REPORT

OF THE

NINTH ANNUAL MEETING

OF THE

ASSOCIATION OF

EXECUTIVE HEALTH OFFICERS

OF ONTARIO

HELD AT CHATHAM, ONTARIO,

14TH AND 15TH AUGUST, 1894.

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OFFICERS

OF THE

EXECUTIVE HEALTH OFFICERS' ASSOCIATION

OF ONTARIO.

President, Alan Macdougall, C.E.	Toronto.
First Vice-President, Dr. H. Howitt	Guelph.
Second Vice-President, Dr. W. R. Hall	Chatham.
Secretary-Treasurer, Dr. P. H. Bryce	Toronto.

Council.—Dr. J. Herald, Kingston; Dr. M. McCrimmon, Palermo; Dr. J. W. Coventry, Windsor; Dr. C. McDonald, Tilsonburg; Dr. Charles Sheard, Toronto.

NINTH ANNUAL MEETING

OF THE

ASSOCIATION OF

EXECUTIVE HEALTH OFFICERS OF ONTARIO.

MINUTES OF MEETING.

The Ninth Annual Meeting of the Association of Executive Health Officers of Ontario, was held at the town of Chatham, on the 14th and 15th of August, 1894.

First Session—August 14th.

The meeting was called to order by the President, Dr. Allan Cameron of Owen Sound, at 10 a.m.; Mr. Thomas Glenn, sr., Chairman of the Local Board of Health, calling upon the Rev. A. McColl, to open the session with prayer.

The Secretary, Dr. Bryce, thereafter read the minutes of the last meeting of the Association, held at Guelph, June 27th and 28th, 1893.

The minutes were adopted on motion of Dr. Bryce, seconded by Mr. Alan Macdougall, C.E., Toronto.

The Secretary then read letters of regret from Dr. Griffin, Brantford; Dr. J. Ryall, Hamilton, and Mr. H. J. Bowman, C.E., Berlin.

Col. Bishop, Chatham, United States Consul, then read a paper on "The Disposal of Town Garbage and Refuse."

It was decided that all the papers referring to sewerage and sewage and garbage disposal be discussed together.

Dr. S. Stewart, of Thamesville, then read a paper on "Cremation as a Method for Disposal of the Dead."

In the absence of P. D. McKellar, Esquire, Chatham, County Registrar of Kent, Dr. H. E. Vaux, read the paper of H. J. Bowman, C.E., on "The Economy and Utility of the Separate Sewerage System."

Mr. McKellar, thereafter read his paper on "Sewerage and Disposal of Sewage."

Dr. Bryce, thereafter announced a change in the programme for the day, the Local Committee having made arrangements for the Association to make an excursion to the Rondeau in the afternoon.

Dr. MACDONALD, Hamilton, opening the discussion, said: I think the discussions on these papers need not be long, as the papers have been very clear. I think the Committee did well to take up the important subject of sewerage and sewage disposal at the beginning of the sessions.

I would desire to express the appreciation of the Association for the paper read by our friend from the United States, Col. Bishop. I was very much gratified at the paper from beginning to end. I was especially pleased at what he said with regard to Buffalo, I suppose on account of its proximity to Hamilton, the town from which I come. It may be remembered that at our meeting at Niagara Falls, we were told some things about Buffalo, among other things that sewage from that city was dumped into the Niagara river, and was allowed to go down the river anywhere without filtration, and that it was polluting the water supply of Niagara Falls town. The idea of drinking water polluted with sewage from Buffalo, was not pleasant. I did not drink any during our stay there. The officer who came to our meeting from Buffalo, Dr. Vanderburgh, said so many things about the condition of the river water, told us that the condition of the water would be the same as far as the city of Buffalo was concerned, and that if Niagara Falls wanted pure water they would have to get underground water. We all want pure drinking water. I was glad to hear the last paper read, and to know that good water might easily be obtained, and without any great expense, and have it pure as well.

I think it ought to be impressed upon the people the desirability of purifying sewage. I have complained for some time against our city for polluting our bay. We have four large sewers which empty into the bay, which is perhaps four or five miles wide. These sewers carry pollution to the bay, which I do not think should be allowed. I am very glad I have the opportunity of speaking here so that it may impress our people with the necessity for further action and that sewage purification is not expensive, and that the work is not great to prepare the sewage in a condition which will not be dangerous to our people. It has been said that the water cannot be greatly contaminated with sewage as it does not seem to hurt the fish, but that they thrive in water contaminated with it. I would not like to eat any, though perhaps it is superstition on my part.

Dr. COVENTRY, Medical Health Officer, Windsor, said: I do not think I shall trouble you with a general criticism on this subject as I have gone on record on former occasions as having discussed this subject. I would refer you to the immediate practical result of the discussion of this question, practical and important to the town of Chatham. I have for some years thought that Chatham was to be congratulated upon its future with regard to sewerage, owing to the facility with which it can carry the storm water sewage to the river, and by a small system of separate sewers carry the house sewage below the town for filtration on a sewage farm. What is required is some systematic method of relieving the old system now discharging the house drains into the river, which only needs to be seen to detect its pollution. The old practice of throwing the water into the backyard and allowing it to evaporate, must be changed. The practice is, as one of the gentlemen said, almost as revolting as the vault so much in use. The conveying of sewage to some portion of land at a distance where the same will be disposed of by irrigation without danger to the people, will be of the greatest benefit to the town of Chatham. I hope the town of Chatham will have this system put in. The selection of an engineer who is capable, who is conscientious, and who will see to it that the modern systems are used, is demanded, in order that the town of Chatham will feel that they have what

other towns are getting. I am sorry the other gentlemen who were to read papers are not present so that we might have been able to discuss their papers also. I might say regarding the doubt as to the utility of the separate sewerage system that I have never heard of a town where it failed, and I have had a long experience.

Dr. VAUX, Brockville, said: I represent one of the towns where the separate sewerage system has been adopted. A few years ago we were confronted with the same difficulties which Chatham has at this time. After consulting many engineers experienced in sanitary matters, we finally decided on the separate sewerage system. We have an intercepting sewer which skirts along the town, gradually running back through the town ending in local sewers about nine inches in diameter. The tiles for cellar water are laid in the same trenches as the sewer tiles. I think it of the very greatest importance that you get your contractor to put in your service pipes to the houses at the same time as the sewers are laid. Our greatest source of trouble was trying to put them in after to the street line at the expense of the property owners. Our flush tanks are situated in large manholes. The tanks can be emptied once or twice a day as necessary. We have not allowed any connections to be made to the sewers without the plans of the sewers being filed with the engineer of the town, and so drawn as to meet with the approval of the engineer and the health officer. Any one coming to the town and desiring to purchase a residence, may by this means be rendered valuable service and saved expense by going to the town engineer and finding by the plans filed there the diagram of drains, form of the closet, etc. I do not know whether there are any other points which any of the gentlemen would like to ask regarding our system. I might say regarding our method of disposal of garbage that we have it plowed in in large longitudinal furrows.

Mr. MACDOUGALL asked: Did you say that the agricultural tiles fill up with sand?

Dr. VAUX: We have had some instances where the agricultural tiles fill up. We found one instance wherein hotel corks had been thrown into the small well in the cellar and caused the tile to become

choked. I think a small screen placed over the mouth of the well would prevent this difficulty.

Mr. MACDOUGALL: How do you dispose of the contents of the sewer?

Dr. VAUX: It eventually goes into river.

Dr. BRYCE said: I would say that it seems to me the great value of the papers and of the discussion on the papers is, that the actual cost of good results may be known to any town which is going to undertake work of this kind. I am particularly interested in the paper by Mr. Bowman from the fact that he knows exactly for every day from experience for the last five years in his own town of Berlin, which has put in an extensive system of sewerage, what would be the cost to any town. Mr. Macdougall and myself had an opportunity of seeing this system last autumn. Since that time the neighboring town of Waterloo has begun the construction of a system of separate sewers. If we were to make a practical reference in this matter, we may assume that the town of Chatham has 15,000 population. We know the town of Chatham will not be content with a population of 15,000, and it probably will grow to 25,000. Let us assume that Chatham must dispose of the sewage of 15,000 people. We have seen in Mr. Bowman's paper that a sewer 8,000 feet long which will not have to carry sub-soil water needs to be only fifteen inches in diameter and have in part of its course sub-soil drains, and is to cost $10,000. It used to require $20,000 or $25,000 for a mile of sewerage. Such a plan is one by which Chatham could dispose of its sewage, and which could be discharged on such a field as Mr. Bowman has referred to. He tells you how to get the sewage to the farm, while the working of such a farm can be seen by any one going to Berlin. By calculating the cost per mile and the feet per lot, you can understand the infinitesmal amount local sewers would cost each householder of Chatham. I take it this principle of local assessment is that used by Mr. Bowman.

We have heard in Mr. McKellar's paper of the drinking of filtered sewage at the farm. He has given references to the Massachusetts sewage farm, the London sewage farm, etc. I think the town of

Chatham may well afford to discuss the plan of sanitary sewers, and may undertake the work in another way than that adopted at present.

