at the outfall, the water carriage system is undoubtedly the best plan for the removal of excreta.

It is not my intention, as not falling within the scope of this

paper to discuss the merits of the different forms of sewers employed in the water carriage system, except to say that for small towns what is known as the separate system is probably the best. In this system, the one in use in Brockville, nothing is allowed to enter the sewers but sink water and closet material, agricultural tile being laid beside the sewer pipe for cellar drainage, all roof water being allowed to find its way through gutters and surface drains. Automatic flush tanks at frequent intervals serve to keep the sewers perfectly clean.

Even where water carriage system is practicable, many authorities regard the dry earth system as preferable and if carried out with great attention to detail, no doubt, the purposes aimed at may be accomplished. In small towns and villages especially is this the case, but in large cities it is hardly practicable no matter how vigilant the health officers may be, and if there is one abomination greater than the old-fashioned pit wells, it is an earth closet minus the proper and frequent admixture of earth.

Edward S. Philbrick, of Boston, says in speaking of the system of dry earth removal in the United States, "that such a system can only be made tolerable by the enforcement of a rigid discipline in its administration and is, therefore, better adapted to prisons, barracks, hospitals, etc., than to communities governed by civic law. It may possibly be satisfactory in a small community or a somewhat scattered population, but its success depends upon great thoroughness in the daily attendance, a thing which is difficult to attain in large towns, especially when governed as with us in America by officers annually elected by the people. In short, its administration, if properly conducted, partakes largely of the character of what is known as paternal government and is in no degree automatic."

Besides, no system of dry earth removal provides for the waste waters of the laundry, scullery, etc., which in large towns are quite as important items, and quite as likely to make trouble as the alvine discharges.

In view of these considerations, it is not surprising that the system of removal of filth by water carriage should be already largely accepted by our people. Its popularity is, indeed, so great that scarcely any other method is known or considered in the

hundreds of new towns which are constantly springing up all over the west. The ultimate disposal of sewage has been made a study by the most eminent sanitarians and by committees and commissions appointed by various governments, and I cannot do better in closing this paper than by giving part of a report of a committee appointed by the Local Government Board of England, to enquire into the several modes of treating sewage:

1. That most rivers and streams are polluted by a discharge into them of crude sewage which practice is highly objectionable.

2. That so far as we have been able to ascertain, none of the existing modes of treating town sewage by deposition and by chemicals in tanks, appear to affect much beyond the separation of the solid and the clarification of the liquids. That the treatment of the sewage in this manner, however, affects a considerable improvement, and when carried to its greatest perfection may in some places be accepted.

3. That so far as our examinations extend, none of the manufactured manures made by manipulating town refuse with or without chemicals pay the contingent cost of such modes of treatment; neither has any mode of dealing separately with excreta so as to defray the cost of collection and preparation by a sale of the manure been brought under our notice.

4. That town sewage can best and most cheaply be disposed of and purified by the process of land irrigation for agricultural purposes where local conditions are favorable to its application. But that the chemical value of sewage is greatly reduced to the farmer by the fact that it must be disposed of day by day throughout the entire year, and that its volume is generally greatest when it is of the least value to the land.

5. That land irrigation is not practicable in all cases, and, therefore, other modes of dealing with sewage must be allowed.

6. That towns situated on the sea coast or on tidal estuaries may be allowed to turn sewage into the sea or estuary below the line of low water provided no nuisance is caused; and that such mode of getting rid of sewage may be allowed and justified on the score of economy.

DISEASES OF ANIMALS IN RELATION TO THE PUBLIC HEALTH, AND THE DUTIES OF HEALTH OFFICERS IN RELATION THERETO.

BY T. V. HUTCHINSON, M. D., LONDON, MEDICAL HEALTH OFFICER,

GENTLEMEN,—When we take into consideration the extremely high death-rate among children, especially of those under one year of age, and that milk forms a very large portion of their food, the importance of having a wholesome supply from clean healthy animals cannot be overestimated. London, I believe, was the first city in the Dominion to establish a system of periodical inspection of herds, cow-byres and places where milk is kept for sale, and to control and regulate the sale thereof in the city.

For this purpose the city council enacted a by-law, which provides for inspection and examination by the inspector, that any person offering milk for sale, shall first obtain a certificate from the health officer, that his animals are clean and healthy, that his stables and premises are also clean, that his waggon has his name and number painted upon it, and that he has complied with all the requirements of the by-law. Upon this certificate a license is issued by the city treasurer for one year, subject to be withdrawn any time for infraction of the by-law. The fee paid for the license is one dollar annually.

Like liberty, eternal vigilance is the price of wholesome milk, and in order to accomplish this, the health officer or other sanitary expert should make periodical inspections of the animals, their stables, food and water, also frequent examination of milk taken from the waggons, the places where it is kept and the people who keep it.

The health officer or a competent veterinary surgeon should visit the herds twice a year, preferably in the spring and autumn, he should see that the stables are well ventilated and clean, and the drainage good, examine each animal carefully for tuberculosis, tumors or cancers, especially in the spring of the year. The herd should have daily exercise, no cows can give wholesome milk that are tied up for weeks and months in the year, as is frequently the case. Many herds near cities are fed almost wholly upon brewers' grain, which produces a large quantity of watery milk, such animals become feverish, the milk unwholesome, and in two or three years are fattened and killed.

Pure water is absolutely necessary, and milk from cows having access to foul pools or streams, contaminated with sewage, should not be permitted to be sold.

The health officer should keep a register, in which to enter the names of all vendors, their places of business, the number of cows, their condition, source of water, kinds of food used, with columns for entering the specific gravity, the percentage of butter fat of the samples from each waggon, and a very good way also is to take samples from the herds and compare the genuine with that obtained from the waggons or shops, and a column for remarks, with the date of inspection. He should see that no milk is allowed to be sold from dairies or dwellings where there is any infectious disease, and lastly to make assurance against tuberculosis and other diseases, doubly sure, the milk should be boiled before using, as there is probably nothing which has a greater affinity for disease germs. To give an instance :—A milk vendor in one of the suburbs of London, a few years ago, had five customers to whom he carried the previous night's milk every morning. This man had scarlet fever in his family; of the five families to whom he sold the milk, scarlet fever appeared in four, with two fatal cases, and one in his own family. There was no scarlatina anywhere else in the village or neighborhood. It might, perhaps, be supposed that he carried the disease germs in his clothing to these families, but he did not. Having to go to his work early, he left the milk in vessels placed outside their doors, before the people were up.

This system of inspection has been followed in London, with the result, that for years no case of infectious disease has been traced to impure milk.

That impure milk has much to do with infant mortality, will easily be seen from last year's mortuary statistics. In one of the large cities of Quebec, where there is no system of inspection, or at least a very imperfect one, out of every one thousand deaths, four hundred and seventy were of children under one year, while in London, under a rigid system of inspection, the ratio per one thousand of infants under one year, was only two hundred and thirteen.

A few weeks ago thirty cases of typhoid fever occurred in the town of Waterbury, Conn., which caused an examination of the milk to be made. It was found that all the cases had been purchasing

milk brought into the city from the farm of one man. This man was ill with typhoid fever, his hired man was sent to the hospital where he died of the disease. A small stream ran by the house, into which it is quite possible some of the germs were washed, and as the cattle drank from it, and the milk cans were washed in it, this stream was an excellent channel for spreading the disease.

The facts in this case show again that the dairy herds and farms, from which milk is brought into a city to be sold, should be inspected frequently by sanitary experts. The owner of the cow or some member of his family may be ill with an infectious disease, or the cows themselves may have tuberculosis, or the milk may have been exposed to infection from polluted streams or wells.

The Waterbury case has been taken up by some of the Montreal papers, as accounting in a great measure for infant mortality in that city, and the heavy death-rate annually reported. One writer says the mortality is high, but if it were not for the large number of infants who die under one year their death-rate would be as low or lower than any other city. What kills so many of these young children? Milk kills them. They are fed principally upon milk fresh from the cow, and of these cows which supply Montreal with milk, a large number are fed indoors the year round.

Considering how largely milk enters into the food of the people, particularly of children, the necessity of periodical inspection by competent persons, of the cow byres, and bringing the vendors within the pale of proper control, is self evident.

Municipalities should take the matter in hand, and see that the purveyors of that class of food are licensed, and compelled under pain of having their license cancelled, not only to keep their cows clean and sweet, the animals in good health and condition, but that the fatty matter which constitutes the chief nutritive part of milk should be ample in quantity. The diseases of cows which the health officer should look for and guard against are the following given in the order of frequency, tumors, tuberculosis, anthrax, actinomycosis and other diseases not so dangerous to man, such as bovine scarlatina, small-pox, pleuropneumonia and blood poisoning. Tumors should always be regarded with suspicion until such time as a correct diagnosis can be made.

Tuberculosis bovis is far from being a rare disease, those of you

who remember the struggles and hardships of our fathers, thirty or forty years ago, while clearing the land, may call to mind the number of cattle that died of the "hollow horn," the same disease under another name, and no matter how well the animals were fed, toward the spring emaciation steadily progressed, till one day the herd would return from the woods, for there was no pasture in those days, with the weak one missing.

Actinomycosis bovis is a chronic inflammatory affection, characterized by the presence of a microphite with nodular tumors which break down and suppurate. In its histological character it resembles tuberculosis, but not only attacks the soft part, but the bones as well. It has been mistaken for osteosarcoma and tuberculosis, and attacks man, swine and horses, as well as cattle.

These diseases have been only briefly touched upon, with a view of bringing them to the notice of the meeting.

HOW CAN WE BEST SECURE AND MAINTAIN A WHOLESOME PUBLIC AND PRIVATE SUPPLY OF DAIRY PRODUCTS?

BY O. J. SHOWELL, ESQ, OWEN SOUND.

Gentlemen,—About three or four years ago in the city of Birmingham, England, a well known butter and cheese monger exposed for sale in his store window a certain keg of butter. The dealer was a judge of butter; he had tasted and tested that particular keg and said that it was good—really good—and up to the average and what was more it was remarkably cheap. That keg of butter was purchased as an experiment, it had been shipped from Canada and the Birmingham butter dealer wanted to try if he could do anything in the Canada butter market. And so that keg had a prominent position in the centre of the marble slab of his handsome plate glass

window, and was adorned with a bright show card setting forth its nationality, its superior quality and above all its cheapness. One—two—three days passed away, people came and went carrying with them their cheese, butter, eggs, bacon and so forth, but *that* keg from Canada had not been touched. The dealer was a shrewd man and gave his orders accordingly:

"Take away that Canadian butter and set it on the other side of the window, put a fresh card and mark it at the full price. But *don't* say where it comes from."

The order was obeyed and before night that keg was empty.

This incident was of little consequence to the Birmingham dealer and no doubt has long since passed from his memory, but to us in Canada it represents a leakage of thousands upon thousands of dollars in the national wealth of our Dominion and points to an evil in our system which leads the world's market to avoid dealing with us in this article.

We now proceed to investigate the subject for ourselves.

Great Britain, though a little spot, is far greater than many of us have any idea of in population, in wealth, in national influence and in her demands for the goods things of this life, and among these for those three great B's: Bread, Butter and Beef.

We learn from the valuable papers of Mr. Thos. Macfarlane, Chief Analyst of our Inland Revenue Department, that the enormous amount of 187 million pounds of butter are annually imported by the United Kingdom. Set this down at the small first cost price of butter to-day, 12½c. per lb., and we have a sum upwards of 23 millions dollars, which is within the reach of our Canadian farming interest, and yet, for three days one little keg is offered to the inhabitants of one of the largest cities in England and not one pound of it will they buy until the name of Canada is hidden, and then they swallow the pill at once and find it is not so bad after all. And so we get the hint that while some of our exported butter is very good there is other which is exceedingly bad.

There is another little kingdom in Europe, we speak of Denmark a good agricultural country with a climate something like our own,

but very much smaller in her acreage. There is room enough in Canada to plant 235 kingdoms as large as Denmark and still leave us upwards of 12,000 square miles, and yet this little kingdom with a population of 2,000,000 against our of 5,000,000, possesses 900,000 milch cows while Canada can only raise 781,000 odd. Out of the 187,000,000 lb. of butter purchased annually by Great Britain, 69 millions are supplied by Denmark and this amount is increasing every year at the rate of about 20%, while on the other America can only find room in the London market for three million pounds and this small amount has been decreasing at the same rate that the other has been increasing, until to-day it takes a smart man to sell a single keg of Canada butter to the British public and he has to draw the veil before he can do it.

"What's in a name?" Ask any well appointed West End London housekeeper what butter she will buy and her reply will be, "Oh, the Kiel, certainly," follow this with another question, Do you ever buy Canadian butter? and the probable answer will be, "Oh, no indeed. *We* never do," with a special emphasis upon the "*we.*"

Now, true as all this may be, it is not at all gratifying to us who call Canada our home, and say from our hearts, "Canada, with all thy faults I love thee"

If you wish to know the cause of Denmark's supremacy read Mr. Macfarlane's paper on "Dairying Operations in Denmark," and you will be both delighted and instructed. But if you are willing to unearth the roots of our own failure let us together examine our own operations and see wherein they diverge from the laws of health and from the system adopted by Denmark.

Tainted Milk.—Set a pan of warm milk in a close closet amongst your groceries and in about an hour taste it with a clean mouth and you will be able to detect the various parcels of pepper, spice, coffee, soap or what not. Bear in mind this faculty which milk possesses of partaking of the taste of things which are only near and not actually touching and then answer for yourselves the question: "Is that milk good and wholesome food which has stood in the

underground milkhouse built of logs partly decayed, with fungus and mould in the corners and the chinks stopped with damp straw, and it may be a toad peeping out from under a loose stone. We hardly dare carry this hint on warm milk any further, in cases of fever or contagious diseases in the family where the butter is to be produced. Inspectors and laws are powerless under our present system, so we will return to the underground dairy. Suppose the cows are few and not giving much, the cream crocks are filling up slowly, the weather is close and the cream souring and thickening; but the table must be snpplied and there is nothing but the cows for the family to depend upon so the eldest girl must churn and carry the butter to market; the horses are busy in the field so she must walk The road is long, hot and dusty, and when she arrives at the store the butter is too soft to lift from the dish and so the boy after weighing it, dish-cloths and all, carries it into the cool cellar, gets rid of it in some way, returns the oily dish and cloths, fills the basket with the required groceries, *ad valorem*, for the weight of the butter and the tired girl returns home.

But the butter! We cannot forget its appearance when it was carried away to be poured out in that storekeeper's cellar. We must all bear in mind that there are many good butter-makers among us or we fear our own housekeepers might be tempted to send to Denmark for their supplies. And now to get rid of that butter in the storekeeper's cellar. A selection is attempted, a little extra salt is added to kill the rancidity, the various parcels are compounded, packed in kegs and shipped to *establish a character for Canada* wherever there is an opening for doing so. And the taint of all those ill-kept dairies, cellars and closets is gathered together in that compound. The poison may not be very potent, but such as it is, it is *there* and it enters into the systems of all those who partake of that butter for food, whoever and wherever they may be and it does its work accordingly.

Creamery.—This picture though still true and in operation, is not to be taken as the general system of Canada to-day. The creamery collectors have worked a great improvement. The warm milk

being placed in closely covered cans is submerged in ice water or a running stream and escapes most of the evils of the tainted dairy. But it is not generally adopted or likely to be as the farmer's pay from the creamery proprietor is regulated by the market value of butter sold in the store by other farmers. This means that no matter what care he may take he must be satisfied with one cent per pound above the lowest price which the worst quality of home made butter will produce on the market. He also loses all his buttermilk, and is further subject to deductions in cash for certain tests by the creamery proprietor over which he has no control. And so he is left financially worse off than those who do their own churning.

Denmark Dairies.—We will now briefly review the operations of Denmark, again quoting from Mr. Macfarlane.

The history of her butter manufacture he divides into three periods:

First.—The repacking period which though superior corresponded somewhat with our system and failed as ours has failed.

Second.—The factory system, which also was far superior to our present cream collecting system, but failed in its turn because the interest of the farmers and the factory proprietors were not identical.

Third.—The co-operative or partnership system of centrifugal dairies as now generally carried on wherein each farmer is a partner holding as many shares as he owns cows, and as much interested in the quality of the butter as in the quantity of the milk, and every factory carried on under strict laws and government supervision.

Our Remedy.—Now, that we see our own failure and the success of Denmark, our wisest course is at once to forsake our old tracks and step on to the platform where Denmark is now standing. Profiting by her experience, without following her intermediate steps, we may even attain to a higher standard.

Operation.—To do this we must petition our Goverment, say our Provincial Government to draw up instructions and regulations,

provide proper overseers and suitable buildings and plant; the rent for such being secured out of the various companies or partnerships would become a revenue to the province. And, lastly, to send such officers into the world's market as shall introduce and secure the sale of the article when produced.

Reasons.—By adopting this plan we arrive most quickly and surely at a solution of the difficulties, evils and failures of our present system.

1st. Because the milk never goes into the many impure dairies, but is strained direct from the milking pail into the transfer can and is at once removed to the well-appointed co-operative dairy of the district.

2nd. The farmer has no inducement to tamper with the quality of the milk because being a partner his interest lies in the success of the dairy.

3rd. Because inspectors can do their work in one large dairy under a regular routine management, where they can never attempt it in a multitude of smaller scattered ones which are subject only to the will of the various owners.

4th. Because in cases of infectious diseases among the cattle or in the family of any farmer, the regulations will prohibit the sale of his milk to the dairy under a heavy fine. And, further, it is evident that as the table of each farmer is supplied from the dairy of which he is a partner, each one will be on the look out that no tainted mllk from their neighbors is mixed with that which is to become the food of their own families.

5th. Because each farmer will benefit financially as he will participate in all the profits, and becanse the best markets can more easily be reached by co-operation than by individual effort.

6th. Because much time and labor will be saved in each farmhouse and therefore each farmer and his family will have time and opportunity for improvements in other directions.

We may say in conclusion that ultimate success cannot be expected at once. Many will prefer the old way, others will

want to see success before they venture and few will be able to lead in the reformation though they may be willing enough to follow.

If, therefore, the system advocated meets with the approval of the officers of this association, we hope that they will take the initiative in bringing about a reformation, which will not only improve the quality of our daily food, but add incalculable wealth to our vast Dominion.

PHYSICAL EDUCATION: ITS NEEDS, AND HOW BEST EFFECTED.

BY J. J. CASSIDY, M.D., TORONTO, MEMBER OF PROVINCIAL BOARD OF HEALTH.

I may say that the title of my paper would be more properly "Physical Culture in Youth and Middle Age."

Ladies and Gentlemen,—If we look at physical culture from the standpoint of the laws, which govern our bodies, and sum up the results, we will find that its principal advantages are perspiration and stimulation of the digestive organs. Sweating is a ready way of getting rid of waste material in the body, which must be disposed of somehow. The helpers of the skin in this cleansing process are the lungs, the liver and the kidneys. The more work the skin does, the less remains for these organs to do, and the more easily will they perform their own tasks of getting rid of waste, be it carbon, watery vapor, or waste food. Hence sweating relieves the intestines. It also clears the head. How many gloomy notions and "carking cares" have been dispelled by its genial working. It cleanses a man's view of life and leaves the body in a tranquil purified condition, ready for mental work, nourishment, or sleep.

Closely allied to perspiration is the stimulus to digestion afforded by the quickened respiration. A healthy man breathes by moving

his diaphragm up and down. This motion acts directly as a stimulus to the kidneys, liver and stomach, which organs lie just beneath the diaphragm. Hence in exercise it is not so much the shaking of the body which helps the liver, as the quickening of the breathing from an unconfined chest.

In perusing the statistics of the Department of Education for Ontario, it is pleasing to observe that physical culture is receiving great attention in all the schools of this Province. In a paper which I read at the last quarterly meeting of the Provincial Board of Health of Ontario, I quoted statistics showing the number of pupils attending Public and Separate Schools, and the percentage of of those who receive instruction in drill and calisthenics at these schools. A brief *resumé* of some of these statistics may not be inappropriate here. In 1888, the last year of which we have any report, there were 464,200 pupils attending the Public Schools, of whom 200,348 or 43 per cent. were receiving instruction in physical culture. In the Separate Schools there were 31,323 pupils, of whom 16,901 or 50.39 per cent. were receiving instruction in physical culture. Of those attending Public Schools

In counties	33.59	per cent.
" cities	85.92	"
" towns	60.97	"

received the required instruction.

Of those attending Separate Schools

In counties	22.63	per cent.
" cities	70.59	"
" towns	65.75	"

received the required instruction.

The excuse offered for this meagre devotion to athletics in country schools is that the children usually get exercise enough in attending to sundry chores about the farm, and that their parents do not therefore think it necessary to pay for instructing them in drill and calisthenics. There is a certain amount of force in this, and if the country boy becomes a farmer or follows some other laborious occupation, it will be unnecessary for him to seek for exercise, as his muscles will be sufficiently employed at his daily work. Should he

however adopt some light trade, become a clerk in a store, office or factory, or enter one of the professions, he must, if he desires to enjoy good health, devote some portion of the day to exercise.

In our towns and cities also many are every day being added to the working population, who wield the pen instead of the axe, plane or lever. When at school they were trained in physical culture; left to follow their own inclination do they continue their exercises or do they give them up? In many instances they cease to take any interest in athletics. Yet one should not judge them too harshly, for the taking of exercise without the pleasure of association calls for a certain measure of heroic resolve. For instance much of the success in drill, gymnastics and calisthenics as taught in schools depends upon co-operation. Competition and the desire to excel stimulate the nerves and call forth a correspondingly active state of the muscles. Were the pupils called upon to take exercise singly or in twos or threes it is likely that a lack of interest would soon be manifest and the results would be meagre.

Hence it is much to be regretted that many young people, after leaving school are left to their own devices in the matter of taking exercise, and it would be an excellent thing if all who can would join some club or athletic association so as to continue and improve upon the physical training received at school. Then again many grown people are getting on in years, who, owing to their devotion to business or other pursuits, take little or no exercise, and consequently neglect or very much abuse their health. Ladies also often lead lives of indolence and ease, thus entailing on themselves in many instances impoverished health with all its attendant ills. In this paper I propose to suggest methods of physical culture for young people of both sexes and also for persons of maturer years.

As an indication of how true it is that young men need not give up exercise on leaving school I may point to the well-known fact, that of late years there seems to be a development, a multiplication and growth of clubs and associations for every kind of exercise. There is hardly a town of any size, that has not got its football club or its lacrosse, bicycle, lawn tennis or baseball club. The matches, which are quite frequent between club and club, city and city, all require organising and combined effort, and an expenditure which only the association of means in common funds could maintain.

All this is beneficial; the healthy exercise giving common enjoyment and the social intercourse are efficacious in diffusing good fellowship, dissipating prejudice and creating bonds of union, where the effect of party spirit or self interest would otherwise be disintegrating or destructive.

All these games, which are extremely popular among our people, give excellent opportunities for healthy exercise in fine weather, and in addition they have the great advantage of being played in the open air where the purification of the blood is most easily and perfectly carried on. Moreover on account of their social and inspiriting character they call forth the requisite nervous stimulus to put the muscles into vigorous action. This is a most important advantage. If the will forces the muscles to work while the nerves are unstimulated, fatigue indeed will result, but fatigue alone is not the object of exercise. Even if perspiration and stimulus to the digestive organs are secured it will be at the risk of depression and exhaustion. Every one has felt the difference between a congenial, though rough and boisterous game such as football, and an uncongenial exercise such as a solitary walk along a dusty road. It is difficult of course for young men to play these games without exposing themselves to serious bodily injuries, but apart from this drawback the games mentioned are deserving our heartiest commendation.

Bicycling is also a valuable summer exercise and has started many on the road to health. The principal advantages are open air, sunshine, pleasant riding with a good machine and the slight expense of maintenance.

Rowing is pre-eminently a delightful and healthful exercise. There are several rowing clubs in such of our Ontario cities and towns as are situated by the waterside, and young men desirous of acquiring a knowledge of the art, either in the old fashioned fixed seat or the more modern slider, will have no difficulty, in four oars, pairs, or sculls.

I shall not here indulge in any extended remarks on the art of rowing as an exercise, but will just say that it is important to learn to row on a fixed seat, and to understand the correct position for hands, legs and body when first taking a seat in a boat, and the reason for each. These concern the health as much as the successful

handling of the oar. The position should be natural and unconstrained. All tricks, such as side jerking of the knees, turning of the head on one side, looking at the oar during the stroke, arching outwards of the back, turning out of the elbows, etc., should be avoided by the learner. Considering the strain which is put on the muscles during the stroke, it is important that at the end of the stroke and during the recovery no more muscular power should be exerted than is necessary for the bringing forward of the body and the oar into position for the next beginning. During this time of muscular relaxation the chest should be expanded, the shoulders kept from turning inwards, the arms shot out in a straight line from the body with hands rising to the level of the shoulders. Thus a good inspiration can be taken, filling the lungs and supplying its full share of oxidized blood to the heart, which will also be left free for its expansion and contraction quickened by the exercise of rowing if the chest is not contracted and the back straight.

Thus the muscles of the arms and legs require to be got into rowing condition in order to do the work satisfactorily, and the heart and lungs have to be habituated to do their share, which is no small part of the work.

Canoeing is quite popular in Canada and justly so, as in these little vessels great distances may be travelled and great enjoyment obtained. As a muscular exercise rowing is preferable, but for those who do not care for it the next best thing as far as exericse on the water is concerned is to paddle a canoe. The danger of upsetting, which is hereby suggested, makes me inclined to say a word with reference to an accomplishment of great importance to those who take their pastime on the water, viz. swimming. It is strange that many of those who habitually frequent the water do not know how to swim. Much good would be done if all boys learning to row were at the same time taught to swim. In fact, if this useful exercise were more generally taught many of the catastrophes which annually turn our homes into houses of mourning would be prevented and many a life saved.

To leave school with a knowledge of drill, sufficient to enable him to take his place in the ranks of a volunteer company, should be possible to every young man in the Province. Apart from the consideration of its educational value, I think that our young men

are happy in having such an institution as the volunteer service open to them, wherein duty and pleasure, exercise and recreation are well harmonized and combined by love of country. In most of our large towns and cities the volunteer corps give opportunities to young men for bodily exercise of the best possible kind. More indeed might be done in this direction and the service made more popular than it is by giving frequent opportunities for physical exercise especially in the winter time to volunteers in drill sheds In the summer, though volunteer camps obtain to a certain extent, much more might be achieved by the establishment of camps for exercise easily accessible by rail or boat, to the great benefit of the youth of our cities and to the additional security of the country. But this of course would require very considerable help from the funds of the Dominion Government, and can only be expected when the need is recognised, and its satisfaction demanded by strong and enlightened public opinion.

The games and exercises mentioned above are practised principally during the fine season. In winter the rinks offer splendid opportunities to skaters and curlers. The toboggan slides are also not without their advantages, not the least of which is the tramp uphill through the snow in expectation of the delight of rushing downhill at railroad speed a few minutes later.

Apart however from these well-known and delightful winter recreations, a more thorough and perfect development of the whole muscular system may be obtained by placing one's self under the guidance of a careful and experienced instructor in gymnastics, who will give each pupil a regular systematic course of exercise. By taking exercise of this kind for from half-an-hour to one hour-and-a-half every day in winter and selecting some congenial and suitable amusement in summer it is quite easy for any person to preserve good health and activity of body with a capacity for continued effort and the endurance of fatigue up to and beyond middle age.

As long as a man is young the desire for active exercise will assert itself. The time will come of course when he will have to give it up, but as long as he can take exercise and feel the better for it so long should he resist the inevitable conclusion that will be forced upon him some day or other that it is too much trouble, that he cannot afford the time, and the like. Wise is the man who,

when his time comes and the love of ease is gaining ground, yet still refuses to drive, but walks in and walks out to his place of business from his home, and continues to make his legs do their duty towards keeping his body healthy. It has been said that a man under forty-five, in order to keep his body in sound health, ought to take exercise equivalent to a walk of nine miles every day. Very few men, except such as by their occupation are compelled to lead an out-door life, regularly do anything amounting to this. Yet it is well to have a standard of comparison. It is well also to have a clear conception of the reason for continuing such physical labor at a time when the inclination to spare himself trouble is gradually growing upon a man. The exercise is for the benefit of heart and lungs and brain and for that which is life-sustaining in them. It is recreation and rest to one class of muscles and nerves, while it gives their due share of vibration and expansion and contraction to another.

I think that many of the young ladies sit indoors too long, and sitting up late at night they do not care to go out or take exercise in the open air. I have nothing to say against needlework; but I think that novel reading as an indoor occupation is responsible for many weakened hearts and feeble lungs. How much better if they habitually went to bed betimes, and rose early, and were accustomed to out-door pastimes suitable to their age and strength. As an eminent surgeon says, "Whatever arguments may be used for athletic games for men and boys, they are as applicable for women and girls, subject only to what may be deemed a reasonable selection of games."

Girls should run, yes, even run races together; should play lawn-tennis, and, if they have the chance, they should certainly learn to ride. They should also learn to row, to paddle a canoe, and to swim. In winter they should skate and visit the toboggan slide. Dancing is also particularly useful. It should form part of every girl's physical training. But then it is counted as a lesson and is conducted indoors. Fortunately in fine weather dancing on the greensward or in suitable pavilions can be enjoyed in the open air.

In winter however, dancing in well ventilated rooms, under proper regulation is an excellent and healthful physical exercise, from which the most feeble may receive benefit. As I stated already, when

speaking of the superiority of certain games because they stimulated the nerves, this exercise is doubly beneficial, because it is accompanied by exhilaration of mind. "Dancing," (says Mr. Sheldrake, in Chambers' Edinburgh Journal) "is one of the most healthful, as well as one of the most pleasing amusements that can be practised by the young. If it is learned from those, who are well qualified to teach it, and practised as it ought to be, consistently with the instructions given, it will contribute more to improve the health as well as the form of the human frame than any other exercise."

The generations to be born, however healthy and active their fathers may have been, by reason of good physical exercise and healthy training, will be most beneficially affected by their mothers having had similar advantages, in pastimes suitable to their sex. They cannot but be injnred by the habits of life, which induce feebleness and want of energy, and too often an unhealthy tone of mind and body.

I do not wish to be mistaken however. I do not advocate in any way the aping of what is masculine by the ladies, but rather such reasonable enjoyment of physical exercise and recreation as will educate and maintain in them also "a sound mind in a sound body."

ISOLATION OF INFECTIOUS DISEASE.

BY J. D. MACDONALD, M.D., HAMILTON: MEMBER OF PROVINCIAL BOARD OF HEALTH.

Gentlemen,—Perhaps we have no better example of the fluctuations which medical opinion undergoes from time totime, than that now afforded by the attention which is given by physicians to the subject of infection. Common observation had seemed to show that there was, in many diseases, such a character as infectiousness. Men had in all ages fled from cities infested with pestilence. But physicians of all men, are prone to scepticism. They were no doubt aware that, for their own professional doctrines, they had no satisfactory basis, and so they theorized much and often regarding the *nature* of disease. Within the memory of some men yet living, there were Humoralists and Solidists, the followers of Brouscisas and those of Hahnneman. These all contended vigorously, not to say sometimes

passionately, for their especial pathological doctrines, each sure that the others were advocates of baseless notions, but no party in the contention was able to afford any objective evidence of the correctness of its own pet fancy. In fact, the means for so doing did not exist. The contests among the classes of disputants were hot and noisy, especially so in later days when the disciples of Hahnneman came to assert themselves so loudly. It seems, however, as if in those discussions, the minds of professional men were more occupied with processes of action in disease and that the more profound questions of origin were hardly reached by them. Infection and contagion were to the people, "the vulgar," a manifest, if not a very satisfactory cause of much evil, but both were coming to be thought, on the part of physicians, to be of comparatively limited influence, indeed by some physicians, and they of no mean reputation, they were said to be in but few instances, of any influence at all. Perhaps Hahnneman's guess as to the origin of disease came nearer the truth than many others. He thought there was a dynamic influence, a power of unexplained nature, which itself was disease and produced certain symptoms, but no more than others did he discern the nature of the power. In all respects he was mystical, as became a German theorizer of his time.

It was reserved for a very recent time to show, by the help of the microscope, the true nature of the origin of much disease and to extend and confirm the doctrine of infection. The use of this instrument served to show that, in the greater number of the most fatal diseases, not only those which have been known as epidemics, but others which have been regarded as arising from constitutional predisposition, there are present in the various organs of the body, minute organisms which have their favorite habitats. These small mischief makers have come to be described by various names, as bacilli, bacteria, microbes, micrococci, etc. They are vegetable in their natures and are able to maintain their own lives and to multiply at the expense of the living body in which they have established themselves. They assimilate for their own increase the constituents of the fluids of their hosts, thus producing decomposition of those fluids, poisoning them, and inducing those phenomena by which are recognized the various diseases which arise, each from its particular variety of poisoning agent, and it has farther been satisfactorily shown

that those organisms, mingled with the discharges from the bodies of the sick, are then taken up by water, or are dried and diffused through the air, and so with drink or inspired air generally, obtain entrance to the bodies of healthy persons, and reproduce in these the same distress which was seen in the bodies from which they had escaped. It is but a short time since our experts with the microscope have shown us these things, but already great results have come of their revelations. True advancement has been made in the knowledge of the causes of much disease and the outlook is more than hopeful that this knowledge, if taken advantage of, shall be abundantly serviceable. Art is not, and may never be, able to deal with malignant cholera, when fully developed, nor, as I am inclined to think, at any period of its course, but if attention is given to a mode of meeting and arresting its cause, something better may be effected than attempting to cure cholera. The evil may be prevented. In adverting to the prevention of infectious disease we may at once admit that we cannot expect to make disease utterly disappear. The occurrence of it is, after all, nothing unnatural and we may say that we can no more expect to prevent it, than can the gardener the appearance of weeds in his flower and vegetable beds. "The seeds of disease" is a perfectly correct expression in very many instances. Hitherto, like the gardener, the physician has directed his efforts to checking and if possible destroying the growth which has sprung from evil seed. Our present effort is to show that there is a still more excellent way.

It is admitted that if seeds are not sown, weeds will not grow. Our object is to prevent the implantation of the seed, to separate the sick from the well, the infected from the non-infected, to recommend the plan of "isolation."

Isolation is a resource of very old and very high authority. We all well know how the case of the leper was dealt with in Old Testament times. The leper was isolated, as soon as the nature of his malady was suspected, and we do not know anything better to be done yet in leprosy, or in two or three other diseases with which we are unhappily better acquainted, as diphtheria, scarlatina, and small-pox. These three, at least, and one or two more, are among the troubles which can with some certainty be prevented, but are not so surely to be cured. There was no pretence of medical treat-

ment in leprosy. And in this connection it is interesting to reflect, that Moses having been instructed in all the wisdom of the Egyptians. it is not unlikely that in his dealing with leprosy, and in his sanitary regulations generally, there is an evidence, that the science of sanitation, so new to us, was very perfect several thousand years ago in Egypt. Isolation to be efficient must be complete. It must be continued as long as the disease and its sequelæ are known to endure, and until disinfection of the person of the sick, and of all their apparel is assured. The child must be separated from the parent, or the parent and child must be separated from the family, as well as from the general community. There can be no half measures in isolation, as the meaning of the word shows. "*Isola*" is the Italian for an island, and isolation in the management of infectious disease is a word which has the same force as the corresponding word "insulation has in electricity." Most of us apprehend the force of that word in the science of electricity and know its derivation from the Latin, insula, an island.

Whenever a case of the more intractable infectious diseases occurs in a house, that dwelling must be quarantined, the house and all in it. unless it be that the sick person has been but a few hours in it, Even in the case of a few hours, the room where the infected person abode must be cleaned and disinfected, as well as the clothing and that of the persons with whom the sick may have come in contact. Rich persons who have large houses may quarantine their friends at home. It is marvelous how perfectly, by due care, infection can be confined to a room or to a section of a house, but for the mass of men, that care is not practicable, and there must be public accommodation always ready. The community or municipality should provide properly constructed buildings—huts, so-called—to be rented by such as choose, and larger houses or hospitals, for such as are unable to pay rent. Such buildings need not be expensive, and they could be so constructed as to be easily kept clean and easily disinfected. These might be for the accommodation of persons having any description of infectious disease, but it should be imperative that every case of the more deadly kind should be sent to them, unless a qualified health inspector certifies that isolation can be thoroughly carried out at the home, and that it *is so* carried out during the illness there.

Possibly our old social and domestic habits may incline us to look with disfavor upon the intrusion of a public official into any and every house on all occasions of sickness in the family; but, putting aside the right of the public to protect itself against the approach of devastating disease, the advantage to the families afflicted will be very great. The farther communication of infection to themselves will, very often, be prevented. The business necessary to their livelihood will not be interrupted; there will be in a measure a continuance of the family comforts, and doubtless much saving of suffering and life.