Dr. CAMERON, said: I am glad to hear that the town of Chatham is proposing to adopt a system of sewerage, and I hope one will be decided on which will best serve the interests of the town.

Mr. MACDOUGALL said: It is gratifying to hear papers read by gentlemen who are closely allied with us in our work, who can hardly be called professional writers, and yet, by their thoughtful consideration of the subjects they write upon, make it clear that they are in close touch with the important movements of sanitary science. Such a paper is the one we have listened to with so much interest and pleasure from Colonel Bishop. The reader has a comprehensive knowledge of his subject, and he brings forcibly before us the important differences between garbage and refuse. Refuse, if free from organic matter, such as household garbage, can be readily deposited in vacant, low lying lands, without being a menace to the public health. The practice of dumping garbage and refuse into lands likely to be built upon should be discouraged and forbidden by the Provincial Board. Decomposition sets in and is arrested in these dumps; thorough decomposition does not take place. I need not say much on this as it has been discussed at former meetings.

The destruction of garbage by fire is being carried out successfully in Toronto, and at a moderate cost. The experience of other cities, especially Chicago, will do much to advance this effectual method of destroying noxious matter. I need not refer to the other papers. I am sorry Mr. Bowman was not present to give us information on his work. Dr. Bryce and myself visited his sewage farm at Berlin last November. The effluent from the sewer was strongly impregnated with tailings from the gas works which emitted a powerful odor of gas, but on watching, we noticed the effluent from the filter beds was clear and free from smell. Mr. Bowman informed us he has also been able to purify the refuse from the tanneries, one of the most difficult things to do.

Dr. Macdonald, of Hamilton, suggested the taking up of the discussion of Dr. Stewart's paper on "Cremation as a Method for Disposal of the Dead," but as a number of the members had left the meeting, in justice to Dr. Stewart's paper, the discussion was laid over.

J. B. Rankin, B.A., Chatham, not being present, his paper was not read.

Dr. CASSIDY, Toronto, said: I would like to speak of the method of the disposal of sewage as adopted at a small summer resort near Toronto. The experience of a great many has been that health resorts have in a few years become lacking in the sanitary results owing to the want of pure water and proper disposal of refuse and sewage. The summer resort I am most familiar with is Long Branch, where we have formed a sanitary association. We have a method for the disposal of sewage, house refuse, etc., for which we pay a contractor $1.50 a season, the season being from the 15th of June to the 15th of September. There is a large barrel for the receipt of slop water. We provide the barrel as well as a tile and see that the water is placed in the barrel; other materials are placed in boxes. The contractor removes the contents of the barrels and boxes by night after the residents have retired for the night. The cost per household is $12 per season, and this provides electric light to ten or eleven p.m., and water, which is taken from lake Ontario and filtered. With regard to putting water pipes in, it cost me $17, the tap is there, and we have water just as conveniently as in Toronto. The boys collect all the odds and ends, leaves, etc., and take them to the shore and place around an old stump perhaps, and have a bonfire.

It is shown from the sanitary legislation by the Provincial Board of Health, and of the people generally, that the municipalities must have their sewage disposed of satisfactorily, while a few years ago these needs were not thought of. Health resorts have failed financially through want of proper sanitary arrangements.

Dr. MACDONALD, said: In sandy soil it might not be always possible to have filtration perfect, but it is possible to make a filter and use the water drained therefrom without danger.

Dr. CASSIDY, said: At Mimico Asylum, where the government has tried to dispose of the sewage, I find on discussing the matter with Dr. Murphy that the difficulty is not the removing the filth so much as the removing of the laundry water. It is not very hard by filtration to get a fairly clear effluent, but where we have to run laundry water, it is found that shortly a scum will rise and cause an unpleasant smell.

In the London case where there is machinery to separate and mix the sewage, the discharge of the laundry water is found possible.

It did not seem possible for us to endeavor to dispose of our sewage at Long Branch by filtration on a farm, so we decided the best way would be to remove all the matter to a reasonable distance.

At 12.45 the Association adjourned.

No afternoon session was held, the Local Committee having arranged to take the Association to Rondeau, a trip of some twenty miles, by the Erie & Huron Railway. The train left the Canadian Pacific Railway at two p.m., arriving at the lake about three o'clock. There were many expressions of admiration, as this was the first time many of the members and visitors had seen the Eau. A number of representative citizens accompanied the Association; among others were Mr. Glenn, Chairman of the Local Board of Health of Chatham, and Dr. Hall, M.H.O.

After generous entertainment and amusement the train left the Eau at about five-forty, reaching Chatham at seven, when the ceremony of unveiling the beautiful drinking fountain, presented by the city W. C. T. U., to the corporation, and erected on the market square, was performed with due formality. There were on the platform, besides the President and members of the W. C. T. U., the various clergymen of the town, several aldermen and others. The unveiling was performed by P. C. Darr; the address of presentation was read by Mrs. Sowerby, President; the address in reply was delivered by Mayor Smyth; Rev. R. McCosh offered prayer; Dr. Bryce delivered an address, followed by His Honor Judge Woods. Rev. Mr. Murphy offered prayer, and the band closed the ceremony by playing the doxology.

CITIZENS' EVENING—TUESDAY 14TH.

The Association met at 8.15. The meeting was opened by prayer by the Rev. F. H. Larkin, after which addresses of welcome were delivered as follows:—Mr. Henry Smyth, Mayor, on behalf of the corporation; P. D. McKellar, President, for the Board of Trade; Samuel Glenn, Chairman of the Local Board of Health, and Dr. W. R. Hall, as President of the Chatham Medical and Surgical Society.

Dr. Macdonald, Chairman of the Provincial Board of Health, briefly returning thanks on behalf of the Association for the kindnesses and courtesies shown the members, said:

Mr. Chairman, Ladies and Gentlemen, I am called upon to answer to the addresses of welcome given by the Mayor and the gentlemen who have spoken after him. You have expressed your satisfaction at seeing the Board of Health and Association in your town. The Association has been discussing sewerage and waterworks systems to-day. Your town has a water supply, though, I learn not a very large supply. The Mayor has stated near the end of his address that you have some reason to believe that running through the town there is a plentiful supply of water, and that you will have a pure supply in greater quantity than yet obtained.

We have just returned to-night from a very pleasant trip to the Rondeau. I have great pleasure in meeting the people here to-night and trust the papers read will be profitable to those who hear them.

Address of Welcome of the Council,

By Henry Smyth, Mayor.

Mr. President, Members of the Association of Executive Health Officers of Ontario :

Gentlemen :—It affords me extreme pleasure on behalf of our citizens to welcome you to Chatham, situate in the midst of as fine an agricultural section as the sun shines on, and truly named "The Garden of Canada." Grand, I may say and boundless in the extent and variety of its agricultural resources and its adaptability for the production of almost every class of fruit, its horticultural bounty has kept pace with its agricultural until its orchards and vineyards abound with the apple, the pear, the peach, the plum and the grape, and memory is lost in the effort to particularize the endless variety of small fruits with which our gardens are overwhelmed.

This, too, is historical ground. Here it is, within a stone throw of where we now are, that that great ally of the British in the war of 1812-13, Tecumseh, proposed to General Proctor to make a stand against General Harrison.

Upon yonder delightful spot, formed by the junction of McGregor's Creek with the Thames, which is now our highly valued and delightful "Tecumseh Park," the great Tecumseh, after an examination of the ground, decided that upon that spot he would either defeat Harrison or there lay his bones.

With this spot he was charmed. According to an historian he exclaimed : "This is grand ; the spot is delightful ; when I look at the two streams they remind me of the Wabash and the Tippecanoe."

Perhaps no better position could have been chosen for meeting an enemy than this place presented. The result has been told; the Thames is consecrated for ever by the bones of the illustrious Shawnoe statesman, warrior and patriot which repose upon its bank.

We have recognized our obligation to this great man and have perpetuated his memory by naming the spot upon which he should have defeated General Harrison, "Tecumseh Park" and there we long, we hope to see his monument.

In the centre of the peninsula, between the great lakes, our climate is in the highest degree salubrious, neither too cold in winter nor too hot in summer. Our citizens are generally healthy and robust, and I point you with pride to the mortality tables, which denote that sickness and disease is less frequent with us than most counties of Canada. Time was, and within my memory, when fever and ague abounded in this district, but, as the county became denuded of its extraordinarily heavy growth of timber and the low land became drained, these diseases disappeared and the community became an exceptionally healthy one.

Our lands being flat, complete drainage was only accomplished after years of hard and earnest labor and the expenditure of vast sums of money, but the fall for the water being ample and our people realizing that when drained we possessed the finest and richest agricultural lands in the world, they pushed on undaunted, and are now reaping the harvest of their labor.

But as this western peninsula became denuded of its timber a note of alarm was sounded that our climate was changing; certainly our winters here have changed, for it is rare indeed that we have a winter's sleighing as in "Ye olden time." Certain it is our rainfall is diminished until our farmers are becoming alarmed at the yearly recurrence and lengthy duration of the drought.

Has this state of affairs been brought about by the clearing of the land; and if so, has the disturbance been local or is the general climate affected? Would this not be an interesting subject for discussion? And if the climate is affected by the denudation of the land, how is the health of the people affected thereby?

For four or five consecutive years we have been visited with a drought which has reduced the crops in this county very materially, and I shudder to think what will be the effect, when the country is entirely cleared of its timber between lakes Huron and Erie. Clearing the land has made the country more healthy, but have we not reached the point where, with ample drainage, clearing should be stopped?

The Hospitals.—This town possesses two most excellent hospitals, thoroughly well conducted. The General Hospital erected in 1892,

with most efficient nurses, has done and is doing a great and good work. What a comfort to the medical practitioner! What a blessing to the rich and those who are able to pay, and what a haven to the sick and needy stranger who is brought within our gates.

St. Joseph's Hospital, also situate on the banks of the Thames, erected in 1890, is doing a noble work. Conducted by Sisters of Charity, their work is indeed a noble one. The nurses of the sick, the comforters of the sorrowful. Unwearied in their work of mercy, in a spirit of thankfulness they accept their lot, turning its very bitterness into joy by gratefully receiving the many pleasures still vouchsafed to them; for it *is* a happy world, in spite of all its trials, to those who look aright for happiness.

Our Sisters find it and bestow it. How many bless their name! How many have reason to love the memory of these unobtrusive women, the type of a class—the true, simple, earnest, brave, holy Sisters of Charity!

We have also a House of Refuge, erected ten years ago, in which many a poor old man and woman, left to the cold charity of the world, have found the comforts of a home, sustained and nourished with the knowledge that they would not be permitted to want in their last days. This institution is managed by a committee of philanthropic ladies who devote a great deal of time and labor to the work; the town wisely making them a yearly grant and leaving the administration of its affairs entirely in their hands. It is conducted on the strictest business principles and methods, and the ladies of the Home have earned the gratitude of every ratepayer of the town for their unceasing and unwearied efforts.

Board of Health.—If one may judge from the good work that is being done by our Local Board of Health, the good that your Association is doing is of immeasurable benefit.

We have had evidence recently that its hand was as bold to execute as its mind was quick to conceive, and although those who narrowly felt that they were alone affected by the determination of the

authorities, raised all sorts of objections and made all manner of threats, they were powerless in the hands of the law, when its aid was evoked by those who were determined the strictest duty should be performed.

We are so much creatures of habit that to be convinced of an error is very far indeed from being ready to correct it. It may be as clear as possible that there is some physical condition attaching to our residence rendering it unhealthy, but, if we have long endured the evil and have no more than a chance of being seriously injured by it, our customary acquiescence in the routine of existence is almost sure to make us indifferent to it.

The people are not generally ignorant that a confined room with little change of air, or a collection of surface water near a dwelling, or an imperfect sewer, or water from an impure source has an unfavorable tendency with regard to health; but their traditionary habits enable them to submit patiently to such evils. The difficulty is to get them to change their habits.

The structure of many of the existing houses presents great obstruction to sanitary reform.

In many of our towns the principal thoroughfares and lanes are as they were laid out years ago, and a vast number of houses are as they were built before any one thought of arrangements for health.

A town placed long ago upon ground unsuitable for drainage, is like some settled system of life which we feel it to be impossible to reform.

We see houses that might be roomier, the streets wider, and effective drains conducted under ground; but *there* is the house built long ago; *there* is the street with its property demarcations fixed in the past and it is not to be changed without an enormous amount of trouble. If there is any law of social life that makes itself strongly visible to us, it is that the wise have to take the foolish in hand, and those who have knowledge those who have none, and constrain them into ways conducive to their safety and happiness.

It will not do in a dense, highly organized society like ours to allow indefinite freedom to each individual. When man comes into

city or town, he must be accommodating or he will not be endurable. This seems fully to constitute a right of the enlightened and rational to see that plans are adopted for the good of the whole and that they are duly enforced, where, from ignorance or indifference, there is any disposition to shirk them.

It is, in short, the basis of the idea of a police, a force designed for the support, not of a selfish despotism but of an authority inspired by views of general benefit and which has no other purpose than to make individuals act, or refrain from acting, as is best for the entire public.

On this theory, and under our law it is clearly allowable to take strong measures for the enforcement of the rules of health among the people.

I note with pleasure that papers will be read to-morrow upon the importance of waterworks for towns and villages and upon artesian well supplies. These papers are quite opportune, in view of the fact that we are grappling with the question of a water supply and the source whence it may be derived, and I trust, while you are upon the topic the subject of the modern methods of filtration may be touched upon.

We have an abundance of water in the very centre of our town, to which the eyes of many are being turned as the source to which we will be compelled to resort. But what will the Provincial Board of Health have to say upon the subject? And will we be permitted to give our people river-water when recourse to other and purer sources are not impracticable?

Again Mr. President and Gentlemen on behalf of our citizens I welcome you to our town. I trust that your ninth annual meeting will be both pleasant and profitable, and that you will take with you to your homes enduring favorable impressions of our town and its people.

Address of Welcome of the Board of Trade.

By P. D. McKellar, Esq., President.

To the Executive Health Officers of Ontario:

Gentlemen:—The members of the Board of Trade of the Town of Chatham desire to express their gratification that you have chosen the town of Chatham as the place for holding your annual meeting for 1894.

Recognizing the fact that apart from the pleasure afforded them of meeting and becoming acquainted with many eminent fellow-citizens of the Province of Ontario, your deliberations cannot fail to have an important influence and result upon the sanitary questions which force themselves upon every community, and demand a solution in the interests and safety of the people. The members of the Board of Trade express their confident belief that the results of your visit will be apparent in the improved sanitary condition of our town, and it is their hope that your visit may be pleasant as well as profitable, and that you will carry away with you many pleasant recollections of Chatham and its citizens.

Address of Welcome of the Local Board of Health.

By S. Glenn, Chairman.

Gentlemen,—I am exceedingly glad on behalf of the Local Board of Health to bid you a hearty welcome to our town. I am glad to meet you, and am sure we are all pleased to have you with us. I hope the information we get from you may aid us greatly in the future, and trust this meeting may be profitable to us all.

Address of Welcome of the Chatham Medical and Surgical Society.

By W. R. Hall, M. D., President.

Mr. President and Members of the Association of Executive Health Officers of Ontario:

Gentlemen:—The physicians of Chatham hail your advent on your great mission of sanitary education, and trust that your gathering here will be productive of much local as well as general sanitary advantage.

We believe that the meetings of this Association do good by educating the people as well as the profession, and since in this free country, the state only represents the people, we hold that the proper mode of initiating sanitary reforms—on that larger scale which to be successful, must be carried out by the state—is by first establishing a conviction of their necessity in the minds of the general community that ultimate fountain of all political and executive power.

It is estimated that 13,000 deaths take place in Canada each year, which are preventable by ordinary means. Surely the prevention of 13,000 deaths is worthy the attention of any government.

The state should encourage sanitary investigation by liberal aid.

Municipalities ought to spend more than they do in preventive medicine, thus saving the people from misery, expense and premature death, and also rendering more endurable, lengthening and beautifying life.

The medical profession of Chatham—of the whole world—rises above sordid considerations and they are more pleased than any other class, with the progress of sanitary achievement.

The profession deals with the problem of life and death. We battle for their lives and strive to guard from the hateful power of death, dear ones entrusted to our care.

We bind up wounds, give hope and courage to the despondent and soothe with kind words and deeds, the hearts of those crushed by the agony of despair.

All this amid gloomy surroundings, in the presence of disease, too frequently of poverty and filth.

Who can do this work successfully without a keen professional interest, and a heart filled with human sympathy, forgetful of reward in serving humanity? Reward will come however, as to those on His right hand, when Christ shall say: "Come ye blessed of my Father, enter into the Kingdom. . . . In as much as ye did it unto one of the least of these my brethren, ye did it unto me."

In conclusion, on behalf of the Medical and Surgical Society of this town, of which I have the honor to be President and which embraces all the thirteen members of our profession resident here, and working harmoniously together in the interest of medicine and of the cause of humanity, it is my pleasing duty to extend to you a hearty welcome to the town of Chatham.

Dr. Allan Cameron, Owen Sound, thereupon read his address as President of the Association, which was followed by a paper by Mr. J. Dearness, of London, Inspector of Schools for the County of Middlesex, on "School Sanitation."

Dr. Bryce then read a paper on "How are we going to Lessen Consumption?"

The Session adjourned at 10.30.

THIRD SESSION—AUGUST 15.

The Session was opened at 9.45 a.m. with prayer by the Rev. Mr. Larkin, after which Dr. J. H. Duncan, Chatham, read his paper on "The Relation of Settlement, Cultivation and Drainage to Disease, especially to Malaria, in the Western Peninsula."

Dr. G. J. McKeough, Chatham, then read a paper on "Notes on School Sanitation."

The discussion on municipal sanitation was opened by Dr. Chas. Sheard, Toronto:

DR. SHEARD: Am I to limit my remarks to the papers read?