In referring to atmospheric conditions and their bearings upon the outbreaks and disseminations of disease, it has to be said that these have lost some of the importance which was of old assigned to them. The condition now of prime importance is the degree to which the air is charged with disease producing organisms; yet its movements and its conditions with respect to heat and moisture are not without influence. Its varying temperature, its degree of moisture, and perhaps of pressure, probably are efficient in maintaining the life, or in preventing the dispersion of organisms with which it is charged, as also in modifying the general health and power of resistance to infectious or other disease. The atmospheric condition of houses is all important, for reasons which are obvious. Houses which are not cleaned often, and continually well ventilated are pretty sure, sooner or later, to affect injuriously the health of their inmates, and both directly and indirectly to favor the outbreak and spreading of infectious disease. Not only are the inmates weakened in their general health, but such houses are apt to become prolific nests of infection. There may be perhaps, from the ground on which the house stands, perhaps from importation in other ways, a continually increasing abundance of disease germs on its partition walls and in its furniture, particularly in its carpets and its curtains, until becoming crowded in these, as vermin is apt to do, getting shaken or blown out of them, and mingling with the dust floating in the air of the house, they obtain entrance into the bodies of those who dwell in it. Obtaining that entrance in sufficient numbers, multiplying they multiply, and there is forthwith infectious disease established.

Providentially, disease-producing organisms are much less abundant than those which are not injurious in that way. In the open

air, the former seem unable to go far from the place of their production ere they suffer such dispersion or enfeebling as to render them harmless. Possibly where they are outnumbered by other bacteria which are their natural enemies, they are destroyed, at least it is so in water and in moist earth. In seems certain, that while they can apparently be carried a long way in a small stream of water, and retain their virulent properties, they seem to be soon rendered harmless in the atmospheric ocean. They are lost no doubt rather than appropriated by their enemies. There is a difference in the vitality of disease germs. Some are happily short-lived, and like the diseases produced by such, the value of isolation will be apparent. Such diseases, Asiatic cholera for example, can be completely stamped out by timely isolation.

There are other germs which can be carried a long way by the air, and retain their vitality, for example, the poison of malarial fevers, as that of ague, which as we know, often wanders a considerable way from its native swamp. It is possible that this miasma may owe its powers so far from its home, to its abundance, and to the configuration of the land where its results are experienced, permitting the concentration of the bacilli. Happily, in the case of the agues, in their various forms, isolation is not needed, there being so far as is known, no hurtful emanations from the bodies of the sick.

Happily too, on the other hand, in the more deadly infectious diseases from which we suffer, and for relief from the visitations of which we look to isolation, the diseases do not travel far in the open air, and retain their energy. To thus travel, they need such aid and shelter as are commonly afforded by the persons and clothing of the friends of the sick. Whether by dispersing them simply, or by affording means for their destruction, the open air is soon fatal to their influence and activity.

If it be then, that of all points where those organisms come to abound, they prosper especially in the fluids of the living human body, and issue from thence again in greater profusion than from any other source. If they infect other bodies near at hand, but cause no evil to those which are kept at a distance, and that not a very great distance, it is clear that the true way to deal with those minute destroyers of our lives is to maintain a complete separation between

those whom they are troubling, and from whom their progeny is proceeding, on the one hand, and the individual to whom they have not had access on the other hand. That is to say that in infectious diseases, especially those of the more deadly kinds, those who are sick of them should be placed within an impassable enclosure, and far enough removed from the healthy, to render these safe from the noxious emanations, material though invisible, which proceed from the bodies of the sick.

"Deforesting," as an economic question, is a subject of very great importance, but as an agent in originating or disseminating any of the graver infectious diseases which affect our country, I do not know that much can be said about it.

For a time after the trees have been cut down, and the sun's rays have more direct access to the earth, there is often a great increase of fevers which arise from marsh miasma, but the increase is temporary, it lasts until the moisture is evaporated from the exposed ground, and the old bacteria of the wooded surface are supplanted by others which thrive better in the new conditions. Thus the country becomes a healthy one to live in for the most part. Again, if there be an irreclaimable marsh near, the removal of surrounding forest both deprives the neighborhood of the natural consumers of what proves to man a poisonous miasma, but it also affords unobstructed course for the various marsh fevers which the miasma produces in man. We do not propose isolation as preventive of marsh fevers. The seeds of ague seem, where they prevail, to be too plentiful to make any efforts for their exclusion successful. In some other diseases of a much more formidable character, with which we have become only too well acquainted, it seems to have been satisfactorily proved that by due care their infectious power can be limited to a few feet, nay, that it can be confined to one room. In such diseases and they are among our deadliest, there can be no hesitation in recommending that the sick be *isolated.*

PREVENTION OF DISEASE BY INOCULATION.

BY C. N. HEWITT, M.D., SECRETARY STATE BOARD OF HEALTH, MINNESOTA.

To the President and Members of the Association of Executive Health Officers of Ontario:

Gentlemen,—When I received the kind invitation of the President, through your Secretary, to come to the third consecutive meeting, I promptly resolved to go, taking with me a little essay and a story or two, in case the Colonel, or some one else, should call me out at the banquet, by the toast "To the President of the United States and the American Eagle."

But sober second thought (confound it!) very coolly proceeded to tell me that I have pressing business at home and suggested that it would be the proper thing to send regrets, which I could easily do out of office hours.

Joking aside,—I have for a few months been going to school to some of our brethren abroad. It was not a finishing school either, for it broadened my horizon of experience and observation, and opened up new views of familiar subjects, which are refreshing and stimulating. But all this time our laboratories have been closed; large arrearages of work have accumulated; much has been done which I must learn about; and we have to quicken our pace if we are to keep step with the rest of you.

So I have been compelled, sorely against my inclination, to give up the trip.

It has occurred to me that I might put some things I wanted to write about, into the easier and less formal shape of a letter, so I have done so. I submit it with the wish it were worthier of your acceptance.

I went abroad to see for myself the working of sanitary law and regulation in the every-day practice of boards of health and health officers. That is what a health officer, from our side ought to do, for the reading of a report gives a very imperfect idea of how such work is done. So I visited as great a variety of representative men and places as I could, but made a point to see as much of ordinary routine matters as I could also. This par-

ticularly of the village and country work. I visited places where notable work was going on, made the acquaintance, when possible, of those in charge, got the literature of the subject, so far as I could, and moved on. I visited and studied in this way, the sewage farms of Croydon, Birmingham, Paris, and Berlin, with others; the systems of sewage and garbage disposal of London, Manchester, Sheffield, Hull, Bradford, Paris, and Berlin; disinfecting apparatus in Dublin, Leicester, London, and Berlin, and made a special study of the methods of collecting, storing, and using humanised vaccine lymph, as also the process of cultivating, preparing and distributing animal vaccine from calves, in London, Paris, Dresden, Berlin, Brussels and the Hague. I made a practical study of the treatment of rabies in Pasteur's laboratory, and got personal instruction from Yersin in the work which he and Roux have done in the bacteriology of diphtheria. I studied the same subject with Klein in London. I send a few copies of Klein's paper before the Royal Society, which I reprinted from proof sheets. It is worth one's while to get off the American standpoint, and to see familiar problems worked out under new conditions; it is an education in itself.

Don't forget that this is a free and easy letter, not a formal paper, a sketch and not a careful drawing. It is a hurried account of some things which impressed me, but, very likely, not what would strike another or better observer.

My first strong impression began at the first interview with a British official (he was the clerk of a city), and grew stronger all the while I was there. It was the marked difference between their position and our own, in independent and executive authority. They are not members, as we are, of the boards they serve, but are elected, after sharp competition, to be the advisers of the sanitary Authority when their opinion is asked for. There are the two great classes of health officers abroad as with us, the workers and the lazy fellows. The workers there feel constantly the mortmain of precedent, old customs, and of complicated and tangled rights and laws. In proportion to their energy, tact and ability they are worried by these things, for though the best men, by their commanding talents, can often compel attention, they must, very likely, be satisfied with *going on the record*, when what they wanted

was *to go to work*. How much the new county councils will help their position it is hard to see. These councils *may, if they see fit*, appoint and pay a health officer. Then there is the other class of medical officers, for whom old ways and venerable precedents, with very deliberate administration, make a very acceptable creed, and judging by the rare specimens I saw, the principal petition of their litany must be "*Noli me tangere.*" But despite many obstacles, what a proud record our English, Irish and Scotch brethren have made (!) The great sanitary blunders (London sewage disposal for example) are compelling more attention to the purely sanitary side of such questions.

By the kindness of Dr. Buchanan, Medical Health Officer of the Local Government Board, I had the pleasure of accompanying Dr. Barry, their medical inspector for Yorkshire, in a tour extending from Hull to Sheffield, including townships, villages, and cities. As the survey involved several special inquiries, I had frequent opportunity to see the every-day work of different officers, in a very satisfactory way. It was amusing to hear the same venerable old "chestnuts" of excuse for neglect of duty. The medical inspection system which Dr. Buchanan is wisely and surely building up, besides training a special class of men, is to be a powerful stimulus to steady local work all over England.

The inspection of children who have been vaccinated since the last visit of the inspector, enabled me to see the methods and success of several public vaccinators, and to examine the vesicles and scars of the arms of several hundred children. Humanised lymph is, I think, exclusively used, and at least four insertion made. I spent some time in the national vaccine establishments London, watching the methods with both kinds of lymph. Later I compared these with similar work on the continent. The whole subject of vaccine virus, its sources, possible dangers, protective powers, use and abuse, is now undergoing a searching review in England, where the anti-vaccinationists have secured a Royal Commission, the co-operation of a number of medical men, and a good deal of popular attention. The crusade, ostensibly against compulsory vaccination, is really against the practice itself. I visited Leicester to talk with the chairman of the health committee who boasts of 15,000 unvaccinated children as the results of his teaching.

That fellow did not dare to deny "that he had himself re-vaccinated when small-pox was last in his city." He is a type of a class who spend a good deal of time persuading other people to refuse a safeguard which *he* accepts with remarkable celerity and cheerfulness.

In dealing with infectious diseases of men, there does not seem to be the same authority to enforce isolation *in the home*, that we have, but they are developing a system of isolation hospitals, and securing a degree of popular support, which is just what we lack. We, on this side of the line, look to you to follow the lead, and show us how to do it. We have, in Minnesota, compulsory notification and isolation, and *hope* for the hospitals.

The infectious diseases of animals are now known to be so closely related to those of men that they come, of necessity, within the field of the duties of boards of health. Tuberculosis is, within a short time, admitted to be there. Actinomycosis is there too, and since January 1st, diphtheria has been inoculated from a child into cows, and passed *via* their milk, in fatal doses, to cats. We must study these diseases, and there is no lack of inducement or material.

Let me name what seems to be the most pressing of the duties which have been added to our list, and this letter shall close.

With us that means work in two directions: in one's individual field, and in the common field, the province or the state, for they are interdependent. Because of the rapid extension of the field and the variety of work, the best workers are those who keep nearest abreast of the reliable results which are daily accumulating, or who can add a grain or two to the pile. To do that there should be available for every health officer, a central laboratory, library, current literature club, and a collection of all available illustrations of every department of our studies and work. These things the central board ought to have, and they should be so arranged that they shall be of the greatest use to all. The laboratory must include facilities for both chemical, microscopical and bacteriological work. Even this will not meet the present demand. If we are to make our coming discussion of the vaccination question less troublesome than it now is in England, we must be able to verify, beyond reasonable question, the *source* and *proper use of the lymph we use.* I see no other way to do that than to make the supply of animal lymph one of the duties of the laboratory, and to distribute the product free to all who will

comply with the necessary conditions of use, and report of results, to enable the laboratory to watch the lymph at every stage of production and use. The rabic treatment of Pasteur should be obtainable there, and other vaccines, among which, I think, that of diphtheria will be the first.

Tuberculosis investigation has just resulted in a Royal Commission in England, but we need not wait, for we know now positively that it is communicated in flesh and milk. If only for that, inspection of the carcase *with viscera in situ*, is a sanitary duty. What advance is desirable from our present position?

But I beg pardon, I did not intend writing so long a letter, but events are rushing in matters of public health to-day. They are increasing our duty and our responsibility; and my sense of both has been quickened by what I have seen and heard among our brethren over the water. I venture to hope for a stirring committee of your body to consider the subjects I have proposed, as I have much matter I should be glad to submit. But whatever action you take, I beg leave to express a loyal confidence in your wisdom and judgment. I wish you profitable business meetings, the jolliest of good times in every other way, and a safe trip home again.

I am your obliged and thankful fellow-worker,

CHARLES N. HEWITT,
Secretary, State Board of Health of Minnesota.

Red Wing, Minnesota, August 15th, 1890.

OWEN SOUND SEWERAGE SYSTEM.

BY A. CAMERON, M.D., OWEN SOUND, MEDICAL HEALTH OFFICER.

Gentlemen,—About the year 1840 the first clearing was made in a tangled mass of cedar, spruce and hemlock, growing on a swampy piece of land, placed in a hollow surrounded by rock on three sides,

with a river flowing conveniently through the centre of the depression to the Georgian Bay. As further surveys took place, roadways were cut, and houses sprang up, until finally the village of Sydenham afterwards the town of Owen Sound was located.

During the early history when the population was small and houses sparsely scattered, epidemics were almost unknown, and sanitation received no thought—the virgin soil being capable of absorbing all the refuse matter placed upon it. But with the increase in growth and consequent crowding of buildings, the soil became gradually surcharged with noxious materials, the emanations from which brought with them a corresponding amount of disease. Matters continued in this state until the early part of the eighties when sporadic cases of typhoid became more frequent, finally becoming a regular visitor, until a total of 49 cases was reached in the year 1887.

With this state of matters individual responsibility must cease, and the united action of a community becomes necessary to overcome the increasing danger to public safety. To this end in the year 1885 it was recommended to the Town Council that a system of sewerage adapted to the needs of the locality should be adopted.

In order to give some idea of our local disadvantages it might be well in the first place to consider the nature of the soil in the various parts of the town.

The eastern portion of the town named Bay ward is composed principally of gravel, rock and clay—elevations above the river, 11 feet at intersection of Poulett and Division streets—50 feet on Hill street. The middle portion, named Centre ward is low and flat, the centre of a depression on the east side of the river, the surface soil is mostly clay loam, varying from 2 to 5 feet in depth, the bottom a soft blue clay and quicksand ; elevations above the river, 11 feet at above intersection, 20 feet at Market, 40 at Boyd street.

The southern portion named River ward is high, the soil principally sand ; elevations above the river, 20 feet at market to 27 feet at cemetery bridge, 35 feet at Murdoch street.

The west side of the river, now called West ward, is composed at its southern extremity of sand and gravel. The northern half is not so fortunate, the surface soil is a coarse sand with a cold wet subsoil,

in the most northerly portion the elevation is so slight that when the water in the river is high, the ditches are filled ; elevations above the river of northerly portion at Paterson street 15 feet, gradually diminishing to 2 feet at Harrison's saw-mill.

Centre ward being situated most disadvantageously as regards porosity of soil, and having the greatest amount of population, was considered most in want of sanitary reform. For that purpose the present system of sewers was commenced in the year 1886. Egg-shaped brick sewers of the capacity of four square feet were constructed on Division, Baker and Union streets, carrying sewage from Boyd street to the river, these with the branch sewers running north and south and connecting with these mains have apparently done much to improve the health of the locality, for since the year 1887 the number of cases of typhoid fever has been diminishing, last year reporting only six. Pipe sewers have also been laid on Peel, Bay and Terrace streets, as the wants of the localities have become known.

Such is the present system, devised with two objects in view : 1st, to relieve a portion of the town from excess of pollution ; 2nd, to keep within a certain pecuniary limit in accord with the municipal purse. The question may now be asked : Has it any advantages ? I hold it it has one—however doubtful –great advantage in the river Sydenham so conveniently placed by nature to perform the duty of a trunk sewer ; this river is doing a good work, for with every ebb there is a corresponding flow bringing with it a variable amount of fresh water from the lake, assisted by freshets from the higher levels. Without this river, in the present state of our finances, I ask : what under the circumstances could be done with the sewage of this town ? For even if the bottom were suited, there is not room to carry out any system of sewage farming.

But as with the growth of the town and increase in the number of sewage conduits the river pollution must increase, perhaps to such an extent as cannot be longer borne, it becomes us to consider, by what means at reasonable expense we can best carry out an efficient system of sewerage without river pollution.

With a view to promote discussion on a subject of so much importance to us, I shall propose one method, which, if the means were forthcoming, would I believe meet the views of the most fastidious, viz.—

The construction of a trunk sewer from some point (1) near the cemetery bridge (on Poulett street) to intersect and convey the sewage matter of the sewers already laid by way of Water street to a tank at some point on the marsh to the north of Russell street. Here one of many methods might be adopted, among which are precipitation by chemicals, and electrolysis with the ultimate disposal of the contents of the tank. Or the elevation of the sewage by means of the Shone system, or by pump to a point on Bay street near the Court House from which point another trunk sewer might be constructed capable of conveying all the sewage of the town down the declivity of Bay street to a point on the shore of the bay at some distance from the town.

The rapid increase in the population of the eastern portion of Bay street makes this latter sewer a necessity, the more so as an outlet is required for the sewage of the gaol, and eastern and more elevated portion of Hill street, one of the oldest settled parts of the town.

CONSTRUCTION OF PUBLIC SEWERS ON A REVENUE BASIS.

BY J. COVENTRY, M. D., WINDSOR, MEDICAL HEALTH OFFICER.

Mr. President and Gentlemen:

I have been asked to contribute a paper on a subject which is brimful of interest to every sanitarian, and there are those who believe "there's millions in it" for municipal corporations.

In these days when theoretical sanitation has well nigh exhausted itself and hypothetical sight-drafts are no longer accepted by the unscientific ratepayer, a scheme which will convert an article, hitherto worse than useless, into a valuable increment would certainly be a very popular contrivance.

But right here, on the very threshold of my subject, let me take you into my confidence and tell you a secret. The building and operating of sewerage works by municipalities and companies, on a financial basis, is to me, what it is to most of you, a *terra incognita*.

By some unaccountable potentiality in the secretary's office, just two weeks ago, I was invited to tell you what I know on this subject. If I wished to be candid and laconic at the same time, fine words would suffice.

This however might seem ungracious, so, if you will bear with me a few minutes I will submit some rambling ideas which have suggested themselves to me, in the very limited time I have had to consider the subject.

The utilization of sewage—that is of "whole sewage" of towns and cities as a financial investment is a too recent experiment to determine, 1st, its ultimate utility, and 2nd, to demonstrate its permanent financial success.

True, in continental Europe, the cities of Berlin, Paris, Dantzic, Frankfort, and in several smaller municipalities, sewerage farms have been operated for the past fifteen years, some of them yielding profits above expenses, not counting interest on investments.

In England, sewerage farms are numerous, but the results as to the disposal of "whole sewage" have not been satisfactory so far as I can learn.