Dr. BRYCE: I have endeavored to arrange the papers so that they would fall into groups, and have placed the names of members on the programme to discuss the various subjects with which I thought they were most familiar. But we could hardly ask Dr. Sheard and Mr. Chipman to limit the discussion to the papers read as they were not here at the time of reading.

Dr. SHEARD: With reference to ventilation Dr. McKeough has touched upon the Smead Dowd system. I know that in many schools in Toronto in which this system is in operation the ventilating flue is heated by means of the furnace flue, which is hardly possible to do if there is much moisture in the air, nor when the fire in the furnace is allowed to get low. I think in all cases it should be insisted upon that the furnace flue and ventilating shaft be supplied with separate means of heating so as to get a more perfect current of air.

In the Shirley Street school in Toronto there has been added an automatic tip tank to flush the excreta into the sewer, and which is a valuable addition, as it does away with the foul collections remaining for many months under the school room, foul air from which will reach the school room, as the bricks on the floor of the chamber become polluted by deposits between them and do not remain porous, as was the original intention. As to the drawing in of cold air above the hot air, as is done in many rooms where the system is adopted, it appears to me to be contrary to physical law and difficult to make work; the hot air will naturally ascend and it cannot be prevented. I am of opinion that water closets should be separate from school buildings. They could be placed in an adjacent building properly covered over with a shed and connected, if necessary, by means of a covered passage, which would afford a protection in inclement weather.

As to the operation of the breather or fresh air inlet to the drain, I think its value may be questioned. I am convinced that the fresh air inlet frequently operates as a foul air outlet, and if anyone will take the trouble to examine on a frosty morning any number of these so-called breathers, I think he will be convinced that such is

the fact, and it appears to my mind not beneficial to have the so-called breathers in a confined space between two walls, which air space communicates with the windows of the building, nor is it a good arrangement to have such breathers opening immediately under the shop front, over which vegetables, fruit, meat, etc., are placed. I think the action of the breather is often interfered with by the soil pipe extension becoming blocked by collections of ice or snow, and sometimes, though rarely, by birds building their nests in connection with the pipe, an example of which I have the pleasure of presenting herewith.

Regarding myopia, I was very favorably impressed with the remarks of Mr. Dearness in his paper last night. I think the care of school children's eyes of great importance. The consideration of the lighting of the school room is most important in this connection. The careful examination of the eyes, the early use of glasses would be valuable in preventing permanent ill effects It might also be of value to have the school teachers better informed in reference to the physical conditions relating to light, as well as the mechanism of vision and the *modus operandi* of the muscles and media of the eye. On the whole, however, I must commend the present system of education as being, from a sanitary standpoint, much superior to the system which was in vogue twenty years ago.

Mr. W. CHIPMAN, C.E.: The views held by the city taxpayers in the great question of water supply and sewerage, are of great interest and value to those who are more intimately connected with matters of sanitation.

More attention is now given to the proper disposal of the waste products of civilization than at any time in the world's history.

The paper of McKellar is an index of the interest now being taken in such problems when discussed by able writers.

Sanitary engineers will, however, dissent from the writer of the paper when he states that it is still the practice of the world to consider its wastes satisfactorily disposed of when they are hidden from sight. This may have been true in the past but it can be shown that to-day nearly every civilized city has given or is giving intelli-

gent, scientific study to the question. As an example of this, it may be stated that in New England a small town of 30,000 inhabitants has expended over $9,000 in engineering work and scientific research before expending a dollar on sewer construction. This may be an exceptional case, but it indicates the trend of public opinion. For every dollar spent on engineering, the city will reap ten dollars reward.

In Ontario the necessity of sewage purification is not the rule, but when required there is no excuse for not doing the work properly. The process of sewage purification is now well understood by sanitary engineers and bacteriologists, and the taxpayers who need are following. We are living in a democratic country and must, in all our studies of sanitary reform, take the taxpayer into consideration, and into our confidence, otherwise our schemes must fail.

In 1892 Berlin, Ont., upon the advice of Mr. H. J. Bowman, Town Engineer, adopted broad irrigation for the treatment of its sewage. As consulting and designing engineer on this work, my observations, after two seasons' experience with the farm, may be of interest to the Association. In general the farm has been a success, when we take into consideration the fact that the soil of the tract selected is unfavorable, and that it was the first attempt at broad irrigation. To save expense, the Town Council did not grade the different areas as recommended by the engineer, the surface slopes being left double what it should have been. In consequence of this blunder, the sewage when applied at the upper edges of a plot of land, ran too rapidly across it, forming ruts and channels, and saturating the lower portions of the fields. This error is being corrected this year by grading down the fields as first designed. The mistake made in selecting the land could not be rectified, as the main sewer had been laid from the town to a corner of the tract before the farm was laid out or graded, but it is probable that if a larger amount had been appropriated for preliminary engineering, more suitable land could have been obtained.

Crops requiring periodic hoeing are the best suited for sewage farms.

The use of the hoe and the cultivator keeps the ground porous, breaks up any crusts that may form, and the sewage can be uniformly distributed with little attention.

During last winter the sewage was not applied to the land in a satisfactory manner. The error in grading could not be corrected in the winter months, and it followed, of course, that complaints were made by the riparian owners below.

These mistakes of management will no doubt soon be corrected, and we may confidently expect that the Berlin sewage farm will in the future be considered a model in that respect.

If the results at Berlin have not been uniformly satisfactory, the causes are to be found in changing original designs and in not following the advice of the consulting engineer and the town engineer as to management.

The town of Waterloo is now constructing filter beds for purifying its sewage, with the same consulting engineer and chief engineer as in Berlin.

The lessons to be drawn from the Berlin farm are :

1st, Make a thorough preliminary study of the problem by the aid of experts.

2nd, Do not "improve" upon the original designs too radically.

3rd, Do not expect a farm to take care of itself for several consecutive months.

I am glad to hear Dr. Sheard say he is examining the plumbing system of Toronto. In a number of towns the by-laws provide for continuous soil pipes through the buildings.

In a modern house in which I live in Toronto there is a clay pipe which is supposed to be ventilated, extending through the house. I think it is time these clay pipes should be abolished. The soil pipes should be away from windows and neighboring houses. I am speaking not from theory but practice, as I have been an inspector of plumbing for some years. In regard to the construction of sewers, in designing the sewers they allow for the minimum flow and thus the sewers become foul.

Dr. COVENTRY: The discussion this morning seems to have been largely upon the Smead-Dowd system of heating and ventilation. I desire to say I recently visited the headquarters of the Smead-Dowd Company at Toledo with a view to inspecting this system.

We had a system of heating and ventilation in one of our schools similar to the Smead-Dowd system, but through the carelessness of someone we soon had to make repairs. Wanting to learn any new system I went to the proprietors of the Smead-Dowd Company. I found they were using a flush tank and seemed very anxious to put one in for us. The janitors, as a rule, who attend furnaces are either incompetent or not well informed. Often the fault is not in the system but the way it is managed. In one system they put in about a ton of slack in with the coal, this keeping at a moderate heat and being much cheaper, the cost being about $1.10 freight a ton. This of course cheapens the fuel. The furnace is constructed with a hole about four and a half feet from the ground where the coal is thrown in. The fresh air comes in through an opening and the current which is fed from above causes complete combustion, and no smoke comes from the chimney after the fires were started. If you look into the furnace you will see it is burning coke. I think this system is a very great improvement and together with the flushing system does away with the ordinary plumber who is a luxury.

In one system there has been adopted a self-feeding furnace. It is so constructed that it is fed from a small hole in its floor where the air is also admitted, with the result that it goes on feeding itself, the current of cold air from above meeting the hot air, changing the smoke into gas and thus leaving no smoke to be emitted from the chimney.

They strongly recommend, where large schools are built, the use of a fan at the fresh air inlet. The fan can only be used where in reach of electrical current or where a steam engine is used as motive power. Three or four horse-power is ample for a twelve-room building supplying a maximum ventilation.

The matter of medical inspection has long seemed to me one of great importance and I think the change we all desire will not be

attained till the school boards and trustees are more in touch with the health authorities. The law should provide that an inspection should be made of the schools and reported to the Education Department of the district in which the schools are situated; not till then will we get good sanitation.

I was much impressed by Mr. Dearness' paper and that of Dr. McKeough. I rather agree with regard to the high pressure in education. I think there is too much attempted education. The teacher is not to blame, but the teacher who does not keep up the high pressure loses esteem of employers, so also does the inspector. He also is a part of the scheme and receives his orders from headquarters.

I picked up a little "skit" on the home work of the children which illustrates how their work requires them to sit up at night to study to keep up with others. The maximum is placed too high. I think more children would be benefited if the maximum was more moderate.

Dr. Coventry then read the "skit" to illustrate his view on the subject.

Dr. Bryce read the propositions for the compulsory notification of tuberculosis in Ontario forwarded for discussion from the Provincial Board of Health, and said: I trust the Association will take up the discussion of this subject.

They were as follows:

Propositions *re* Notification of Tuberculosis.

By the Committee on Epidemics, of the Provincial Board of Health.