The most gigantic attempt to deal with the entire sewage of a city is that of London, England, where tankage is provided for 60,000,000 gallons daily. This is gathered from an area of 117 square miles, inhabited by 5,500,000 people, living in 740,000 houses, the annual rateable value being about $160,000,000. Intercepting sewers carry their foul contents a distance of twelve miles, where it is collected in tanks covering eighteen acres, from which it is pumped by engines of 3,500 horse power, and distributed partly for purposes of irrigation, but mostly into ebb tide. Enormous as these figures are they represent just one-half of what the city of London requires to-day to get rid of its sewage.

The irrigation farms near the city of Berlin are perhaps the most extensive in the world, and so far as I can ascertain they are the most profitable. Nearly 17,000 acres are irrigated daily, and upwards of 2,000 people are employed in the work. This irrigation consists of only 25 per cent. of the whole sewage, 75 per cent., or the more watery portion being allowed to flow off into the River Spree.

It would almost seem that there would be a time limit when the supersaturation of the soil with manure would be beyond the powers of oxygen and microbes to correct.

About one-fourth of the sewage of Paris is distributed over agricultural districts with varying financial results to individuals and companies who may succeed or fail in securing farm lands at reasonable rates contiguous to sewage outlets.

In the United States a considerable number of cities and towns have turned their attention to sewage irrigation, the majority of them having been compelled to adopt it, thereby making a virtue of necessity. Partly on account of want of minute information concerning sewerage farms on this side of the Atlantic, and partly for reasons which I will state further on, I will not attempt to go into an enumeration of them, but will pass to the general question of expediency of establishing them in Ontario.

Every country must be guided in this as in other matters of every-day life, by its necessities and ability to accomplish. The tendency of this, as of nearly every age, is for people to congregate in towns and cities. In proportion as this takes place filth accumulates and its rapid removal is one of the most important factors of existance.

Toronto with its population close upon 200,000, and its sewers emptied directly into its beautiful bay, which has no reliable current passing through it, that would even periodically remove the debris, must, before long become a competitor against Montreal in the mortuary returns. Hamilton is more fortunately situated in regard to distance from the point of discharge, and its altitude is above the miasmatic line. Ottawa, too, is fortunately situated on a rapidly flowing river which can be trusted to give rapid transit to sewage if other communities are not drinking it. London is at present in the throes of litigation on this subject.

If other cities and towns cannot discry the black-cloud on their horizon, I warn them that the storm is gathering, and a little more pollution of the once clear limpid stream that erstwhile was used to quench their thirst, will bring financial destruction to their munici-

pality, unless being forewarned they forearm themselves by the adoption of a system of sewers which looks to a plan of irrigation for its final disposal.

The pollution of bays, rivers and streams on which communities depend for a supply of potable water is a subject which the health officer has studied in the past mostly with an eye to the protection of his own water supply. The time has come when he is invited to consider his neighbors very reasonable desire to take a drink and to take his "clear." Now the health officer makes his bow and falls back and the ratepayer is called to the front. The broad principle of law that requires a man to consume his own smoke requires him to do the same thing with the rest of his offensive offal.

Nearly all our towns and villages are situated on streams, and while these are recognized as nature's water-ways for the conveyance of surface water, a broad legal distinction is drawn in regard to deep artificial sewerage, and as it is the contents of these that constitute the burden of our song, and is the *casus belli* with our neighbor, we may as well accept the inevitable situation and adopt plans which will minimize the taxation necessary to meet the emergency. I think for the time being we may leave villages out of consideration, except in rare cases, as with a very little care on their part, they can provide against contamination of streams.

Most of our cities and towns in Ontario have adopted some system of sewerage, and in nearly every case the rainfall, small streams, subsoil-water, sinks, baths and water-closets are discharged into large common sewers. These in turn empty into the nearest river or lake. This, although not the best system was good enough so long as it was discharged where it was quickly carried into deep water, and did not interfere with other people. But now, when we are brought face to face with the necessity of its being treated by some of the plans now in use for its partial or final disposal we must make strenuous efforts to minimize its bulk by the exclusion from it of rain and other comparatively clear water except such as is necessary to secure its rapid removal. This is best secured by a double set of sewers, one for the rainfall and another for the more offensive dregs of the city.

The first complete work of this kind was inaugurated in Tottenham, England, some forty years ago. For some years it seemed to languish and was not adopted to any great extent until revised by Colonel Waring, an American engineer, who perfected it and adapted it to the needs of modern urban life. The system is at once thorough and economical, and wherever introduced has given perfect satisfaction.

Another system makes a partial separation of solids from fluids by gravitation, and still another uses chemicals for that purpose, but neither of these are effective, inasmuch as they do not finally dispose of the water which constitutes nine-tenths of all sewage.

If we, as health officers, would retain the good opinion of the taxpayer, we are in duty bound to throw our influence in favor of the plan which will, with the smallest possible outlay, bring back the largest returns. We are even justified in advocating a larger present outlay if it is made clear that larger gains can be derived from it.

When we can make a beginning by securing the construction of a few well designed systems of sewerage, with sewage farms properly irrigated, and broad acres covered with wavy grain, huge root crops, and sleek cattle wading to their eyes in pasture, when lands treated with sewage will double and quadruple the yields of lands in the same locality not so supplied, we will become distinguished not as sanitarians only, but as economists as well, having complied with Adam Smith's formula of making two blades of grass grow where only one had previously existed.

Shall this work be carried on by municipalities under the management of one of its own committees, or by granting a license or privilege, or entering into a contract with a company for a term of years?

This is a question which I find myself altogether unable to answer, from the fact that I have no knowledge of any company undertaking this work, except in the case of Chreveport, Louisiana, and Atlantic City, New Jersey, and from these, although I have written them, I have had no reply. Colonel Waring favors the municipality owning and managing its own works.

This involves besides the preliminary construction necessary for

the collection of sewage, to a given point or points, either the purchase of farm lands in the proportion of one acre to every 300 or 400 of the population, having in mind the probable increase, or the renting of farms, which in order to prevent the too common occurrence of creating one nuisance by abating another, it would be necessary to manage and control in all its details.

In other words, another wheel would be added to the already somewhat cumbersome municipal machine. But we need not be discouraged about a little matter of this kind when we look at some cities on the other side of the Atlantic. Take Glasgow for example, controlling and managing besides the different bureaus incidental to all corporations, there has been added gas works, street railways, a fund for the purchase of dilapidated and unhealthy blocks, model tenement houses are erected, and lodging houses are built and managed under municipal control; abattoirs, public baths and public wash-houses, epidemic hospitals for each contagious disease, public libraries and picture galleries are some of the labors devolving on the ten bailies and Lord Provost, who are managing a corporation, not greatly in debt, not heavily taxed, and conducting all these departments on a revenue basis.

To state the question in a definite form I will assume that one municipality will not allow another to pollute its streams. Sewage must be gathered and disposed of. The separate system is the most modern and most approved for this purpose. By this or some kindred plan a town's sewage is delivered at a given point. A farm is procured and placed in charge of an efficient manager, pipes are laid through it, and the system of irrigation begins. The power necessary to do the pumping will be windmills when they can be used, and steam or water in calm weather. The rest consists of the daily routine of farming and disposal of crops. Whether this can be made a financial success or not, depends largely upon proper management. My own opinion is that it can, but as my personal knowledge and experience is altogether too limited to speak with authority, please regard me rather as the bugler sounding the call "to arms."

Objections have been made to the odor on sewage farms, to the

propagation of diseases from the irrigation process, and sentimental objections to the use of vegetables grown upon them. From time to time for the past fifteen years or longer, government commissioners and public and private inspections have been made by engineers, physicians, chemists, microscopists, biologists and others, who were best qualified to give reliable opinions on the subject, and the consensus of their conclusions was that the general observance of certain principles in the superintendence of the work obviated all danger from the effluvia, and that the absence of disease in the irrigated districts was noteworthy in nearly every case.

Municipal corporations have made financial investments and have derived handsome revenues from water works, gas works and electric lighting. Public money invested in sewers has, in Ontario, only given indirect returns in increased health and diminished death-rate.

Now, we point the way for self-sustaining sanitary regulations which may be made in a given number of years to pay back, with interest, judiciously invested money in sewers and sewage farms.

As this is a momentous question forcing itself on this country for an early solution, and feeling my inability to grapple with it in detail, I would respectfully ask this Association to refer my paper to a select committee for a report at our next meeting. There is a good year's work for its members in collecting data and formulating specific directions. It should be the combined effort of engineers, physicians, chemists, agriculturists, and men well versed in municipal law, associated with gentlemen possessed of large experience in the workings of municipal affairs.

A report from a committee of this kind would carry authority and conviction with it, that no individual opinion could hope to secure.

ON THE DISPOSAL OF SEWAGE.

BY THOMAS MACFARLANE, F.R.S.C. CHIEF ANALYST, OTTAWA.

Gentlemeu,—The discussion so far has referred principally to the case of Owen Sound. It seems to me from what I have seen while here, and from what I have heard from Dr. Cameron's paper and otherwise, that the matter of sanitary arrangements in Owen Sound is settled ;

that nothing further can be done beyond what Dr. Cameron has proposed. When once a town has committed itself to the carriage of sewage by water the introduction of any other system is next to impossible. The time for an Association like this to offer suggestions to a town is before the authorities have committed themselves to any system, so that it can begin with a clean sheet, and without considering any local work already done. I have not forgotten in this connection a quotation from the lectures of an old professor of mining at Freiberg when he was dealing with the subject of the concentration of ores: "Do not scatter abroad that which is already within narrow limits." And similarly I would say, do not use water to take away that which is already in a concentrated form and may be used to advantage. If household refuse is mixed up with and carried off by a large volume of water no use can be made of it, and little or nothing can be obtained in return for the labor and money expended in making it inoffensive.

At the outset I must confess my inability to contribute anything original to the literature of this subject. Inasmuch, however, as said literature is growing every day more voluminous and valuable, it has occurred to me that it might be of advantage to lay before the Association some of the results of recent investigation. These I have taken chiefly from "Die Verunreinigung der Gewässer" or The Pollution of Rivers, by Dr. J. König, Münster in Westphalia.

What shall we do with sewage? is one of the questions proposed for discussion in the circular which called us together here. By "sewage" is evidently meant all household excreta and refuse whether removed by water or otherwise. I presume that the removal by water can only be regarded at present as a necessary evil, which can only be abolished after we have found a satisfactory system to put in its place. I shall not refer to the system of disposing of sewage by irrigation, the advantages and defects of which are no doubt well known to the members now present. But I shall first endeavor to state the results which have been reached in the chemical treatment of water borne sewage as these are summed up by Professor König at p. 181 of the above mentioned work.

If we attempt to summarise the results so far reached in the treatment of sewage by chemical precipitants, we come to the conclusion that by these and subsequent clarification it is only, on the

whole, possible to remove the suspended matter present in town sewage, but not those which are dissolved in it. For ammonia we have no means of precipitation which has any sensible effect, not even when we use soluble phosphoric acid and magnesia salts. Equally difficult is the removal of potash. The phosphoric acid can indeed be wholly or almost wholly precipitated, but of the total nitrogen found in sewage, it is in general not found possible to precipitate more than one-third; that is to say, if the town sewage contains an average of 70 to 80 millegrammes nitrogen per litre, 20 to 30 millegrammes will go into the precipitable, while 30 to 45 remain in solution.

This is proved not only by the analyses of the sewage before and after purification, but also by examining the mud produced in the operation. While the natural sewage on the average contains four or five times as much nitrogen as phosphoric acid, the proportion of these substances in the precipitate produced is about equal, and sometimes the phosphoric acid exceeds the nitrogen in quantity, and besides, the precipitates contain proportionately very little ammonia and potash.

The influence of the precipitants upon other dissolved organic substances is also very slight. Indeed not unfrequently it is found that sewage which has been treated with an excess of lime contains after classification even more organic substance *in solution* than originally. This can only be explained by supposing that the excess of lime acts upon the suspended organic particles, and transforms part of them into a soluble condition. It has frequently been cited as a proof of the innocence or good quality of the purified sewage especially of that which has been treated with excess of lime, that the purified liquids, when treated by Koch's process with gelatine plates gave little or no trace of microphytic colonies, while thousands and millions of such organisms capable of development, are to be found in the original sewage. This is certainly correct, but to draw the conclusion from this that such liquids are equally as good as the purest spring water is simply nonsense.

As a matter of course all germs of micro-organisms are carried down in the precipitation with the precipitants and the suspended slime particles and no doubt also, the free lime prevents the development of the bacteria of decomposition, but it has also been found

that when in such purified liquids the free lime has been neutralised by carbonic acid, or when they have been allowed to stand exposed to air, then the germs of micro-organisms begin to collect in great quantity, and decomposition begins again although not to the same extent as originally.

Seeing that so many disadvantages attend the removal of household refuse by water, and its utilisation by irrigation or chemical treatment, it may be profitable to pass in brief review the other systems which have been applied or proposed for removing or working up such refuse.

1. The open pit system is only now mentioned to put on record the average result of nine analyses of the manure obtained in this way :—

	Lbs. in 2,000.	Value.
Water	94.78	
Dry substance	5.22	
Organic matter	3.49	$
Nitrogen	0.447 = 8.94 =	1 43
Mineral matter	1.73	
Phosphoric acid	0.29 = 5.8 =	46
Potash	0.173 = 3.46 =	14
		$2 03

In order relatively to compare the value of such a product with the manure obtained by other systems, I have calculated its constituents as worth the following rates per pound ; nitrogen 16 cents, phosphoric acid 8 cents, potash 4 cents. At these rates the value of the open pit product would be worth $2.03 per ton of 2,000 pounds.

As a standard with which to compare the value of such products the analyses of fresh stable manure from cattle may here be given as

ascertained by E. Von Wolff, together with the valuation at the prices above given for the manurial constituents.

	Per cent.	lb. in 2,000.	Value.
Water	72.26		
Dry substance	27.74		
Organic matter	23.87		
Nitrogen	0.458	9.16	$1 46
Mineral matter	3.87		
Phosphoric acid	0.143	2.86	23
Potash	0.386	7.72	31
			$2 00

2. The pail or barrel system is a great improvement on the open pits both in sanitary and economic respects. Only the excrements are thus collected, and even the water required for washing the night vessels is excluded. These barrels are securely closed, the pipes for filling them properly trapped, and provision is made for the proper ventilation of the pipe which conducts the excreta to the barrels. These must, where they are small and portable, and contain about twenty-five litres for the use say of five persons, be emptied twice a week. This is what is actually done in the cities of Kiel and Rostock on the Baltic, and Gröningen in Holland. A similar system is in use at Manchester and Rochdale in England. The mean of three analyses by Soxhlet, Guntz and Schimper, shews the contents of these barrels to be as follows:

	Per cent.	lb. in 2000.	Value.
Water	94.05		
Dry substance	5.95		
Organic matter	4.41		
Nitrogen	0.479	9.58	$1 53
Mineral matter	1.44		
Phosphoric acid	0.216	4.32	34
Potash	0.206	4.12	16
			$2 03

3. The next system worthy of mention is the "differenzir system" of Liernur, so called because the human excrements are removed

out of the town separate from other household refuse and garbage The essential characteristic of Liernur's system is the removal of the excrements by air pressure from the various receptacles through a net work of iron pipes which are air-tight and stand in communication with an engine house outside of the city. Here are the pumps which induce the pressure and bring the excrements into a series of reservoirs, from which they are, according to the newest plan of the inventor, worked up in vacuum pans to a species of pondrette, which is found to contain, according to the mean of several analyses as follows :

	Per cent.	lb. in 2,000.	Value.
Water	11.9		
Organic matter	53.3		
Nitrogen	7.5	150	$24 00
Mineral matter	29.8		
Phosphoric acid	2.7	5.4	4 32
Potash	3.1	6.2	2 48
Per ton of 2,000 lb	....	....	$31 80

This system is at present in use at Dortrecht and also in Amsterdam, a city of 62,000 inhabitants.

König mentions a great many such systems, among others those of Shone, Breyer, Scheiding, Mosselman, Petri, Teuthorn, Thon, Tiede, Schwarz, Dietzell, Sindermann and Friedrich, but in the most of these cases the analyses of their products are not given, or other substances are mixed with them which makes a comparison of their values with others impossible.

4. In Augsburg, Bavaria, Von Podewil's process is in operation, and for two years the excrements of 30,000 inhabitants have been treated by means of it. The system consists in evaporating the whole product until 50 per cent. of the moisture has been expelled and then drying it up with peat, ashes or earth, in quantity equal to four per cent. of the original material. The moist mixture is

formed into bricks and dried. The fæcal guano thus produced contains:

	Per cent.	lb. in 2,000.	Value.
Nitrogen	5	100@16c	$16 00
Phosphoric acid	9½	190@ 8c	15 20
Potash	2	40@ 4c	1 60
Per ton of 2,000 lb			$32 80

5. In Karlsruhe and also in Freiburg, Breisgau, Buhl and Keller's process is in operation, which consists in working up the city excreta into sulphate of ammonia and poudrette. The contents of the manure pits as they are carted out of the city are collected in large subterranean overarched reservoirs, where they receive an addition of a manganese salt, which precipitates some of the soluble constituents. The fluid part is then separated from the deposit and the latter pumped through filter presses and formed into cakes. The fluid part is distilled with lime, and the ammonia liberated is condensed in sulphuric acid. The sulphate of ammonia thus produced is of the usual strength and quality. The raw poudrette has the following composition and value:

Water	13.63		
Organic matter	35.87		
Nitrogen	2.59	51.8@16c	$8 28
Mineral matter	42.37		
Phosphoric acid	6.72	135.4@ 8c	10 83
Potash	0.62	3.4@ 4c	53
Value per 2,000 pounds			$19 64

6. There is very little contained in Professor Koenig's book which has reference to the earth closet system, and probably not much experience has been gained in Germany regarding it. It is considered to be inapplicable in a city on account of the large quantity of earth that would have to be carted in and out. This is said to amount to 2,560 pounds annually per individual. On the other hand there appears to have been very considerable use made of moss litter and peat dust for absorbing and disinfecting fæcal matters. Moss litter is the upper fibrous layer of the moors or mosslands of North Germany, which undergoes a process of teasing and sifting before it is considered fit for use. The siftings constitute peat dust which can also be produced from the lower layers of the peat bed.