To the Chairman and Members of the Provincial Board of Health:

Gentlemen,—In accordance with the terms of a Resolution adopted by the Board at its last quarterly meeting, the Committee on Epidemics was instructed to prepare a series of propositions for discussion at the next session of the Board, and by the meeting of

the Association of Executive Health Officers of Ontario. Your Committee begs to present the following report, containing a series of propositions :

Prop. 1.—That the prevalence of tuberculosis in Ontario, both in men and cattle, calls for the active interference of all authorities to whom are delegated the protection of the public health.

Prop. 2.—That the prevalence of the disease depends (*a*) upon the direct inoculation with the bacillus or germ of tuberculosis, and (*b*) upon causes which either reduce the resistance to the contagium of the disease, or which increase the danger of inoculation by increased exposure to the germs of tuberculosis.

Prop. 3.—That Boards of Health are therefore called upon to investigate and remedy, to the greatest extent within their power, such insanitary conditions, whether municipal, domestic or individual, as are now known to promote the disease.

Prop. 4.—That inasmuch as inoculation with the bacilli of tuberculosis is direct (*i. e.*, by their inhalation into respiratory tract, as dust) or indirect (*i. e.*, by being taken into the body with food or drink) the sanitary measures to be taken for its prevention must extend to the lessening of infection, whether its source be infected persons, houses and articles exposed to infection, or infected cattle, the places occupied by them and the food and milk obtained from them.

Prop. 5.—That the first step to lessen the spread of infection from persons tuberculized, depends, so far as health authorities are concerned, upon the notification by persons, householders and physicians of existing cases of the disease.

Prop. 6.—That with this end in view physicians and health officers are everywhere advised to take advantage of the facilities supplied by the Provincial Board of Health for an examination of the sputum of any suspected cases of the disease.

Prop. 7.—That to the end of accomplishing these results it is expedient in the public interest that the Provincial Board of Health does, by resolution, recommend that an Order in Council be passed

placing tuberculosis on the list of contagious diseases requiring notification in the same manner as diphtheria and other communicable diseases.

Prop. 8.—That, therefore, the Provincial Board of Health, when informing Local Boards of Health, physicians and the general public of the regulation, should add in their circular of recommendations to Local Boards, particulars for their guidance similar to the following, most of which are now adopted in New York city :

(1) The Local Board of the Municipality will register the names, address, sex, and age of every person known to it to be suffering from tuberculosis, and requests all physicians and householders to notify the Secretary of the Board of any cases of tuberculosis within their charge. This information is principally for statistical purposes ; and no visits to any premises where such patients reside will be made, nor will any surveillance of them by the Local Board take place, except where the person resides in a hotel, boarding house, or tenements. The Local Board will not visit the premises to make such inspection if requested by the attending physician not to do so, and if said physician is willing himself to deliver circulars of instructions and to take measures intended to prevent the communication of the disease to others.

(2) Whenever the Local Board of Health learns of the existence of cases of consumption in hotels, boarding houses and tenements, not dealt with as aforesaid, the Board will inspect the premises and supply the patient and family with circulars of information regarding measures to be taken to guard against the spread of the disease. Where necessary the Board will direct the cleansing of apartments with the end of destroying therein existing contagion.

(3) In workrooms, factories, etc., where tuberculized persons are employed, and where, owing to the nature of the work or the number of persons engaged, there is danger of the dissemination of the infection, the Local Board of Health may deal with the matter in such a way as will best serve to protect the employees.

(4) In all cases where the Local Board learns that any apartments have been vacated by a tuberculous patient, either through death or removal, it will direct the disinfection of the apartments and of all articles liable to contain infection, according to the rules published by the Provincial Board of Health for checking contagious diseases, and will prevent further residence in said apartments until satisfied that such disinfection has been carried out.

(5) The authorities of all public institutions, such as hospitals, dispensaries, asylums, prisons, homes, etc., will be required to notify within seven days, the Local Board of Health of the municipality wherein they are situated, of name, sex, age, occupation and last address of every tuberculous person coming under their observation.

(6) That every institution receiving either municipal or government aid shall, under penalty of the withdrawal of such aid provide separate apartments wherein consumptive patients shall be maintained.

Prop. 9.—That in view of the fact that there are on an average in the older settled counties of the Province 50,000 inhabitants, exclusive of the large cities, and that there is an average of 50 deaths a year in each from consumption, or probably a hundred cases of the disease in any county at a given time, it seems a necessary part of any scheme for effectively dealing with this disease, that one or more "Homes for Consumptives" be established within the Province, either by the Provincial Government or by a number of counties combining together for the purpose. It will be seen that such a scheme would not be impracticable when it is remembered that there were in 1892, 4,231 inmates of our provincial asylums.

All of which is respectfully submitted,

C. W. COVERNTON,
P. H BRYCE,
Committee.

Dr. CAMERON, Owen Sound: You know through my paper my views on the subject. I think this Association ought to take some action in the matter.

Dr. SHEARD: I think the general draft of the propositions submitted very satisfactory. Every health officer knows what difficulty there is in getting cases of infectious diseases reported, but that should not deter us from making further advancement. One recommendation I should like to see, and that is the notification by veterinary surgeons of infection in cattle. We know how objectionable it is to get milk from a herd where there is a tuberculous cow. And the proprietor very often tries to cover the fact by mixing the milk of the one diseased cow with that from the other cows. Therefore I think it an advisable thing to have the veterinary surgeons report all cases they come across in their practice It is difficult to make an inspection of a wide stretch of country and I would therefore recommend that this be added to the recommendations.

Dr. MITCHELL, M. H. O., Delaware Township, said: The invitation has been offered for those present to take part in the discussions. I wish to make a few remarks on the subject. The doctor has hit the nail on the head with regard to the notification of tuberculosis in cattle by veterinary surgeons. I know of many cases where cattle are smuggled off the premises and sold. Ten years ago I had some practical experience in regard to tuberculosis in families. One member of a family was taken sick and died of tuberculosis, followed by three members in the space of three or four years. The father and mother are alive and well to-day and I believe that if I had known then what I now know the others need not have died. Part of the family living away from home are alive and well. How do I account for this? One member of the family came home from spending an evening, took a cold, went to her room sick and died. The room was never disinfected. I would trace the other cases to this. I would recommend isolation as a preventive measure. I think there ought to be homes for consumptives. Amongst the Indians whom I have practice I think they are dying out from consumption. One is sick and lies in a corner of the hut, the others working, eating and sleeping in the same room, and one after another take it and die.

Regarding school education and ventilation I do not think that the education is such as to make practical farmers and farmers' wives, and as the agricultural population is the largest, I think their claims ought to receive some consideration.

Dr. COVENTRY: I think that those travelling in trains and steamboats often disseminate consumption. In travelling we often see invalids, consumptives, in such an advanced stage of the disease that they cannot walk I think that sleeping cars ought to be included in the propositions extended to us. I would ask Dr. Bryce whether any countries have advanced along the lines we are discussing in the matter of notification and if they have been practically carried out for any length of time. We are treading on ground which is somewhat delicate and we ought to get all the information we can regarding it. In Michigan I think they have regulations regarding notification of tuberculosis as well as in some other states. I think this

ought to be a broad matter and should reach out and include the Dominion. If we include one municipality and not another we put pressure on one and not on the adjoining one. I do not say this as an objection to the proposition. I think a circular informing the laity as well as the profession should be issued in order that before laying down any rules the public should be better educated on the question. As it is a matter of discussion amongst physicians whether those who take tuberculosis do so only through heredity or whether any one might take it, in moving along lines to obviate such difficulties of opinion, I think the public should be educated up to the subject and that thus we shall make the measures we take practical and successful.

Dr. BRYCE said: I would suggest that a resolution be adopted to the effect that it is the view of this Association that the time has come when, from the cases of tuberculosis as shown by the mortality from consumption and by the methods of dissemination of the disease having become familiar to the profession, should pass a resolution calling upon the Provincial Board of Health to take action towards giving these views effect. The subject is such a broad one that we are inclined to hesitate to take positive legal steps for restricting the disease. We know of the system taken to limit the spread of other contagious diseases. We know that many who live with consumptives do not take it, but the aggregate shows that many cases occur and many deaths, and we as an Association must take a positive position in this matter. Scarlet fever was once discussed in the courts as to whether it was a contagious disease, but we are now long past that stage. We know now that consumption is contagious and we ought to take measures to prevent its spread.

Referring to the countries and places where action has begun either by notification or other initial measures, he said: Pennsylvania, has passed a resolution asking that governmental homes for consumptives be established. Michigan has passed a positive resolution requiring notification of consumption to Boards of Health. The Michigan State Board has done much missionary sanitary work but it is somewhat defective in executive power. I think if con-

sumption were made notifiable we would be in a position to assist in controlling cases where the public safety is disregarded. Of course notification will go on imperfectly, but still will go on and will in time make progress.

Mr. Alan Macdougall, C.E., Toronto, read his paper on "Artesian Well Supplies," in the absence of Dr. McLeay, of Watford.

The Association adjourned at 12 50.