The peat dust possesses [illegible] which render it much preferable to earth for use in dry closets. It is capable of taking up from five to nine times its weight of water and also of absorbing offensive gases and decomposition products. As a matter of fact it is extensively used in special closets constructed for the purpose. This system is in partial operation in the following towns: Braunschweig, Münster, Bielefeld, Hildesheim and Poimmritz. The turf dust in its natural state has the following composition:

		Lbs in 2,000.	Value.
Water	21.34		
Organic matter	77.55		
Nitrogen	.56	11.20@16c	$1 80
Mineral matter	1.02		
Phosphoric acid	0.05	1. @ 8c	08
Potash	0.12	2.4 @ 4c	09
Nominal value per 2,000 lbs			$1 97

The noteworthy feature about this analysis is that it shows a larger percentage of nitrogen than even barnyard manure. The average analysis and value of the manure produced in the five towns above named in fresh natural condition is as follows:

		Lbs.	Value.
Water	84.38		
Organic matter	12.70		
Nitrogen	0.56	11.20@16c	$1 80
Mineral matter	2.64		
Phosphoric acid	0.32	12.40@ 8c	99
Potash	0.26	5.20@ 4c	21
Per 2,000 pounds			$3 00

7. Owing to the fact that it is quite troublesome for the house inmates to keep in stock and fill in the peat dust when required, and also on account of the large amount of water contained in the product, experiments have been made for the purpose of ascertaining whether by treating the excrements after their removal with peat dust, drying it and mixing it again with the same refuse, and repeating this process, a more concentrated manure could not be obtained. The drying was done under covered sheds on shelves of laths so as to admit air. At the beginning considerable heat is

developed which favors the drying. When moss litter is treated in this way three times and dried it has the following composition per cent. and value per 2,000 pounds.

Organic matter	76.87		
Nitrogen	3.00	.60@16c	$9 60
Mineral matter, including sand.....	23.12		
Phosphoric acid.....	1.86	37.2@ 8c	2 97
Potash	1.33	26.6@ 4c	1 06
			$13 63

With peat dust a similar mixture is obtained, analysing as follows:

Organic matter.....	75.75		
Nitrogen	3.09	61.8@16c	$9 88
Mineral matter.....	24.24		
Phosphoric acid	1.73	34.6@ 8c	2 76
Potash.....	1.44	28.8@ 4c	1 15
			$13 79

It is evident that products with such values as these would be capable of being transported considerable distances, and so command a wider market than the immediate neighborhood of the city producing them. This plan is now being tried on the large scale in the town of Elberfeld and is occasionally used in the slaughter house at Paderborn.

Of all the plans here described the one with peat dust and moss litter offers the most encouraging prospects. The latter material is now being used in many of the large London stables. It is not only capable of absorbing all the urine produced by the animals and retaining its ammonia, but also furnishes excellent bedding for them. During the day it is drawn aside and dries sufficiently to be used as bedding for a week. In this connection it is worthy of mention that the Indian mother wraps her baby in this same dry moss litter, and does not require to be concerned about its comfort during the long journeys of the family she belongs to.

With regard to the adoption of one or other of these systems in our various cities and towns, their local circumstances and conditions have to be considered in the first place, and possibly there are many where no other system than water carriage combined perhaps with irrigation would answer. Sanitary considerations are to be considered of course before any regard can be had to benefiting agriculture or making a profit by the sale of manures. To run away with the idea that the sanitation of our towns can be made to pay its own cost is to make a great mistake and to reckon without one's host. On the other hand it is of the utmost importance, wherever possible, to create sources of income from the utilisation of excreta or sewage, and it is in order to forward efforts of this character that I have given the relative values of the various products produced in the several European towns named.

In general it may be concluded that purification by filtration and chemical precipitation is not only the most imperfect but the most unprofitable system. Irrigation or manufacturing to manures are far more promising but are much dependent on local circumstances. In no case, according to Professor König, does any of the systems adopted produce a profit to the municipality. According to another authority, however, the pail system which has been in operation in Gröningen with 40,000 inhabitants for many years is a source of income for the town. In 1878, this is said to have amounted to $14,000. In conclusion I would suggest to this Association the wisdom of adopting such measures as would secure to its members the latest and most reliable information as regards the progress that is being made elsewhere in these matters, so that any suggestions they may make in their various localities may be well founded, and made after full consideration of the practical results which have been gained in the working of the various systems which have been tried for the disposal and utilisation of sewage both in the old and the new world.

In conclusion I would venture to say that I heartily concur in the recommendation made by Dr. Covontry yesterday, that a committee be appointed to enquire into and study this whole subject.

RESULTS OF A YEAR'S EXPERIENCE WITH THE LONDON ASYLUM SEWAGE FARM AND THE PRECIPITATION WORKS AT AGRICULTURAL COLLEGE, GUELPH.

BY C. G. HORETZKY, C. E., PUBLIC WORKS DEPARTMENT.

Gentlemen of the Association,— Having been connected more or less with the construction of the works for the disposal of sewage recently put up by the Provincial Government at the Asylum for Insane, London, and at the Agricultural College at Guelph, I have been asked by the Secretary of the Provincial Board of Health of Ontario, to relate my experience of the systems now under trial, and the results thereof.

I have much pleasure in laying before this meeting all the information at my command, more especially since my observations go to show that, in one case at any rate (that of the London experiment) the conclusions arrived at and set forth by the Provincial Board of Health last year in their report to the Commissioner of Public Works, were sound, and have been in great measure amply justified, judging from the results so far obtained.

I shall now proceed to a brief description of the London system and its working. The work at London has been performed on the same general principles as that at Norristown, Pa., both having been executed by Col. G. Waring of Newport, R. I., the London work differing from that of Norristown in one very important particular, *i. e.* the carriage of the crude sewage from the receiving tank to the disposal field, by pumping instead of by gravitation as at Norristown. The difficulties found at the latter, as regards soil and subsoil were not, however met at London, the character of the ground here being very light and porous, and remarkably favorable.

To begin with, a sweeping change was made in the local sewer arrangements at the Asylum, Col. Waring substituting for the old ones, new six inch sewers which deliver their contents into a large receiving tank under ground, of a capacity of 100,000 gallons. Thence the sewage is pumped through an 8-inch main to the disposal field, 1,500 feet distant, where, upon the highest part of a 20 acre

field a tract of 4½ acres was levelled and divided up into the arrangement of beds and ditches shown on the diagram.*

The mode of working the irrigation tract is as follows :—

At 2 p.m. each day, the centrifugal pump is set in motion, and the daily average, say from 55,000 to 60,000 gallons of sewage is pumped on to the level tract in the space of 1½ to 2 hours.

By the system of dams already described, any portion of the tract can be flooded. In general six of the ditches are sufficient for one day's pumping, and the whole dose when spread over the six ditches covers the latter to the depth of 4 inches in the centre. From 10 to 11 hours later the whole has disappeared, the entire tract being again dry, with the exception of the easterly portion of the northerly ditches where the soil is rather heavy and underneath which there lies a rather impervious stratum of clay.

The area of the level tract is however so large that the refractory ditches in question are generally given more time than the others to dispose of their contents.

In general each set of ditches obtains 48 hours rest after flooding.

But in addition, the large irrigating field south of the level tract can be utilized at any time if necessary.

Here I may call your attention to a fact of importance. Many of you doubtless in picturing to yourselves the appearance of the flooded ditches, see a series of fetid canals bearing on their surface floating and putrescent abominations which, after absorption of the liquid portion, cling to the sides of the ditches and foul the vegetation. There is nothing of the kind visible, the thorough pounding given to the sewage by the pump completely reducing all solids to pulp and the consequence is that nothing solid larger than a pin's head can be seen in the dirty water upon its arrival at the distributing well. This alone repays amply for the cost of pumping, since, after absorption has taken place, all that remains in the bottom of the ditches is a very thin film of organic paste nearly inodorous, and in fact quite so, if there has been strong sunlight. This paste breaks up by the

* Here the tract was described giving areas and measurements, etc., the lay of the irrigation field, samples produced of the soil before the sewage was laid on, the underdrains, the manner of flooding, etc., etc., damming.

action of the sun and air, and is raked on to the beds, between which and the ditches a continual interchange of soil is taking place, the patients detailed for this work being constantly employed in raking and keeping clean the ditches.

So light and porous is the soil of this level tract that neither rain nor sewage leave any traces of moisture after a short time, indeed after a rest of 12 hours duration, the beds and even the ditches (with exception of the clayey portion) assume a parched look.

Hitherto, from what cause I am not able to say, very few attempts have been made at systematic cultivation of the beds upon this level tract. At present, some desultory trials are in progress, and when last in London, I saw very excellent samples of squash, vegetable marrow, pumpkins, citrons, melons, tomatoes, turnips and carrots upon these beds, and their advanced and healthy appearance was decidedly apparant. It appears to me that these beds should be cultivated to their full extent; vegetation to absorb the putrescible matter of the sewage being a *sine qua non*, in fact playing the most important part in the system. And if we desire to get rid of the filtrate daily deposited upon these ditches, the more quickly vegetation is fostered the better.

Now it will not be out of place to say a few words upon the subject of smells, flies and other objectionable matters commonly laid to the charge of sewage irrigation farms.

With the thermometer at 85° in the shade and a strong wind blowing, also under the conditions of a close and muggy atmosphere, smells were not perceptible, excepting during pumping time or when the ditches were wet. It is undeniable that when the ditches are empty and dry, there is no smell.

As for flies I have never seen any, nor has the attendant in charge.

The population of the asylum is about 1,100. Deducting the few who use earth closets, it will probably be near the mark to estimate the sewage contributors at 1,000 persons. The daily output being assumed at 60,000 gallons, we get 60 gallons per day per capita.

The absorptive powers of the land have been, and must necessarily be, variously estimated. The figures vary from 150 persons to 480 persons per acre, that is from 9,000 to 18,800 gallons per day.

At Gennevilliers, a suburb of Paris, where in 1869 the disposal of a portion of the Paris sewage was first attempted, the *annual* average dose *per acre* has been from 16,000 to 30,000 cubic metres. (1 metre = 1.3080 cubic yards.)

The annual output of the asylum sewage is, in round numbers, 22,000,000 gallons, equal to 100,000 cubic metres, and as the porosity of the soil cannot be excelled anywhere, it may be assumed that the four acres of level tract are quite competent to deal with the whole amount of sewage, without the aid of the irrigation field to the south. As a matter of fact, such has been the case, and examination of the soil at different depths under the ditches has demonstrated the fact that, generally, the bottoms of the ditches which receive the filtrate, are but very slightly contaminated with organic matter, and that the purity of the soil downwards is maintained until, at a depth of six feet, the brightness becomes nearly absolute.

Test pits were sunk recently at various points on the level tract to find the level of the *ground water*.

This stratum of saturation as it may otherwise be called, was found at the depth of 7 feet, and from $7\frac{1}{2}$ to $8\frac{1}{2}$ feet below the bottom of the ditches. It will be observed here that this stratum is below the lowest grades of the under-drains. Some six months after the level tract had been in use, I became desirous to find out how the under-drains were doing their work, and to this end, I caused pits to be dug at different points, so as to bare the drains. It was found that in many parts of the tract the drains were perfectly dry and clean, in other places a mere trickling of moisture was seen, while at the west end, half-way between the north and south corners of the tract, the six-inch tile was found running half full, and some fifty feet further down the pipes were again found to be dry. The porous soil had actually absorbed the effluent before it could reach the point of *exit* from the tract. A permanent well was accordingly sunk at the point of lowest level of the under-drains, and, since then, we have always found the water in it to remain at nearly the constant level of from 15 to 20 inches beneath the under-drains. The 6,000 feet of under-drains laid by Col. Waring, have thus never been called upon to perform the duty for which they were intended.

This circumstance furnishes a complete refutation of the argument brought forward by the city of London, that the new sewerage system adopted by the government was causing the pollution of the delectable stream known as Carling's creek. As a matter of fact, this creek of Carling's is very much more foul than the effluent from the level tract. Sam ples of water were taken from the ground below the level tract in several places, also from the field south of level tract, from Carling's creek, and from the well at the building.

A biological examination of these waters has shown Carling's creek to contain more bacteria than the ground water beneath the tract. But, even were it not so, I think that I am quite correct in stating that not a drop of effluent from the level tract has ever yet reached Carling's creek through the effluent pipe laid for that purpose, owing to the causes I have above given.

I may here add another instance which goes to prove what I have just adduced regarding the effluent.

Months ago it was found that the effluent drain leading to Carling's creek was constantly becoming choked, and at last finding that surface water was carrying in sand through the open joints of this drain, it was decided to take it up and replace it by a sealed one. On opening it just below the level tract, no indications of either stoppage or water were seen. The difficulty was found about 160 feet south from the tract, and then the trench was opened and some of the tiles removed. This trench has still remained open, and at the bottom and at the exact level of the ground water in the well, water is gently oozing from the ground. This is, of course, the effluent water after having passed *laterally* through a filtering medium 160 feet in thickness.

It is highly probable that this lateral filtration is going on all along the declivity south of the level tract, and if so, it will pass in all likelihood many feet beneath the bed of Carling's creek, if it reaches so far. It may be that in time the ground water may rise to the level of the effluent pipe, which will then play its part and conduct the effluent to the destination originally intended for it. Tests of the soil from the bottom of the ditches down to the ground water have been made, which shew the relative quantities of organic matter absorbed by the

filtering medium. Tests were also made to find the degree of saturation of the soil beneath the ditches.* For result see page 110.

"Polarite" is a pure and absolutely insoluble mineral substance, specially manufactured for the filtration of water, fluids and gases. This mineral has been carefully examined and tested by analysis, by one of the greatest living authorities, Sir Henry Roscoe, M.P., F.R.S., LL.D., etc., etc., who reported that the "porous nature of the oxide, its complete insolubility and its freedom from rusting constitute its claim to be considered a valuable filtering material," and he gives its percentage composition as follows:

	Per cent.		Per cent.
Magnetic oxide of iron.....	53.85	Water, with a trace of carbon	5.41
Alumina	5.68	Silica	25.40
Magnesia	7.55	Lime	2.01

It contains, therefore, no poisonous metal; it is very hard, porous and absorptive. It extracts iron and lead from water, and destroys organic matter in solution. It is a powerful decolorizer and deodorizer by virtue of the polarized oxygen contained within its microscopic pores. It is extremely durable and magnetic to a remarkable degree, and notwithstanding that iron is the chief element in its constitution, *it will not rust.*

The value of a porous magnetic oxide of iron that will not rust can scarcely be over-estimated, as its powers as an oxidizer approach that of "spongy platinum." The potency of a substance as a purifying, deodorizing, decolorizing and filtering medium is dependent upon, and may be measured by, its power of occluding and polarizing oxygen. The occlusion or condensation of oxygen takes place upon all surfaces, both interstitial and superficial, consequently that material which presents the largest surface in the smallest cubical space is the most powerful purifier, provided it is composed of a proper substance.

* With regard to the action of snow and frost, I may say that no trouble has arisen during the past winter from those causes. During the severest weather a thin film of ice did form upon the ditches, but after being broken up it disappeared after the next flooding of sewage, which has always a comparatively high temperature. Last autumn the trial was made at Guelph Agricultural College of the disposal of the wastes from the Institution by a precipitation process. The *porous carbon* system was used, and is still in operation. From certain experimental exhibitions in the small way under the City Hall, it was expected that a practical adoption of the process would be attended with like satisfactory results. The experience of the last ten months has not, however, justified these expectations. The quantity of carbon required has been six fold in excess of that anticipated. Its quality, as received from England, has been variable, and results likewise. Precipitation by this carbon process has been at times very unsatisfactory, and the filtering apparatus decidedly so. For the latter I would strongly recommend a trial of *polarite*, which is described as above.

That the material is rustless is proved by the production of a sample taken from the Acton filte r beds, which had been subject to the action of the air and water for eighteen months.

Thames water taken from Hampton Court has been purified by filtering through "polarite" at the rate of one thousand gallons per square yard in twenty-four hours, and the results obtained have been excellent.

Polluted water from the Thames below London Bridge was passed through a polarite filter and analysed by P. H. Harland, Esq., F.I.C., F.C.S., and found to be purer than any of the water supplied by the London water companies. About 300 pounds of polarite are required for each square yard of filter, and the price of this quantity would be about 12s., or £4 per ton.

Where space is limited, and the quantity of water required is considerable, large high pressure filters are used, in which the filtering materials are placed in closed cylindrical iron cisterns, through which the water is passed under considerable pressure."

The alleged qualities of polarite, and the magnetic precipitant called ferozone, used by the *International Water and Sewage Purification Co.*, of London, England, were first pointed out to me by the Governor of H. M. convict prison at Parkhurst, Isle of Wight, who wrote saying "Instead of porous carbon we are *now* using 'ferozone,' the arrangements for which are not yet completed, but when they are, and an analysis made, I will send you the result." This was in June last, and I have not yet heard from Parkhurst, but I may say that there the number of persons contributing to the sewage is 2,000, *i.e.*, 1,000 from the barracks and 1,000 from the prison.

Here I shall trespass for a few minutes upon the patience of this meeting by reading one or two extracts from a paper written by a member of the Corps of Royal Engineers:

"In the 'International process' for the treatment of sewage, in which magnetic spongy carbon or polarite plays so important a part, a precipitant is used, prepared from the same mineral that forms the basis of polarite, but treated in a different manner. This magnetic

precipitant and deodorant is called "ferozone," and is rich in iron, and contains also alum, calcium, magnesia and rustless magnetic oxide of iron in a very spongy and absorptive condition.

The following is an analysis of ferozone or magnetic ferrous carbon, made by Sir Henry Roscoe from a sample taken from Acton by that eminent scientist:

Soluble constituents:	
Ferrous sulphate	26.64
Aluminum sulphate	2.19
Calcium sulphate	3.30
Magnesium sulphate	5.17
Combined water	8.20
Moisture	24.14
Insoluble constituents:	
Silica	11.35
Magnetic oxide of iron	19.01
	100.00

The quantity of ferozone used varies with the nature of the sewage to be dealt with, but usually five to eight grains are added to each gallon, equivalent to from seven to eight hundred-weight per million gallons. The cost of ferozone, delivered at any railway station in England, is £3 per ton."

From what has been read, I would suggest a trial of the *International process.* It will cost no more than that in use, since the same plant will answer.

As an additional means of filtration, a suggestion made by Doctor Bryce may be mentioned—*i. e., sub-soil* irrigation. For this purpose all that is necessary is a small level, or gently sloping piece of land, underlaid by three inch or four inch tiles, ten inches below the surface. The contents of a tank being flushed into these, the ground takes up the liquid and natural filtration ensues. By combining both systems, *i. e.*, precipitation first and sub-soil drainage after, there can be no doubt about the result.

HOW SOILS DISPOSE OF SEWAGE: THE PROCESS OF NITRIFICATION.

BY DR. PETER H. BRYCE, TORONTO, SECRETARY OF THE PROVINCIAL BOARD OF HEALTH.

Before reading his paper Dr. BRYCE said: You will see from Mr. Horetsky's description that the soil has not got saturated more than a quarter of an inch after a daily soakage of over a year, and I propose to give you what may be called a biological description of what goes on in that soil and of kindred soils.