FOURTH SESSION—WEDNESDAY AFTERNOON, AUGUST 15TH.

The Session opened at 2.15 with prayer by the Rev. Mr. Murphy.

Dr. J. A. McLeay read his paper on "The Importance of Waterworks for Towns and Villages."

Discussion on Mr. Macdougall's and Dr. McLeay's papers then took place.

Mr. CHIPMAN said: I was very much interested in the papers read. The papers must be of value to the city of Chatham. It is a city with a waterworks system, though not a large supply. I hope we will be able to learn something from the difficulties Chatham has had which will prevent other failures in the future.

Mr. Macdougall referred to the subterranean sources of supply in Galt, Goderich and Barrie. The water at Goderich is hard. I should like to ask whether diseases are caused by the use of this hard water.

Dr. SHEARD: I should like to ask Dr. McLeay the temperature of the water in the two wells?

Dr. MCLEAY stated they were both at 49° F.

Dr. SHEARD: I should like to ask Mr. Chipman regarding the supply of Barrie where they have water so strong in iron as to be practically of little use.

I should like to know regarding these artesian waters, as several schemes have been suggested for Toronto, and I think filtration ought

to receive consideration. Have we as medical health officers and civil engineers given this matter enough attention? I think a perfectly constructed filter free from frost a most desirable thing and one which is worth considering by the people of Chatham.

Mr. CHIPMAN: I might say regarding the supply at Barrie that the supply is to-day as great as it ever was, though I believe that water kept in vessels for some time causes them to become discolored. Any place where I have put in an artesian water supply system, in none has the supply diminished. Mr. Macdougall has stated in his paper that an artesian well supply is problematical. I dissent from this opinion if he means that there is a mystery about the supply, but if he means that the work really requires study I agree with him.

Mr. MACKENZIE: Germany, I believe, is the country where they have carried out filtration with most success. But even there, they have not been able to filter out all the bacteria. If the water is contaminated with typhoid or cholera germs, if polluted to any extent, there will be some which will not completely be filtered. In Berlin and other places it has been recommended that a return be made to underground water. Altona takes its water below Hamburg from the Elbe, but also takes Hamburg sewage.

The fact that during the Hamburg cholera epidemic the suburb Altona, escaped with very few cases has been held up as showing the remarkable benefits arising from filtration of a water supply. It must be remembered, however, that a few months later Altona was visited by a second outbreak of cholera in which there were over a thousand cases, and which upon investigation by Professor Koch proved to be due to certain of the filters being out of order.

The outbreak at Nietleben Asylum near Halle, is another example of the dangers of filtration. That outbreak, which was explosive in character, was due to failures in the filtration of the water supply. Here lies the chief danger from filtration that the filters may at some critical period get out of order and determine the outbreak of an epidemic.

There is no doubt that filtered water is good if carried out thoroughly, but the difficulty is to carry it out effectively.

Dr. COVENTRY: This is a question which affects towns and villages and which is not fully appreciated. Progress comes slowly. Even the largest cities, while they have moved in the matter, have not made much progress. I think in a country where there is an ample supply of water that to contemplate taking impure water and filtering it as a primary resort is shortsighted. I would recommend the people of Chatham to consider carefully before taking action definitely. I myself have had some difficulty in the matter of impure water in Windsor. It is not desirable to drink imperfectly filtered water. Nature revolts against the drinking of water polluted with animal or vegetable matter filtered. The people of Chatham should try to obtain a pure water supply rather than try to filter from a polluted source. You may reduce the number of bacteria but not wholly effect the purity of the water you filter. Take a model filter, make it a foot high or a mile high, and pour Thames water over it and when it comes through it will still be Thames water. The filtering by sand, alum, etc., is not advisable. People do not drink as much water when purified by methods of this kind, and it is the want of good, pure, fresh water, which, more than anything else, causes people to drink something stronger and worse.

Dr. MCLEAY: I should like to have it explained how it is that when a northwest wind blows on certain days the water from our Artesian wells is murky as well as salty, and the other one twenty feet away is not at all affected. I should like some information on the subject.

Dr. CHAMBERLAIN, Leamington: Is the presence of iron in the water injurious?

Dr. COVENTRY: I don't think that iron in a certain quantity is injurious. I do not think waters should contain much mineral.

Mr. MACDOUGALL: I think Dr. Coventry and some of the other medical speakers, aim at too great purity in water, and incline to an almost absolute bacterial purity. We learn from the Massachusets

reports that gravel filters are very effective in destroying bacteria, and I believe a sand filter can be constructed which will purify ordinary river water if uncontaminated by factory refuse and manufacturers' pollutions.

Mr. W. CHIPMAN, C. E.: Mr. Macdougall's paper is a valuable contribution to the literature on "Water Supply," and must be of great interest and prove of inestimable value to the inhabitants of this City, which has a complete system of waterworks without water, and can furnish us in return, valuable data from its experience with artesian wells.

In this paper, many towns in Ontario are mentioned which take their public supplies from subterranean sources, among them Goderich, Galt and Barrie, where the works are constructed upon my designs.

In Goderich the water is no doubt "hard," but it is chemically pure for dietetic purposes, and it has yet to be shown that the continual use of hard water conduces any disease of the digestive or excretory organs?

Goderich also furnishes an example of the Town Council "improving" on original designs. Two additional wells were put down at greater depths than the original four, result: sulphurous water; also, a large reservoir was built at the pump house instead of on the most elevated point in the town, as recommended by the Engineer. Result, a complete failure; the bottom fell out of it.

The wells at Goderich are truly artesian, the water rising generally 20 feet above the lake level. During the construction of the works, it was observed that the flow of the wells was materially affected by the direction of the winds. This is an engineering curiosity and should have been more carefully studied at the time; it is impossible now to explain it.

In Galt the supply is taken in part from springs, and in part from artesian wells, but it is probable that the limit of the present supply will be reached within a few years. An additional supply can, however, be obtained of the same exceptional purity, at a reasonable cost.

In Barrie the artesian wells derive their supply from the high water-shed north of the town, as the water rises twenty or thirty feet above the level of Lake Simcoe. Some private wells were affected by the putting down of the public wells.

In Brantford the supply flows through perforated pipes from the saturated gravel to the pump well. These pipes are laid to a grade, but at various depths below the surface, in a tract of land lying between a power canal and the Grand River, the water in the canal being above the surface of the tract, and therefore about twenty feet above the pipes. When the canal is dry, the supply is not affected; this appears to show that the supply does not come from the canal, and as it rises in the well several feet above the river, it is propable that the river is not the source. If, however, it could be proven that the river or the canal or both were the source, and that the water in each be polluted, it does not follow that the source should be abandoned, as the water flowing into the pump-well is pure, clear and sparkling. Nature's method of filtration is perfect.

Chatham's situation respecting water supply is not an enviable one. That other cities and towns may not make similar mistakes, it would be well if those who are acquainted with the facts should give the Executive Health Officers here assembled, the fullest information respecting Chatham. Was expert engineering advice sought for by the city or by the company on the question of artesian supply, before the works were constructed or afterwards? If so, what was the nature of the report given, and were the recommendations therein contained followed?

It is gratifying to the engineers of Ontario to know that no city or town in Ontario has failed to obtain a pure public water supply as great or greater quantities than promised, where such city or town was sufficiently patriotic to employ as their engineer, a Canadian.

It might be added that in nearly every place in this Province where waterworks have been constructed by foreign private companies, the results have been unsatisfactory from a sanitary stand-

Dr. BRAY: How could one account for an artesian supply being clear one day and murky the next in some wells near St. Clair?

I should like to know whether there was a stream of water running between the two lakes. I have been led to think so. As Mr. Chipman has said regarding the Goderich wells stopping flowing one day, I think we ought to have some information on the subject from some of the gentlemen.

Mr. CHIPMAN: I think some one ought to explain the change of the water and the reason why it ceased flowing.

Dr. CASSIDY: I think some of the Chatham people ought to supply information regarding their system.

Mr. VALLEAU, Manager of the Water Works Company said: We got a supply at different points but it was so charged with quick-sand we had to abandon that source. Other wells were bored. The fire engine was taken out some distance from Chatham and we found a supply in such a quantity that the lot and road was flooded. This was in February, 1892. They had a reservoir built should the well overflow. In June and July of that year we reached the extent of our pumping capacity and the water decreased till nothing more could be got. We dug two other wells and connected them with a channel, but could not get a supply. In August we thought a large well might give us sufficient. We started to dig the well in October. The well has decreased month by month, foot by foot, till it was from about 20 to 30 below the surface. Additional wells were put down but water cannot be increased beyond 150,000 to 160,000 gallons pumping continually. We can only put on half the power of the pump without getting muddy water. The Company think it folly to go any further, as they have expended all the money and not got the water as a supply. An additional supply must be got, but where to obtain it will be a question for the future.

Mr. MALCOLMSON, Chairman of Water Committee of Council: I cannot add anything of value to what has already been said. We have investigated and found that wells which have run for years have decreased. Wells on the Canadian Pacific Railway used as sources of supply for locomotives have had like failure. We w

given to understand that we would have received a good supply from the wells, but have failed. We must now look for another source.

Dr. CAMERON: Could you, Mr. Malcolmson, give any idea where to obtain a supply.

Mr. MALCOLMSON: I think that remains for the engineers.

Dr. HALL: I think this is a question on which it would be unwise for me to unbosom myself as Medical Health Officer, for as Medical Health Officer it would not do for me to get out of touch with the people. I think you will remember that the paper I read at the Niagara Falls meeting gave my view that the wells would not last long. We have at Chatham three sources of supply, namely; river Thames, Chenelle Écarté and lake Erie. I think the Thames a feasible source. Many people form their opinion of the river as a supply as it flows very gently through the town, and look at McGregor creek and think they are both from the same source. This is not so, McGregor creek is contaminated with many sources of pollution but does not flow in the same direction as the Thames. There is a great difference between the river water above and below the town. It is supposed by some there is very little current in the river Thames, but I do not think the river flows upward, but has a current and runs through the town at an average depth of twenty feet. You will judge from these remarks that I am in favor of river water. We have been getting along with very poorly filtered well water and I think if the other sources of supply are too expensive I would favor a system of filtration of river water, if after investigation by a competent engineer the other sources are not within our reach.

Dr. HUTCHINSON: Does Dr. Hall think that the water above would be better than that below the town?

Dr. HALL: This is a matter which I do not feel competent to discuss scientifically. I think the Provincial Board of Health might do something by prohibiting the town of London from polluting the Thames.

Dr. HUTCHINSON: There are three other towns besides London polluting the Thames, and I think the theory of oxidization is doubtful.

Dr. CAMERON: If I were a citizen of Chatham I should not like to drink Thames water. I should recommend the town to have water direct from lake Erie.

Dr. CHAMBERLAIN: I should think the Thames water might be made all right by boiling.

Mr. CHIPMAN: I think the wholesale boiling of water would be something new in engineering.

Dr. COVENTRY: Boiling of water has not yet been practised in schools and children drink a great deal of water.

The discussion on waterworks and artesian wells was then closed, when the following resolution was carried.

Moved by Dr. Cassidy, seconded by Dr. Hutchinson, that Dr. Chamberlain's paper on "The Contagion of Smallpox" be taken as read, and printed in the Annual Proceedings.

Mr. J. J. Mackenzie, Toronto, read a paper on "Immunity in its Relations to Practical Difficulties in Dealing with the Infection of Contagious Diseases."

Thereafter Dr. Bryce said: I had thought in asking Mr. Mackenzie to prepare this paper that it might lead up to a discussion on contagious diseases and the limit of their infectiousness. I recently had an illustration of this in a case where I was summoned to appear before the Magistrate to give expert evidence.

The case was one of scarlet fever of a mild type, and when discovered by the Local Board the doctor stated about the eleventh day that the case was practically recovered. The Board summoned the doctor for defiance of the law, because he refused to have the house placarded after the practical recovery of the case, though still within the period given by the Provincial Board of Health. I was called upon by both Board and doctor to decide the question.

There may be instances in a family where one case occurs and where other members may not contract it. I have heard of other cases where children with mild scarlatina are allowed on the street

I think some action should be taken defining the limit for isolation in cases of this kind, though it seems rather a hardship for children to be kept confined when they have ceased to be contagious or exposed to contagion.

Dr. CASSIDY: I think we all appreciate the paper of Mr. Mackenzie in bringing to our attention the work of these great bacteriologists of France and Germany, as also of his own work in the laboratory. The facts given by bacteriologists aid us, and we could not arrive at points without their aid. Anaemia is an important factor in contagious diseases, and is one of the things Mr. Mackenzie brought out clearly in his paper. The old school doctors were fond of attributing diseases to heredity. Then a new theory came in, that persons could contract diseases which have not been in the family. I think if one has anaemia that one often contracts consumption. If we follow good sanitary, hygienic lines, keep our bodies in good condition, we will offer a stout resistance to consumption. I think with Mr. Mackenzie when he sets forth that anaemia prepares the system for tuberculosis. In regard to these diseases, many physicians go so far as to say that they fail to see the difference between the typhoid bacillus and the bacillus coli communis.

Mr. DEARNESS: I have had a little experience in connection with contagious diseases. I have had experiences particularly with whooping cough. The teachers tried for a time to keep the children away from school, but a certificate was given to two children from the physician admitting the children to school while others in the family were still suffering from the disease. Others thought they should not be kept away under like circumstances. I think the physician ought to have a knowledge of the conditions of the children before certificates are given for admission to schools. I have been much interested in Mr. Mackenzie's paper regarding the information he has given regarding the conveying of diseases. I should like to know how I should take a sample of diphtheria.

Mr. MACKENZIE: There has recently been a circular issued by the Provincial Board of Health giving instructions as to taking

specimens of membrane and sputum for examination. We recommend this method, which is as follows: Remove with forceps sterilized in a flame fragments of membrane and place at once in a sterilized bottle. The bottle and cork must, before using, be sterilized by boiling for twenty minutes. The bottle must be closed by cork placed into it with sterilized forceps and either sealed with sealing wax or rubber film tied tightly over the cork. A small glass phial will serve every purpose.

Dr. CAMERON: In reply to the question how long children should be kept away from school with scarlet fever and when certificates should be given, section 94 of the Public Health Act states the Medical Health Officer should give the certificate. This is, in my opinion, as it should be.

Dr. SHEARD: I wish to endorse your opinion, Mr. President. In Toronto we have a great deal of trouble with the mild cases. The physicians, wishing to oblige the parents, give certificates before, in many cases, it is advisable to do so. I know of one case in the east end of Toronto from which eight cases arose. The first case was not reported at all, being mild, but causing eight malignant cases.

Dr. DUNCAN: The public have in mind that scarlatina is trifling. Some time ago I was called upon to attend a case of malignant scarlet fever brought from an adjoining town. A smaller brother had had mild scarlatina and nothing was thought of it, but the disease developed in the second case was very malignant. I think scarlatina should be given especial attention.

Dr. COVENTRY: One point I would like to mention regarding the prevention of scarlet fever. I have for a number of years, when isolation could not be depended upon, used sulpho-carbolate of soda, five grains for a child, ten grains for an adult, for a few days, dropping it for a few days and taking it up again. It is not always successful, but in some cases it has been a protective against the disease. I am in the habit of applying to the skin bi-chloride in two ounces of vaseline, which is smeared over the body once a day, keeping it up for two weeks, occasionally stopping for a day. I think it prevents

the virulence of the scab, which is supposed to be the cause of the contagion. These being two preventive measures is my apology for mentioning them.

Dr. DUNCAN: There is one thing I think we ought to deal with and that is: How shall we deal with tuberculosis? It seems to fall upon the best of our community. We have patients sources of danger and death to all around. We find friends around them day by day inhaling the poison. It has been said, and with some truth, that some people are immune, but there are conditions which will remove immunity, and the constant attendance upon the tuberculous must lessen this immunity. In England where homes for consumptives have been established, the disease has decreased. I would present the following resolution, seconded by Dr. Bray:

Moved by Dr. J. H. Duncan, seconded by Dr. Bray, that the members of the Association of Executive Health Officers, having discussed the proposition forwarded to them from the Provincial Board of Health relating to the notification of tuberculosis, does hereby desire to express its approval of the proposition submitted to it by the Board, and to state the view of its members that the belief in the contagious character of the disease is now so general that the time has come in the education of public sentiment when methods in some degree restrictive should be set in operation in order that definite progress in lessening the large mortality from this disease may follow the splendid results in the restriction of the more acute but less fatal contagious diseases.—Carried.

Dr. CASSIDY: We cannot make much progress unless we have the active support of Medical Health Officers of the country. I know medical men are not pleased to have the Sanitary Inspector's interference. Therefore we ought to see that the method of notification be not vexatious or uncomfortable to them. I think it should be stated that if physicians make a *bona fide* report of cases of tuberculosis that we ask them to act as their own sanitarians in the matter by asking them to distribute such literature as is sent out by the Provincial Board of Health. I would say that it would be well to act along the lines as set forth by the secretary in the propositions.

Dr. MACDONALD: It would hardly do for a man able to work and support his family to be shut up in an hospital for consumption; but the physician and family might have the information which would aid to keep the disease in some degree from spreading.

Dr. CHAMBERLAIN: Many of us wish to send our patients away. How would they be isolated from others at resorts? I do not think it could be done very well. Many patients have often been helped by staying at resorts, but I fear the method as proposed will not be practicable.

Dr. BRYCE: I think no one has been more exercised over these propositions than I have been, and while the many difficulties in the way are very apparent, we cannot but feel that a beginning with restrictive measures must be made.

Dr. MCCULLY, M.H.O., Horwich: Regarding the notification of scarlet fever, we had an outbreak in our municipality. The whole school section had scarlatina before I was notified of the cases, and I called the trustees and had the school closed and in time the cases died out.