Gentlemen of the Association:—In endeavoring to set forth the phenomena associated with the application to the soil of organic matters, we enter upon the discussion of the succession of processes, which from the time we have any record of men associating themselves into communities, even of such wandering bands as those of the Israelitish host passing through the wilderness, became necessary to their healthy existence. We see that methods of varied character have been in existence, more or less successfully accomplishing the desired result of reducing organic matter to those simpler and innocuous forms which as gases are given off into the soil and serve to nourish and develop vegetable life in its manifold forms.

Observation of results may be said to have been all the knowledge which men of the past centuries have had to guide them in their operations; but the investigation of the causes underlying these phenomena has been reserved for the students of nature of our own time. As a most necessary part of this study have been the extensive drainage operations and the observation of the results of such which have marked the first half of the present century. A study of the greatest interest is found in the accounts of such extensive drainage operations as those of the Duke of Sutherland, who converted the whole character of his thousands of acres from poor sheep-farms into fertile and cultivated fields. Much too has been done in different places on this continent, but we cannot here more than refer to them as showing how gradually a great mass of information has been garnered relative to the nature of soils, their relations to the water which, falling upon them, is more or less

absorbed, and of the important part which ground air plays in the phenomena of plant-life. For the scientific laws upon which these depend we have to go back to Boussingault, Liebig, Voelcker and many other chemists in the field of agriculture; but even to these great chemists of an earlier day the biological factors which play so dominating a part in these processes were little less than a sealed book. Earth-worms, insects and infusoria were for them the potent allies of the chemical forces at work; but never yet had been dreamed of that life which to-day is attracting the attention of the scientific world, and which is comprehended under the term of *microbiology*—the study of the infinitely small—or if you choose bacteriology.

Each of these then, agricultural hydraulics, geology, meteorology, chemical physics, vegetable physiology and bacteriology, plays its own important part in the question we have to consider, and I shall be pardoned if, in attempting to briefly elucidate my subject, I touch but lightly on many important and interesting matters on the assumption that you are familiar with them, and deal with some of the later results of work done in the endeavor to solve the problem of sewage combustion by soils.

The practical results sought after are by none so fully realized as by the members of an association of health officers; since it is they, who knowing the evils of unscientific methods of disposing of sewage, are most keenly appreciative of all work which enables them to deal more effectively with this most difficult of problems.

The Nature of Soils.—This must be our starting point. All soils are not the same, not equally free from sanitary evils, not equally useful for disposing of sewage. Roughly we have clays, sands, marls, humus, as peat bogs, prairies, etc., and the almost infinite gradations between these. Innocuous, as we may say, in themselves, the physical conditions associated with them, affect most potently sanitary surroundings. The cold retentive clays, creating house and cellar dampness, demand most careful and often laborious treatment; arid sands sanitarily good, demand prolonged treatment to make them of agricultural value, while the organic products which cover bog and prairie and become the farmer's paradise, create for a time in their cultivation malarial conditions, often of the most serious character.

Reverting first to the hydrology of these soils, we must briefly enquire into their various relations to water. Discussing their physical constitution we notice several broad and distinctive differences between them. The most prominent is their molecular structure. Clays which consist of particles greatly more minute than sands, are distinguished by their retentive character as regards moisture, which may extend to practical impermeability. Thus, when made more dense by pressure, as puddling, their physical property of adhesion as regards water, seems notably greater than that of sand. Within the minute interstices they gradually can accumulate water to nearly the extent of their own volume. In other words, their retentive character approaches 100. Schubler places it at 75%.

Sands, on the other hand, are notably permeable and loose in texture, and in some instances, as at the sewage beds of the London Asylum, may not retain more than 15 or 18 per cent. of moisture. Durand Claye ranges them from 15% upwards. Doubtless their molecular affinities vary from those of clay.

Marls may be said to stand between them, while humus has features distinctively its own. Permeable like sand (Duclaux), it is yet marvellously retentive of moisture, but by no means so retentive as clay, thus occupying a unique and interesting position in the matter under discussion.

Manifestly, therefore, since the problem of sewage farming is one of the ability of a soil to dispose primarily of the water poured upon it, the varieties of soil must affect very materially the question of quantity in the disposition of sewage. Inasmuch, however, as we have to accept local soil conditions, as we find them near a city, the problem of whether it be possible to utilize a clay soil for purposes of a sewage farm becomes one of great importance.

Before discussing this in detail we must refer to one or two other qualities of soils, and amongst these that of their adhesive properties for various materials.

Duclaux in discussing these physio-chemical qualities of different materials, says in effect: "Let us suppose that water charged with a soluble salt comes in contact with a wall, whose action we may amplify

by supposing it, (as is the soil), a porous body, giving in a small volume a large extent of surface. Experiment teaches that in contact with these bodies, *water*, a dissolved salt and a solid body, it takes on a state of equilibrium such that the degree of concentration of the salt in the water modifies itself.

"Sometimes the liquid layer which we know becomes adherent to the body is more concentrated than the solution employed and then it becomes necessary to admit that the solid has greater adhesion and affinity for the dissolved salt than for the water; sometimes it is the opposite as if the solid body attracted more water than of salt in solution. Inversely if through this mass now in equilibrium we cause distilled water to pass, we will see this water at first drive before it the solution and afterwards borrow from the solid walls the salt which is there found stored up, in such a way that if we continue these effusions of water sufficiently long we can remove from this solid all the salt absorbed and see it give out only pure water. But this would be more or less long in proportion as the adhesion of the solid for the absorbed substance would be more or less great, and there are even cases where this substance is so strongly retained that one cannot remove it."

Closely associated with these qualities of soil, as bearing upon the capacity for holding water, or for allowing it to pass through, is the power of capillarity exercised by its particles. The interstices between the particles must be considered as innumerable tubes through which water must pass, and which will act on it in the same manner, only greatly multiplied, as would capillary tubes of the finest character, increasing as we pass from the kaolin and porcelain clays to the large grained sand and gravels.

To this property of capillarity—virtually adhesion—is due not alone the retention of water, but also the great loss seen in the rate of flow of water through it, as well as in the volume discharged, technically called the *effective charge* by Durand Claye. In drainage in the matter of permeability or removal of water from the irrigation beds this property plays the same important part which it does in the great question of determining the rate of flow, or, in other words, the volume

of subterranean waters which may be depended upon for supplying public water, either by driven wells through pumping, or from artesian sources. We cannot discuss the matter further here, however, than to say that Darcy, Dupont, and after them Durand Claye, have given us definite formulæ, enabling us to calculate with some degree of certainty the amount of work which a soil of given character is capable of performing, as pointed out by them as also by Hoffmann of Munich. This rate of flow, as compared with water in any surface stream, is very slow, at most a few metres per day.

As seen at the London sewage farm, the downward movement equals probably two metres daily. This rate of course will vary greatly with the porosity ot soil. Some as we have seen retain very little water—the minimum limit necessary for daily plant life being almost 10 per cent. according to Claye; we have found as little as 15 per cent. in London sand. From the hygroscopic character of organic matters already referred to, we can very well understand, however, how the rate of flow through a sand receiving sewage matters may gradually become altered, *i. e.*, the flow of water from it become slower, and hence we find established a reason for the intermittent irrigation of such farms.

2. *The meteorology of soils, ground air.*—Everyone will see from the foregoing paragraph, how intimate is the relation whichthe character of the soil bears to the amount and character of ground air, and to the amount of water it holds, or is capable of retaining. Assuming a soil to be in a condition capable of absorbing say, 50 parts in a hundred of water, and of allowing 40 per cent. of this to pass through we can readily see that the interstices first occupied by water must now hold 40 per cent. of air. Assuming for the moment no action going on, we would find this air to be practically of the same constitution as the superambient atmosphere. Such a condition however, unless in a pure sand, can in practice not exist, since we find that physio-chemical action is constantly utilizing the oxygen, and to some extent the nitrogen of the air. In the production of such compounds, the results of organic combustion, are carbonic acid, ammonia, nitrates and nitrites, sulphates, phosphates,

etc. Hence we might say that given a working temperature, we might measure the activity of the operations of organic combustion by the composition of ground air, or of the compounds which are formed out of the gases which make up its various constituents. How this organic combustion goes on, and how the presence of free atmospheric air in the soil, or the products resulting from its oxygen especially, affect the progress of organic combustion we shall now shortly refer to.

3. *Organic matter of soils and its combustion.*—To all of us the question must often have arisen: Given organic matter as of the virgin soil of our forests with its leaf-mould, or the deep rich humus, the remains of vegetation found on western prairies, or of the manure which is carted on to our fields, in amounts at times enormous, as where our market gardeners often put annually 50 and 60 tons on every acre of their little farms—how and by what process, if we agree that it disappears, is this enormous combustion brought about? Not more than five years ago, the late Prof. Angus Smith, chief of the officers appointed to carry out the Rivers Pollution Act of Great Britain, gave, in his annual address before the Sanitary Institute of Great Britain, much attention to the question of organic combustion. He informed his audience how recently he had had to confess to a change of views regarding the process. Trained as a chemist he was accustomed to believing oxygen was everything, thus maintaining the belief of the older chemists that it is the phlogiston —the principle of inflammability.

In the curious language of Nicholson, a chemist, who wrote in 1796 "inflammable air is the phlogiston, 'the consumer,' The air of the atmosphere consists of a mixture of a vital and a noxious part."

Prof. Smith indicated at length that, while he still retained a belief in the chemical action which oxygen exerts directly on organic matters, he yet had to confess that the investigations of recent years left him no room to doubt but that the process of combustion, fermentation or putrefaction—call it by what name you will,—is due in large measure to the action of living organisms, and the process of yeast growth in fermentation will illustrate the process.

Fermentation expressed in the old fashion is defined by Nicholson as follows: "The word fermentation, in an enlarged sense, is used to denote that change of the principles of organic bodies, which begins to take place spontaneously as soon as their vital functions have ceased, and by which they are at length reduced to first principles."

The definition is admirable, if we put in the place of the word *spontaneously*, "by the action of microbes."

Now take an animal, as an ox, kill it, take its flesh in solution in which vital functions have ceased, place this in a flask, sterilize it, leaving a sterilized cotton-wool plug in the mouth of the flask, and we see that no change in the principles of the organic matter takes place. But remove the plug, allow the atmosphere to come in contact with the solution only for a few moments, and we will find that in a few hours the solution has become turbid and bad-smelling. Its principles have changed. We see the same thing with the fruit jar, sterilized and afterwards left open to the air for a few moments. Manifestly therefore, since oxygen of the air remains present in the flask and may further pass in through the cotton-wool, while the beef *bouillon* remains unchanged for an indefinite time, we must see that the oxygen of the air is not the phlogiston. We may similarly take organic matter of the soil, or we may take sewage, sterilize it in a similar manner, weigh it, and weigh it again after a month, and we find no loss in it. Remove from it, by washing and drying, its ammonia, its nitrates and nitrites, sterilize it, and months afterwards we do not find any more produced. Again we have to confess oxygen is not the philogiston, not the consumer. We must seek farther for the cause, for the question presses. Take the sewage farm at the London asylum. We may take as a working figure, 100,000 gallons of sewage as passing daily to the ditches on the four and a half acres of flat bed. Take the organic matter contained in this sewage at the figures given by Latham, which are 34 parts of organic matter in every 100,000, of which 2-5 is soluble and 3-5 insoluble. This would give us in weight for each 100,000 gallons 220 lbs. of organic matter deposited in the field, or for each year we have almost exactly 50 tons of organic compounds to be disposed of in this four-and-a-half acres.

According to the same tables the total bulk of solid sewage would be rather more than three times this, or 150 tons annually.

You have already heard from Mr. Horetsky the answer as to whether it has disappeared, and you have seen the appearance of the soil of the ditches just as it was removed.

We cannot doubt then that the 50 tons has at all events disappeared as sewage.

We have already seen that oxygen alone cannot account for this, and that free air apparently brings something else to aid in the work of destruction, or that this something else is in the soil.

Now, if we take, as we did before, a mere particle of earth and add it to sterilized *bouillon*, we find the latter becomes turbid; and a drop of the solution under the microscope will show innumerable bacteria. Without these no malodorous gases have been present; with them in twenty-four hours the solution is decomposed and bad-smelling. These are the gases of putrefaction. We need not concern ourselves at present with the species of these microbes: it suffices that they are sufficient to decompose into simple elements the complex organic compounds of vegetable and animal matters.

How much they are capable of doing can be guessed from what we see done in malt fermentation. With a square metre of exposed surface a brewer can obtain in eight days in a vat one metre deep the fermentation of one cubic metre of malt, holding 100 kilogrammes (or over 200 lbs.), or four tons a year with one square metre of surface. Similarly with anaerobic bacterial fermentation *aspergillus niger* can consume in a cubic metre, with a square metre of surface, 3,000 kilogrammes of sugar a year, or two and a half tons. Now an acre has a superficies of more than 4,000 square metres, all of which is exposed to the air, so that we can readily comprehend how on a surface 4,000 times as great the destruction of only twelve and a half times as much organic matter in the shape of sewage is accomplished.

Koch has found 38,000,000 bacteria in a cubic centimetre of sewage at Berlin, and every writer gives the number of bacteria in soil as being practically innumerable.

Taking the nitrification capacity of this sewage farm for half the

year to be equal to that of a brewer's vat, we see it could do 2,000 times as much work per acre as at present, whereas the amount of destruction necessary to purify the soil is only twelve and a half times as much as can be done by microbes in one cubic metre of malt, and yet we have four and a half acres of flat beds to work with. In other words, these beds are being worked up to only 1-640 part of their capacity for nitrification. Prof. Percy Frankland has shown from the chemical products of the nitrification of sewage, that an acre is capable of fully taking care of the sewage of 1,100 persons. This has been practically carried out at Merthyr Tydvil, in Wales.

The tests which have been made by incinerating the earth at London Asylum amply prove that progressive pollution of this soil under present circumstances is wholly impossible.

How bacteria work need not be referred to further than to say that like other cellular plants they abstract from the food surrounding them nourishment, and by fission, multiply with inconceivable rapidity under warmth, moisture and oxygen, elaborating new products, as ammonia, carbonic acid, water, nitrates and nitrites, and various other products of a complex organic and volatile character, all in large measure absorbed by the soil, but at other times being given into the surrounding atmosphere. We thus can see that apart from the question of the capacity of any given soil for nitrification, the question of how far this can go on without creating disagreeable odors, becomes one of great importance.

4. *Elements of Sewage Farming.*— We may now very properly take up the question of what elements go to make up the essentials of successful sewage farming, both hygienically and economically.

On every hand it will be agreed that from the theoretical standpoint there must be only one point which can be put first, and that is the hygienic phase of the question. Life must be saved at whatever cost. While this is true, in municipal experience it is everywhere found that engineers and sanitarians must bring their theoretical schemes down to some practical basis, in keeping with the economics of municipal politics, before there is much hope of seeing them adopted. Referring first then to the economical basis of

sewage farming, it may be said that we find in the published reports of many towns and cities of Europe, the most contrary statistics regarding the cost and revenue from sewage farms. At Berlin and Paris, where the soil is of an arenaceous and exceedingly open character, we find the working cost is more than covered by the revenues derived from the renting of the irrigated lands. In the more moist English climate, where much of the soil about many towns is retentive and requires extensive under-draining, there is in some cities an annual loss when the interest on capital is considered, and yet there sewage farming has been most extensively adopted, and various methods are in use, such as partial precipitation, separate sewers, c., all affecting the balance between profit and loss. In the United States a few farms have been working successfully, as at Norristown asylum, at Orange, at Watertown asylum, etc.; but on this continent sewage farming may be considered to be in its infancy. What, then, are the elements upon which we have to depend for reducing the cost of a farm? in other words, of increasing its ability to utilize sewage, and of increasing the revenue therefrom?

(*a*) The application of the sewage to the farm in the proper condition. At London asylum we have seen that by the Webber centrifugal pump the sewage appears in the main delivery drain of the flat-beds as nothing more than like so much soapsuds. No suspended matters are apparent. This might be true in general of the sewage delivered by the *combined* system, but we can readily see that the *separate* system, whereby only house sewage and roof-water are used, is essential to the reduction of the amount of filtering area required. We must include here the sewage being delivered fresh, and this really postulates the existence of the separate system. At Brockville sewage reaches the outlet in ninety minutes from the farthest portion of the town, and at London asylum it is pumped daily to the filter beds. Such sewage is fresh, has undergone no decomposition, and produces no smell. This matter is one of the most important factors economically. No matter at what cost, we cannot have farms from which at night-fall, and on moist days, are arising mephitic vapours, to be wafted over the houses of residents within a

quarter or half a mile of the farm. Moreover, there will be a notable lessening of the amount of land required for a farm when sewage is applied in a proper condition. I have already shown how, theoretically, the London Asylum farm could do many times more work than it is doing; but one cannot be sure that while the nitrification work would be completed, there might not be exhalations from so excessive a decomposition as to limit the amount of sewage applied to a much less amount than theoretically is possible.

(*b*) The condition of the farm. Doubtless this is by far the most important question. We have seen that soils vary enormously in their permeability and retentiveness of moisture. Now, primarily, our farm must be of a permeable soil, or of one which has been converted into a permeable soil, since so long as the sewage remains in solution on the surface until it has had an opportunity of undergoing *anaerobic* or putrefactive fermentation in the water, so long will it give off malodorous gases. Hence the soil must be very permeable.. At London asylum, as you have seen by these specimens of soil, it is extremely pervious and but slightly retentive. Indeed, our experiments have shown it to be as low as the lowest average given by authorities of soils as to their retentiveness of moisture.

This permeability, which presupposes a soil with large interspaces, or interstices, means equally that the dissolved and finely comminuted matters of the sewage will be left in the interstices of the upper layer of soil to some extent. It is seen in London that the bottom of a ditch has a grayish-black baked layer if left in the sun till dried out. Now, what is necessary in order to have this intermixed with the soil, so that its gases may be absorbed by the soil, rather than given off, and that air may readily follow the water downward, is that the ditches be raked after each application.

This is notably essential, since in the degree that the oxygen of the air finds free access to the soil, will the nitrification process proceed rapidly and the microbic life of an *ærobic* character find an extended downward field of action. Hence it is desirable that the saturation line be maintained either by drainage or the accident of arrangement of soils at as low a level as possible. We have

already been told that under the asylum farm there is a hard-pan at a level of about nine feet below the surface, and that the tiles which were laid at from four to six feet below the surface are not needed since the water has so ready a downward movement that it descends till it reaches the supersaturated layer above the hard-pan. The case is an unusual one, and one which gives the fullest scope for nature's operations to work in the completest manner.

The figures of the analysis given of the organic matters in this soil at different levels shows how completely in this case combustion of the organic matter has gone on.

SATURATION OF SOIL AT DIFFERENT DEPTHS UNDER DITCHES.

Of London Asylum Sewage Farm.

	Percentage by weight.	
1 foot	0.061	Assuming the sp. gr. of sand to be 2.5, water being 1.00, the percentage by volume can be calculated.
2 "	0.064	
3 "	0.061	
4 "	0.064	
5 "	0.061	
6 "	0.077	

ORGANIC MATTER FOUND IN SOIL IN BOTTOM OF DITCHES AND EVERY SUCCEEDING FOOT DOWNWARDS.

No.			
1	Bottom of Ditch	2.85 per cent.	
2	1 foot below	3.00 "	
3	2 " "	1.50 "	
4	3 " "	1.23 "	
5	4 " "	Less than one per cent.	
6	5 " "		
	6 " "		

But assuming that the soil is more retentive, as it will be about some of our towns, can we make it fit for a sewage farm? Doubtless it is economically considered most desirable to get the most open soil possible, since it will lessen greatly the expenses of sub-soil drainage; but all who have studied the works of sub-soil drainage will have learned that by laying two-inch tiles at frequent intervals, say from ten feet upwards to twenty-five and fifty, such outlets for

ground-water are created as will allow a very large amount of drainage to take place. I have seen from the mouth of a three-inch tile, four feet deep, in a drain some 500 feet long, in an extremely retentive clay soil, a stream an inch in depth steadily flowing. This amount repeated at intervals of fifteen to twenty-five feet means an enormous capacity for removal of water. Thus ten such drains under an acre delivering a gallon a minute each, means a removal of 14,400 gallons per acre from the soil every twenty-four hours, while if sewage were applied every fourth day, it would mean that a single acre of retentive clay with drains twenty feet apart, would deal with 43,200 gallons of sewage water every three days.

But some one naturally may ask will not the amount of sewage organic matter poured upon a soil, gradually clog up the interstices and so prevent the downward water movement? Now, in reply, we have words of consolation and comfort for the doubting.

Take the pine leaves and leaf-mould which fill the hollows in our natural forests. Has not everyone seen such receive all the snows and rains of winter and spring and silently give them downward passage? Experience given us in tabular form shews such to be almost as permeable as sands and with a capacity for holding moisture nearly equal to clay. Now such is organic matter, and, as is daily seen in good farming and market gardening, retentive clays by heavy manuring are rendered wonderfully absorbent on account of the increased openness produced by the organic matter of the manure, thus introducing air into the soil and allowing nitrification to progress rapidly. Hence if a retentive clay will do a given amount without organic matter it will do very much more with it.

(*c*) Cultivation of the farm. We, however, can enormously aid the process of absorption and combustion of organic matter. We have seen how, at the asylum farm, the raking of the surface of the beds serves not only to mix the organic matters and the sewage with the earth but also to keep the surface of the soil open, thus allowing air to follow the water downward. We have to do more than this in clays. By the cultivator, the plough and the hoe, the soil, as in all good farming, can be kept open, aiding in marvellous degree the

work of destruction by nitrification. But we can add to this. All know the products and the food of the plant. By its roots it takes from the soil potash, phosphoric acid salts, ammonia salts and nitrates, and doubtless other substances sometimes hurtful, sometimes beneficial. Of these the organic compounds are produced by the nitrification process in large measure. If produced and the plant is present it takes them up and growing thereby is enabled to push its roots here and there, everywhere searching for more food. These roots are thus disintegrating the soil, taking up more moisture, thus again giving room for more air in the soil, and so

"It is twice bless'd,
It blesseth him that gives and him that takes."

Thus clover and pea roots have been found running 10 and 12 feet deep into the soil, as also other papilionaceous plants, thereby disintegrating the soil and aiding the destruction of organic matters applied upon it.

Reverting to the process of nitrification it may be said that the biological or chemical elements which carry on the process have since the development of bacteriology been re-studied and the causes are now held in review. The most interesting recent work by Winogradsky indicates its causation by one specific form; but assuming that various forms enter into the work of destructive fermentation of soils it will be of increasing interest to know whether a certain species, by aiding them with a favorable environment will be found to do more work than other species not so well acclimated or suited to the work.

About many old European cities the intensive cultivation of the market gardens seems only to have increased the working powers of their soils; so under proper treatment we can be assured that the sewage farm will increase in all good work.

In reference specially to the hygienic problem of the sewage farm, I may be pardoned if I quote a great authority, viz., M. Duclaux of the Pasteur Institute, a chemist and biologist, and the most experienced colleague and collaborator during many years of the illustrious and glorious Pasteur.

"Purification by combustion of the layers of the soil can then

suffice, in a work properly managed, to destroy the greater part of the organic matter, and to assure the normal distribution of salts between the soil and the drainage effluent. The problem is to avoid saturation. If we wish it to go on more rapidly we compromise the result by the substitution in a soil too drowned or saturated with organic matter, anærobic and malodorant life, for the more active ærobic life. It is then necessary to leave the beds to dry and rest for some time. As for the salts, saturation has the opportunity of carrying them off more quickly as they are not destroyed—only fixed. It is not the living forces which intervene in their destruction ; these are physio-chemical. There would be advantage in constantly removing them from the soil which contains them in order to allow it to absorb others. This is what one unconsciously does by putting under cultivation irrigated fields. One thus at once abstracts organic matter and salts, with this advantage also that the plant utilizes not only the salts, potash, phosphoric acid, etc., which the soil retains, but arrests the nitrates which otherwise would pass away in the drainage water.

Cultivation thus gives its powers to that of the microbe, or rather it produces between the plant and the infinitely small, one of the symbioses, or in other words, factors which exalt each other.

I do not speak of the social advantages of such a combination. I do not wish to leave the scientific field, so I pass on to the subject of inconveniences. The one is of moderate importance ; it is that with a field in cultivation the question of continuous irrigation is not possible, it is necessary to adapt to the needs of the plantation, both of cultivation and harvest. The amount of water per hectare thus purified diminishes a little under these conditions, but not so much as one might think. At Gennevilliers on the land under kitchen garden cultivation, the amount of sewage employed by the farmers is more than 40,000 cubic meters per hectare per annum. Another argument against cultivating irrigated lands is drawn from the presence in these sewage waters of pathogenic bacilli. How can one expose himself, they say, to seeing come back to our houses, under the form of vegetables or provisions, germs of cholera or typhoid

fever. If, however, we only make use of forage and grass, the reflection of the possible danger to the human species would be distant and consequently can be neglected. We might say exactly the same thing of vegetables which we consume cooked, but the salads, the radishes, the strawberries, who can say they do not come to us bearing the pathogenic bacilli of the alvine evacuations of the sick.

This argument warrants examination, but in this it is necessary to set aside resounding phrases. Let us define the problem. The pathogenic germs certainly reach the sewage. No one denies that they do not perish in it, and this we would wish to know before setting them aside; but let us admit that they do not perish, for if they do not all perish, then nothing can prevent them being present. From the moment they are in it, do they become more hurtful in the field of cultivation and purification than they would in any other practical procedure for disposing of sewage?

This is the whole problem to be solved.

What becomes of the germs in irrigated fields? We find them infinitely less numerous in the effluent than in the sewage. At Gennevilliers the number per cubic centimetre does not exceed a few hundred at the outlet. At Osdorf, in the environs of Berlin, Koch has found 87,000 in the effluent and 38,000,000 in the sewage per cubic centimetre.

Pathogenic germs are retained by the layers of the soil as proved by Cornil and Chantemesse, Grancher and Deschamps. The chances are, they perish in great numbers as do other microbes, of which sewage bears infinite numbers, and a gramme of earth holds as many. But this is only a chance, and in regard to it the adversaries of sewage irrigation will say we must take into account the infinite variety of conditions afforded by the same soil, of which no two parts are alike. They say nothing will tell us locally, on a surface of some extent, the moment at which the struggle for existence will be in favor of the typhoid or cholera bacillus. Experiments have shown their great vitality in the soil. Pasteur has found charbon in a soil a dozen years after an animal has been buried in it. Grancher and Deschamps have found the typhoid bacillus in a soil very similar to Gennevilliers more than 5½ months afterwards.

On the other side, the general conclusion of our studies on the fate of pathogenic bacilli in water, has been that the water in general might become a culture medium.

It is clear theoretically that we are exposed in sowing at haphazard pathogenic bacilli on vast surfaces to favoring local cultures which might become dangerous. Is it not by local culture of the comma bacillus that some hygienists explain the endemicity of cholera along the mouths of the Ganges. Are not the same regions devoted to malaria in consequence of their soil and subsoil?

I do not miminize those arguments, and recognise how well founded they are if, in exchange for such recognition, their hypothetical character is granted, and if it be further allowed that from these local cultures a danger does not necessarily result.

There are in the soil many dangerous microbes; there is the pyogenic vibrio, the septic vibrio, the bacillus of tetanus, and others with which we are well acquainted. Those which we swallow in in the form of dust have been dried and have undergone the action of the sun, two depressing, and deadly influences. Those which we consume with the food which we eat raw, encounter a barrier in the digestive canal. It only remains to prevent their penetration into the tissues, and this we manage without much difficulty. Even with the hypothesis realized of these local cultures of pathogenic microbes, the effect would not be very great, and this has been demonstrated by experience as well as by the innocuousness of the bacillus of tetanus.

China has poured for several centuries human dejections on the cultivated fields. The market gardens of Milan have long been irrigated with sewage. In the north, about Lille one does not eat a strawberry or radish which has not been in contact with fæcal matter. Now Lille is one of the towns most free from typhoid fever.

We Parisians, even, know that it is not only from Gennevilliers that vegetables come to us which we are inclined to suspect. All round Paris is a zone of intensive cultivation the air of which is sometimes made pestiferous by the depots of night-soil, which are

not less formidable than sewage in point of view of the germs which it contains, and which are commonly employed in compost heaps or as a top dressing.

Experience does not prove that the health of the inhabitants of Gennevilliers or, if these are suspected because they especially produce their vegetables to be consumed at Paris, that the inhabitants of the vast irrigated surfaces about Berlin and Edinburg and the numerous English towns which have adopted the system, are specially attacked with those epidemics which water can carry.

When, if I am still close-pressed, and if asked to acknowledge that some cases of contagion are possible, I would ask by what practical system can we avoid them? A canal to the sea? But does anyone think that even then there would not be an opportunity for particular instances, for some serious occurrence? The transport via the Seine? But the residents along the river, must we not concern ourselves about them? This is the fate of all human enterprise and who knows? perhaps also of all divine intent to set opposite each other the column of advantages and that of inconveniences. Evil constantly accompanies good in this world, and hygienists are not yet demigods.

All that we can ask of them, and what they do not always do, is not to dogmatize too quickly, not to search too much for the absolute, to weigh the inconveniences at the same time they recognize the advantages of every measure which they propound. But when, after having made this study of Gennevilliers and Achères, they have concluded that it was necessary to act, there is no other reproach to make against them, than of not having answered from the outset their detractors. But your astonishment astonishes us. It does not serve me at all to make a leap into the unknown. We make no pretension of discovering America, but only of establishing a new line to New York. This is not quite the same thing."

We have thus endeavored to sum up the numerous factors which enter into this problem, of how to dispose of the effete matters of our towns and cities by the rational method of returning to the soil those elements which have been removed from it. Our experience

is daily being extended, and our knowledge widened; mistakes are being avoided, distinct advances are being made. What remains, then, for us as progressive sanitarians is, not to be discouraged by our failures, not to despair because our results have been but partial. Remembering the old adage "*labor vincit omnia*" let us too labor; and so surely shall victory crown our efforts, and our success shall burst forth "*Like yonder morning on the blind half-world.*"

SANITATION IN BRANTFORD.

BY E. GRIFFIN, M. D., MEDICAL HEALTH OFFICER, BRANTFORD.

Gentlemen,—In the remarks which I propose to make on the subject of sanitation in Brantford, it must not be supposed that I set up any claim whatever for superiority of work done in that city. My desire is to make a brief statement of what we have attempted to do there since the Public Health Act of 1884 came into operation, and to refer briefly to our plans, methods and experiences for the purpose of comparing notes and interchanging views with, and I trust, eliciting information from, other members of this Association on some of the many and difficult subjects with which, as health officers, we have to deal.

Brantford is pleasantly situated on the Grand river, in an undulating valley overlooked on all sides by hills of moderate altitude. The city is about one mile in width by nearly two in length, the limits embracing about 1,100 acres.

At the time referred to the population was about 12,000, and now it is over 14,000, exclusive of the immediate suburbs which contain over 1,500 more.

The soil is mainly a sandy loam, beneath the surface-soil, sand and gravel extend for a variable depth of eight to thirty feet, resting for the most part upon a uniform stratum of clay which extends to the rock.

The surface drainage is good, the rainfall quickly disappears through the porous soil, accumulating above the clay it gives an ample supply of water to the wells, and breaking out of the banks towards the river supplies numerous springs.

Near the centre of the city lies the Canal Basin, a shallow semi-stagnant pond of about twenty acres.

A small stream running through the city carries the drainage of a number of houses into the basin, and half a dozen small and filthy drains carry the drainage of a couple of hotels and a few dwellings and shops into the same reservoir.

This pond is always a nuisance, and on the occasional breaking of the dam above it is soon nearly empty and becomes an alarming danger.

With the trifling exception named there is absolutely no sewerage or drainage whatever.

The water supply was until recently wholly from wells, the old water works serving only for fire protection.

Over 2,500 privy pits, cesspits and sink holes honey-combed the whole city, nearly all of these were on the soak-pit-principle, admirably designed to contribute as much as possible of their contents to the well water supply.

With an ingenuity almost suggestive of satanic inspiration, many householders sank their pits down to the clay so as to ensure the contents running off more rapidly, with the underground currents supplying the wells and springs.

In many instances a part of the roof water was drained into the pit to effect the more perfect solution and more rapid removal of the sewage contents.

When removal by these means was not successful, and the pits became full, new ones were dug and the old ones covered up, and if possible, tapping was practiced, and the fluids run off into new excavations. A few were emptied at long intervals, mostly because there was no room for further excavations without crowding out the wells. In some of the older parts of the city this has been going on for fifty years, resulting in the contamination of a large proportion of the wells and in the general pollution of the soil.

In addition to the prevailing evils named, pig-styes abounded in many parts of the city, and there were many filthy and dangerous slaughter houses within its limits.

With regard to infectious diseases, it may be said that the spread of infection was restrained only by the alarm excited by some unusually malignant outbreak.

The milk traffic was wholly unregulated, and the public were entirely at the mercy of the torpid consciences of the dealers, swill milk was limited only by the amount of swill obtainable, skimming and even watering were practised to the toleration point of the unusually ignorant consumer. Although, in 1869, a very excellent public health by-law was enacted, designed to mitigate some of the existing sanitary evils, no serious effort was made to enforce its provisions.

Notwithstanding the admirably healthy situation of the city of Brantford, we had therefore, necessarily, a constantly increasing amount of preventable sickness and especially of typhoid fever.

This was the thoroughly bad state of affairs in 1885, a state of affairs I fear, resembling very closely in many of its features, that of many other towns and cities in this province.

To remedy as far as possible the evils then existing, to avoid the dangers impending, and to place the city in a proper sanitary position, it was deemed indispensable in the first place to secure an ample supply of pure water for all parts of the city, and to abandon the use of contaminated well water. Second, to provide for the total abolition of all privy pits, cesspits, sink holes, and all excavations in the earth whatever for the reception and storage of filth. Third, to establish efficient sewerage in all the more populous parts of the city where it would be impossible otherwise satisfactorily to dispose of liquid refuse. Fourth, to introduce the dry earth system to be applied in all unsewered parts of the city, and in all sewered parts where, although the sewers might be used for liquid refuse, water-closets might not be established or desired. Fifth, to fill up the Canal Basin and confine its waters to a narrow running stream. Sixth, to abolish all slaughter houses and piggeries, and to provide an efficient system of garbage removal. Seventh, to secure efficient notification, isolation, and disinfection in infectious disease, and finally to secure a good and pure milk supply, second in importance only to a supply of pure water.

And now, in 1890, it may naturally be asked has Brantford really done anything to carry out these important undertakings, and have any benefits resulted from what may have been done.

Having regard to the comparatively short time, I think we may

fairly claim that much has already been accomplished, and with good results, and that much is now being done, the beneficial results of which are hereafter to be realized.

We have, after overcoming many difficulties, succeeded in establishing a splendid system of water works at a cost of over $200,000, but as it has been only a few months in operation, only a small percentage of the people have as yet been able to avail themselves of it.

Another of the important undertakings deemed essential was the utter abolition of the many thousand privy pits, cesspools and sink holes which have for from twenty to fifty years contaminated the wells and polluted the whole earth on which the city stands, and poisoned the air which it breathes. In this part of the work we have accomplished a great deal by the introduction of the dry earth system. We began by preventing the construction of any new pits, and next proceeded to abolish old ones in entire sections of the city. In one ward with a population of 2,000, in a limit of 50 acres, there were nearly 400 of these pits, all of which were emptied and filled with clean earth and dry earth closets established. In another central ward about one-half of the pits have been abolished besides many hundreds in other wards. So that now there are in use over 1,200 dry earth closets. They are exclusively in use in all the public schools, most of the factories, in many of the hotels, in most of the shops, and in the county gaol and court house.

This work is steadily going on, large numbers of closets being changed every month, and we are now well assured of its entire accomplishment in the near future.

I believe Brantford is the only place in Canada where a systematic and successful effort has been made to introduce and carry out the dry earth system on a large scale. Any dissatisfaction attending this system arises mainly from expecting it to do what it was never intended to do, and is incompetent to do, namely, to dispose of liquid refuse.

The dry earth system is an excellent and entirely sanitary substitute for privy pits, it is not a substitute for sewerage for liquid, household and other refuse. For such, refuse some kind of drainage is difficult to dispense with, especially in thickly populated places. There are several successful methods by which liquid refuse can be, and is disposed of in the absence of drainage, when there is land in

grass, shrubbery, etc., about dwellings, but when there is no such land the matter is more difficult and expensive, although even then by no means impossible.

There is a wide field of usefulness for the dry earth system not only in villages and small towns, and in the suburbs of cities, but even in parts of large cities themselves. The numerous advantages of the system as well as its difficulties and limitations have been well illustrated in Brantford, with its 14,000 inhabitants having no sewerage or drainage whatever.

The necessity for sewerage has been for many years felt to be urgent, and much has been written and said about it at one time and another without, however, any action having been taken. In the various reports I have made during the last five years, I have urgently pressed this mattter upon public attention, and the demand for action at last became strong enough to justify the city council in taking up the work. The fortunate presence in the council of two medical men, Dr. Secord the able chairman of the sewers committee, and Dr. Heath, an accomplished member of this Association, both keenly interested in the introduction of sewerage, has been an extremely favorable circumstance.

The result is that an appropriation of $80,000 has been endorsed by a vote of the people. Plans and specifications have been made by our distinguished sanitary engineer, Willis Chipman, C. E., a vice-president of this Association, tenders have been invited, and before another year has passed much of the work will be completed.

When this has been done we shall be in a position successfully to carry out another of the important sanitary undertakings we had in view, namely, filling up the Canal Basin which has at times been the unavoidable cause of much sickness in Brantford, and which has always been a standing menace to the public health.

The expulsion of slaughter houses, piggeries, etc., was also one of the sanitary reforms contemplated. Of the slaughter houses three or four were driven out, one small one, well attended to and closely watched, has thus far been allowed to remain.

Piggeries do not now exist in Brantford, and pigs are as rare there as snakes in Ireland. In some places it may be noticed that by-laws are being asked for, for the expulsion of piggeries. In Brantford we have found the by-law appended to the Act of 1884, thus far

quite sufficient in this as in other matters. That by-law requires piggeries to be kept at a certain distance from dwellings, and strict cleanliness to be enforced.

When the public are educated to the point of not tolerating pigs in their neighborhood unless they are washed and combed every day, the industry of pig culture is so handicapped in cities as to become unprofitable.

In dealing with the subject of infectious diseases, it is our experience, as to notification, that no dependence can be placed on householders.

As to notification by physicians, it is by no means complete, its importance, however, is so great that we have endeavored to encourage and persuade the profession to the performance of this duty by the imposition of moderate fines upon several prominent medical men. This has resulted in a marked improvement in such notifications. I am well convinced, however, that notification through the agency of the schools, and especially the public schools, is in this province by far the most valuable reliance. Nearly all the cases of infectious diseases are among school children, or at least in dwellings from which some child is going to school. If children are affected in houses where none are attending school, then the danger of spreading infection is minimized, for the schools are the paramount agencies in spreading such disease.

We find the provisions of the Public Health Act in this respect to work admirably. The teachers are in full sympathy with the work, and to them, immediate information is generally available. If sickness occurs in a dwelling from which any pupil comes, and, if on enquiry there is room for suspicion that the sickness is of an infectious character, pupils from such dwellings are at once excluded, by the teacher, and on notification, the sanitary inspector is able promptly to learn the facts often a day or two before a physician is called in, and where no physician is called in at all.

The danger of spreading infectious diseases by means of libraries has not, I fear, generally received that attention it requires. We have, in Brantford, endeavored to carry out the provisions of the Act in this respect. In every known case of infectious disease notice is forthwith served on the free library, and when required, on other libraries. No books are distributed to infected homes, and all books returned from such are quarantined, and unless it is manifest

that they have not been exposed they are subsequently disinfected. A convenient and cheap steam sterilizer operated by gas enables us to do this with great facility. Prior to its introduction last year, a considerable number of books which had been handled by patients with scarlet fever and diphtheria were burned.

As to placarding in infectious diseases, our experience is unfavorable to its use unless in exceptional cases.

There is a strong opposition to being "flagged." and enforcement of the law is impracticable whenever the persons interested are resolved to prevent it.

Among other objections to placarding, it unnecessarily interferes in many cases with workmen going to their shops, but it is especially objectionable because it leads to concealment, and the dread of it sometimes prevents a physician being called. It is consequently in my opinion unfavorable to notification.

We have endeavored thus far without success to secure the erection of a small isolation hospital, convenient to the public hospital, with a few beds for cases of infectious disease. I do not believe it will ever be possible unless in exceptional cases to treat young children in such hospitals; their value is, however, inestimable in other cases, especially of domestic servants, operatives living in boarding houses, occupants of hotels, etc.

Our hospital excludes scarlet fever, measles, and diphtheria, hence the necessity of such a hospital is great.

Disinfection is made a special duty of the sanitary inspector, particularly among the poor, sulphur and alcohol for fumigation and the standard solution composed of mercuric chloride and cupric sulphate are furnished gratuitously, and the use of abundance of air and water enjoined.

The question of a good milk supply is second only in importance to that of a good water supply. This subject has been so well and ably discussed before this Association that I shall not say much more than that our efforts to deal with it in Brantford have been attended with good results, which have been well appreciated by the public.

I cannot, however, claim that we have dealt with the matter as thoroughly as our able coadjutors Dr. Hutchinson of London and Dr. Ryall of Hamilton. I am not well advised as to what has been

done in other cities, but I think there is much ground to believe that in many of them it has not as yet received that attention which it demands.

By compelling all vendors to obtain permits, by frequent inspections of all dairies, by frequent examinations of samples taken at unexpected times from the delivery carts, and by reports in the daily papers of the results of inspections and examinations, we have at least inspired the dealers with a wholesome dread, and we have undoubtedly consigned "the cow with the iron tail" to innocuous desuetude.

We have lessened the amount of diarrhœal affections by interdicting the use of swill feed, and it may be worthy of mention among other things, we have induced our hospital to abandon the practice of feeding its numerous fever patients with the poorest milk possible to be obtained from the lowest tenderer, and to do, what I am not aware of having been done by any other hospital in Canada, namely, obtain the required supply of milk from its own clean perfectly fed and well bred cows. The average of butter fat in the milk supplied to the hospital was $2\frac{1}{2}$ per cent. before this was done, it is now $4\frac{1}{2}$ per cent.

As one of the questions for discussion at this convention is "how we can best secure and maintain a wholesome public and private milk supply," I may express my opinion as to what are some of the necessary requirements in this regard in addition to those we already possess.

1st. It is necessary that a legal minimum standard for merchantable milk should be established.

2nd. Facilities for exact analysis should be supplied to medical health officers in all cities and towns of considerable size. Such analysis need only be made in a limited number of cases, to prove the correctness of the lactoscopic tests, and to furnish evidence in cases where legal proceedings are taken. For the purpose of such analysis the asbestos process of our eminent associate Mr. Macfarlane, Dominion Analyst, with the convenient apparatus devised by him for analysing a number of samples at once appears to be highly suitable.

3rd. Systematic veterinary inspection by a competent veterinary surgeon, with a special reference to tuberculosis.

The expense for providing for these requirements would be small having regard to the signal advantages secured.

In view of the needs of the agricultural community in relation to cheese factories, creameries, etc., and in view of the difficulty of sending samples of milk long distances for examination, the Provincial Government might with great advantage to all interests contribute a portion of the necessary expense.

The awakened public interest in all sanitary matters in Brantford as well as throughout the country has made itself felt not only in the various matters to which I have referred in this paper, but in many others, such as the heating and ventilation of schools and other public buildings, factories, etc.,

It may not be irrelevant to mention before concluding this paper, that we are about to acquire in Brantford an extensive and magnificent public park. This is a glebe of 200 acres, adjoining the city limits, within ten minutes walk of the market square, amply endowed with wood and water, and with hill and dale. The inestimable advantages of such a possession to the public health for all time to come are too obvious to need mention.

Whatever sanitary disadvantages we may have labored under in the past, I think, when all the undertakings we have in hand are fully completed, we may fairly expect Brantford to be then as distinguished for its excellent sanitary conditions as it already is for the beauty of its situation and surroundings, and for the industry, enterprise, sobriety, and virtue of its inhabitants.

Dr. Griffin concluded the reading of his paper with the following remarks : In Brantford instead of taking 2,600 lb. of earth it takes 20 lb. only. I took Mr. Willis Chipman to see the North Ward School where actually the whole amount used was but two cubic yards of dry earth in one year. If you have a fifth of an acre of land any ordinary family can easily dispose of liquid refuse. If you have not that amount of land you will have resort to the barrel or tank system and have the liquid carried away. Regarding the pail system, I do not think the movable drawers or pails are adapted to this climate. A little moisture when there is a low temperature will cause them to stick fast, and they cannot be moved. We do not draw out the matter, we merely shovel it out. There have been

difficulties in the crowded parts of the city, where people have thrown some liquid matter into these pits, but when we have sewerage that will be obviated. Dr. Canniff recently said that they could not secure dumpage in Toronto. We have solved that matter in Brantford by dispensing with the privy pits. There is an immense field of usefulness in the great cities for this system if properly applied.

THE EFFECT OF DEFORESTING ON CLIMATE AND HEALTH.

BY C. M'LELLAN, M.D., TRENTON : MEDICAL HEALTH OFFICER.

Gentlemen,—The economic side of this subject has, I am pleased to know, been presented to the public by the labors of Mr. Phipps, the Fruit Growers' Association, and others so ably that it may safely be left to such competent hands, while we turn our attention, animated by their good example, to the way in which it affects our climate and health.

The study of climate embraces a consideration of the meteorological conditions which influence animal or vegetable life. How the absence or presence of the forest affects these conditions awaits our examination. Temperature and moisture are the two great factors that make up what we call climate, and depend on the prevailing winds which traverse the country.

Desirable conditions of climate require an equable distribution of temperature and moisture, and the presence of vegetation, especially of forest trees, favors such distribution. In hilly countries frosts are felt much more keenly where the hillsides are bare than where they are covered with forests. The latter shelters them from cold downward currents of air and distribute the radiation through a thickness equal to the height of the trees. Forests in these situations also prevent the beginning of land slides and avalanches. Belts of woods in lower situations are credited with preventing the passage of the malarial miasma from neighboring swamps, both by their mechanical resistance and chemical action. The malarial miasma is said to rise

to a height of four or five feet and to be carried by the wind along the surface to an elevation of nearly one thousand feet, unless obstructed in its course by some barrier of sufficient height and thickness.

Radiation from the earth's surface is always greater where that is destitute of vegetation, and greatest on bare, sandy soil. Sand being a bad conductor, the heat accumulates on its immediate surface, and at night radiates so rapidly as to suddenly chill the air. The air over extensive tracts of sandy soil is said to be much drier, which facilitates radiation and intensifies the cold. Extensive sand plains therefore present the most extreme changes of climate. Clay and loam soils are better conductors of heat than sand, and though bare of vegetation, do not yield up their heat by radiation at night so rapidly, nor is the air over them so suddenly chilled. The rays of the sun do not fall directly on ground covered by vegetation, but on the intervening plants, where a portion of the heat is lost by evaporation from the living leaves; the heat is thus moderated, while the cold is mitigated by their obstruction to too rapid radiation.

What is true of ordinary vegetation is in a greater degree true of forest trees where the obstruction to radiation is not confined to the immediate surface, but to a stratum equaling the height of the trees, which in our country would mean an average thickness of twenty or thirty yards. The daily maximum and minimum of temperature, it has been observed, do not occur in the forests till some hours after these points have been passed in the ordinary temperature of the air; the temperature is thus rendered more even, the days being cooler and nights warmer.

Hitherto not much has been done in an accurately scientific way to determine the question of the influence of the forest on climate; but almost every Canadian who has resided in rural districts must have observed the fact that deforesting has sensibly diminished the humidity of the lands reclaimed from the forest. It is a common remark of old settlers that the swamps and low grounds which look so unpromising and are so difficult of clearing become eventually the most valuable and productive on the farm. The streams on which the pioneer erected his mills while the bulk of the forest was yet standing, have in our day almost dried up, except during the spring freshets, or after rains, and the few that maintain their perennial

flow have become greatly reduced in volume. The humidity of forest regions may be to some extent due to the greater rainfall in wooded districts, caused by the trees acting as good electric conductors and dissolving in rain the clouds which pass over them ; but much is certainly due to their power of retaining the moisture from the rains which have already fallen upon them. This they do by arresting the too speedy flow of the waters from the surface of the soil. The forest soil is covered by leaves and branches, as well as fallen trunks of trees which obstruct the escape of the water along the surface or into the streams, and allows it time to sink into the spongy soil beneath them ; the water which has thus settled into the soil penetrates still deeper along the surface of the roots, which act as conduits, and it is thus carried beyond the reach of evaporation. The roots draw on this supply and absorb the nutrient properties it holds in solution. The leaves, also, abstract nourishment from the atmosphere in a gaseous state, as well as water in a state of vapor, which is again returned to the air after the vital processes of the plants have relieved it of its nutrient properties; the moisture thus returned greatly exceeds the water absorbed by the foliage. The liberation of water by transpiration takes up atmospheric heat and produces refrigeration, thus affecting the local climate by equalizing the temperature and humidity.

That the earth is warmer in winter when sheltered by the forest is evidenced by the fact—familiar to most Canadians—that the ground covered by leaves within the woods is scarcely frozen at all, while that of the exposed cleared portions is often frozen to a considerable depth.

As temperature and moisture depend on the prevailing winds which are borne over the country, the way in which they are modified by the surfaces they meet becomes a question of the highest importance to the inhabitants, especially to the invalids, who are liable to be affected by sudden changes and low temperatures. For them it is desirable to know what local conditions and situations would afford the best protection to their health and be most conducive to their comfort and safety. It is well known that a few degrees of cold more or less often decides the question of life or death in the case of enfeebled constitutions. The effect of cold on human life is well illustrated in temperate climates by a study of the tables of

mortality, which show that by far the greater number of deaths occur during the cold weather. The forest, by its mechanical resistance, checks the movement of the winds and prevents evaporation, which strong winds even in winter promote; while in summer it resists the inflow of hot dry winds and screens the earth from the scorching rays of the sun.

Cold is never felt so keenly in deep woods as in the open country. The lumberman, protected by the forest pines, prosecutes his woodcraft in comparative comfort. In winter we appreciate the warmth while driving through a belt of woods or along a road well fringed with trees, and contrast it with the cold biting wind on an unsheltered and treeless highway.

The inundations which have of late years been so destructive to life and property owe much of their violence to the absence of forests from the sources of rivers. The resistance of trunks of trees and undergrowth would retard the flow and divide the force of the streams in traversing the slopes and minimize the evil consequence of floods. The melting of snow is more gradual in the woods than on cleared land, and spring freshets are less likely to occur, for the forest ground is warm and spongy, which admits of the escape into the soil of the snow water almost as soon as it is melted. The snow also lies more evenly on the ground within the woods than on the cleared portions, where its sudden melting hurries it into the swollen river, whose banks, unable to contain so great a flood, allow it to escape into the valleys and plains with destructive force. Even on rich, tenacious prairie lands, where the almost dead level prevents the wasting of the soil, and the luxurious grasses, by their transpiration, cool the air and obstruct radiation, the climate is more excessive than would be the case if they were sheltered by woods. I have noticed the weather boards of the houses in Dakota and Manitoba pitted by hailstones as if they had withstood a volley of musketry.

We know that the countries south and east of the Mediterranean were once the granaries of the world. This was particularly true of Egypt and Palestine, whose fertile soil once supported a teeming population. These lands, in consequence of the destruction of the woods, have in a great measure been converted into deserts and rendered unfit for human habitation.

Marsh, quoting from Caimi, says: "When the chains of the Alps

and Apennines had not yet been stripped of their magnificent crown of woods, the *May hail* which now desolates the fertile plains of Lombardy was much less frequent, but since the general prostration of the forests the tempests are laying waste even the mountain soil, whose older inhabitants scarcely knew this plague." Marsh goes on to say that the destructive changes occasioned by the agency of man upon the flanks of the Alps, Apennines, the Pyrenees, and other mountain ranges of central and southern Europe, has produced a melancholy physical revolution in a single generation. It is certain, he continues, that a like desolation awaits an important part of the United States and other comparatively new countries over which European civilization is extending its sway, unless prompt measures are taken to check the action of destructive causes already in operation. An Italian author from whom he quotes mentions that in consequence of felling the woods of the Apennines, the sirocco prevails greatly on the right bank of the Po, in the Parmesian territory, and in a part of Lombardy. It injures the harvests and vineyards, and sometimes ruins the crops of the season. He omits to mention the deleterious effect of the sirocco on the health of the inhabitants. To the same cause many ascribe the meteorological changes in the precincts of Modena and Reggio. In the communes of these districts, where formerly straw roofs resisted the force of the winds, tiles are now hardly sufficient; in others where tiles answered for roofs, large slabs of stone are now ineffectual. On the other hand, the pinery of Porto, near Ravenna, which is thirty-three kilometres long and one of the oldest pineries in Italy, having been replanted with resinous trees after it was unfortunately cut, has relieved the city from the sirocco to which it had become exposed and in a great degree restored its ancient climate. The felling of the woods on the Atlantic coast of Jutland, he says, has exposed the soil, not only to drifting sands, but to sharp sea winds that have exerted a sensibly deteriorating effect on the climate. The local retardation of spring, he further writes, so much complained of in Italy, France and Switzerland, and the increased frequency of late frosts at that season, appears to be ascribable to the admission of cold blasts to the surface by the felling of the forests, which formerly both screened it as by a wall and communicated the warmth to their soil, and to the air and earth to the leeward. Caimi states that since the cutting

down of the woods of the Apennines the cold winds destroy or stunt the vegetation, and that in consequence of "the usurpation of winter on the domain of spring," the district of Ungello has lost all its mulberries, except a few which find in the lee of buildings a protection like that once furnished by the forest. Clavi states that the department of Ardèche, which now contains not a single considerable wood, has experienced within thirty years a climatic disturbance of which the late frosts, formerly unknown in the country, are one of the most melancholy effects. This would lead us to hope that if our own north-west plains were well protected by plantations, the most formidable enemy of the wheat grower would "leave the country." Marsh puts in a plea for the preservation of the woods of the Adirondack mountains as follows: "It is desirable that some large and easily accessible region of American soil should remain, as far as possible, in its primitive condition, at once a museum for the instruction of the student, a garden for the recreation of the lover of nature, and an asylum where indigenous tree, and humble plant that loves the shade, and fish, and fowl, and four-footed beast may dwell and perpetuate their kind in the enjoyment of such imperfect protection as the laws of a people jealous of restraint can afford them." We may justly ask our Government for the same protection to the forests yet remaining in its possession in northern Ontario, especially in the regions where the soil is unfit for settlement. Their presence would protect the flora and fauna of the Canadian wildwood, and shelter the rich agricultural districts to the south from the frosty winds of the higher latitudes beyond them.

Mr. Chapais, in a paper read before the Ontario Fruit Growers' Association, advises that "our Government give directions to the land surveyors chosen to fix the boundaries of new townships to point out with precision in their reports the regions unfit for agriculture, so that they may never be granted for agricultural purposes, and that the forest limits for the manufacture of lumber be protected against a systematic and complete devastation by the limit owners."

I think we have shown that deforesting would, by removing our shelter, make our climate excessive and of unequal temperature, diminish the humidity so necessary to animal and vegetable life, and rob us of the conditions which promote our health and comfort.