Dr. CHAMBERLAIN: I wish to say that in the little town of Leamington we had over 300 cases of scarlatina. Many cases had not been reported. When I have been applied to for certificates I have always enquired whether there were other members in the household sick with the disease, as many cases have been found where children attended school while others were sick in the house. I think the test of urine valuable. I believe that there is contagion in the urine. After closing the schools for some time the disease ceased.

The resolution was carried *re* tuberculosis.

Dr. BRYCE read the report of the executive, which was adopted, on the motion of Dr. Coventry, seconded by Dr. Macdonald. It is as follows:

ANNUAL REPORT OF THE EXECUTIVE COUNCIL.

The president and members of the Executive Council beg to present their annual report to the Association.

The interval since the last meeting in Guelph, in June, 1893, has not been marked by any event specially calling for action on the part of the executive.

The matter of the place of meeting for 1894 having been left for the decision of the executive, the president called a special meeting at Toronto on 17th April.

Invitations to hold the annual meeting from Chatham and from Kingston were read, as well as correspondence relating thereto.

After a full discussion of the several invitations and of the benefits to the Association in accepting either invitation, it was decided that the cordial and repeated invitation from Chatham should be accepted. The executive believes that the successful meeting we have just witnessed has justified its decision.

It was further decided, that the preliminary programme should state that it was desirable, in order to have good discussions, that members intending to read papers should be asked to send them to the secretary in time for printing and distribution.

The expenditures of the year have been simply those of printing and reporting the papers. It is hoped that this year, as last, the Provincial Board will see its way to still continuing to aid the Association by printing its annual report.

The secretary-treasurer was instructed to pay out of the amount on hand the cost of reporting the meeting of 1893 and also that of 1894.

The executive would recommend in conclusion that the place of meeting in 1895 be left to the new executive for decision.

All of which is respectfully submitted.

P. H. BRYCE,
Secretary.

Election of Officers.

The election of officers was then proceeded with and resulted as follows:

President—Alan Macdougall, C.E., Toronto.
First Vice-President—Dr. H. Howitt, Guelph.
Second " Dr. W. R. Hall, Chatham.
Secretary-Treasurer—Dr. P. H. Bryce, Toronto.
Council—Dr. J. Herald, Kingston; Dr. M. McCrimmon, Palermo; Dr. J. W. Coventry, Windsor; Dr. C. McDonald, Tilsonburg; Dr. Chas. Sheard, Toronto.

Mr. J. Dearness, of London, County Inspector of Schools for Middlesex, was among those nominated as a member of the council, but owing to the constitution not including teachers or inspectors, Dr. Bryce, Dr. Macdonald and others thought that while Mr. Dearness could not be elected this year, the constitution ought to be amended so that teachers and inspectors might legally become members of the council, and the following notice of motion for the meeting in 1895 was given:

Moved by Dr. J. D. Macdonald, seconded by T. V. Hutchinson, that the constitution of the Association be so altered that any of its members may be elected to its offices.

Moved by Mr. Macdougall, seconded by Mr. Mackenzie, that the thanks of the Association be tendered to the mayor and corporation of the town of Chatham for the use of their council chamber and the courtesies extended to the Association.

Moved by Dr. Rae, seconded, by Dr. J. Coventry, that the thanks of the Association be given to the Local Board of Health, the Medical and Surgical Association, and the Board of Trade for their addresses of welcome and for assistance given by these bodies in making the meeting so successful, and also to the citizens for the many hospitalities extended to the members, especially in their trip to Rondeau.

The Association adjourned about 5.30 p.m.

In the evening a complimentary banquet was tendered to the Association by the citizens of Chatham. Samuel Glenn, Esq., chairman of the Local Board of Health, presided, with Dr. W. R. Hall in the vice-chair. Rev. R. McCosh asked divine blessing. The toast list was opened by the proposal of the Queen, responded to by Latham & Taylor's orchestra, which supplied choice selections during the evening, leading in the national anthem. The President of the United States was coupled with the name of Col. Bishop, American Consul. The Governor-General and Lieutenant-Governor were proposed and responded to by three enthusiastic cheers. The Provincial Board of Health was responded to by Dr. Macdonald of Hamilton, Dr. Bryce of Toronto, and Dr. Rae of Oshawa.

The vice-chairman, Dr. Hall, then took charge of the list and introduced the toast of Our Guests, responded to by Mr. Alan Macdougal, C.E., Toronto; Dr. Allan Cameron, Owen Sound; Dr. J. J. Cassidy, Toronto; Dr. Sheard, M.H.O., Toronto.

To the toast of Trade and Commerce Mr. H. Malcolmson and Mr. G. P. Scholfield responded.

The Learned Professions were ably represented by Mr. M. Wilson, Q.C., Rev. R. McCosh, Dr. Holmes and Dr. Bray.

Mr. Dearness and Dr. Bray responded for the Ladies.

The Press was responded to by J. F. Mackay of the *Banner*, and Dr. R. V. Bray for the *Planet*.

MEMBERS OF THE EXECUTIVE HEALTH OFFICERS' ASSOCIATION OF ONTARIO FOR 1894-5.

Willis Chipman, C.E., Toronto; Dr. R. Carney, Windsor; ~~Alan Macdougal, C.E., Toronto~~; Dr. Allan Cameron, Owen Sound; Dr. S. Stewart, Thamesville; Dr. E. E. Kitchen, St. George; Dr. J. J. Cassidy, Toronto; ~~Dr. Francis Rae, Oshawa~~; Dr. C. McDonald, Tilsonburg; E. Jackson, Tilsonburg; Dr. Peter H. Bryce, Toronto; Dr. F. H. Mitchell, Delaware; Dr. T. L. McRitchie, Harwich; Dr. Wm. R. Hall, Chatham; Dr. Harry E. Vaux, Brockville; Dr. J. D. Macdonald, Hamilton; Dr. Robt. Paul, Delaware; Dr. James H. Duncan, Chatham; A. H. White, Chatham; Dr. W. R. Nichols, Baden; Dr. David J. Mirchin, Berlin; Dr. Charles Sheard, Toronto; Dr. T. V. Hutchinson, London; Dr. W. J. Coventry, Windsor; Dr. J. B. Lundy, Preston; Dr. D. P. Bogart, Whitby; J. Dearness, London; Dr. M. McCrimmon, Palermo; Dr. W. W. Hay, Wallaceburg; Dr. George T. McKeough, Chatham; Dr. J. A. McLeay, Watford; Dr. Chas. Chamberlain, Leamington; Dr. C. B. Langford, Blenheim.

By Allan C

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PRESIDENT'S ANNUAL ADDRESS

By Allan Cameron, M.D., Owen Sound, Medical Health Officer.

Ladies and Gentlemen,—I have chosen as the subject of my address this evening some general remarks upon "The Health Laws," and the duty of the people not only to the state and the health officers, but more especially to one another.

From the importance of the subject I shall endeavor to lay aside as much as possible all technical terms and put a matter of so vital interest before you in as plain a manner as the subject permits.

If we look back over half a century we shall find all the large cities more especially in Britain, overpopulated, living not only in crowded tenement houses, but in cellars damp, dark and filthy, which were the habitation and resting place of promiscuous crowds of unfortunates of all ages and sexes, who were glad to find some straw in a dry corner upon which to huddle together, and thereby prevent their half-naked bodies from perishing with cold. While this was the miserable condition of a large number of the people and their manner of living, it was not the only menace. In the alley ways and lanes leading to those wretched habitations were placed at short intervals receptacles for every kind of filth and refuse, which were never emptied and only disturbed by the occasional visits of the rag-picker.

Is it any wonder then with our knowledge of the disease-creating power of filth, unwholesome air, water and food that any locality so situated should be visited by pestilence? Yet even with such surroundings it appears that an apparent state of health may be maintained for a length of time until some favoring influence lights the torch of disease and casts its flames, broadcast over the community. Such was the nature of the scourge which visited the cities of Europe and Britain half a century ago; and so heavy was the visitation that the people were awakened from their lethargy, and recognized the necessity for immediate action to lessen the dreadful mortality.

Hampered by the opposition of prejudice and ignorance, changes in the condition of many were effected slowly and with force, until eventually laws were evolved and officers appointed to carry out the necessary requirements.

Might not a very similar condition have existed in our own province but for the promulgation of laws for the restriction of disease? In the year 1882 the manipulation of these laws was relegated to the Provincial Board of Health composed of men wisely chosen to enforce the regulations and necessities of the Public Health Act; and to that body we are to-day indebted for many improvements in our sanitary regulations. Their duties are many and onerous; we find some of those duties to be "taking cognizance of the interests of health and life among the people of the province; the study of vital statistics; to make sanitary investigation and enquiries respecting causes of disease and epidemics; the causes of mortality and the effects of localities, employments, conditions, habits and other circumstances affecting the health of the people; to make suggestions as to the prevention and limit the spread of contagious and infectious diseases; as well as to look after the systems of water supply and sewerage.'

Another and very important duty is the oversight of the various local boards of health in cities, towns and townships. These local boards are composed of men appointed by the municipal councils to carry out the requirements of the Provincial Board, and I would like particularly to call your attention to certain portions of the duties to be performed by the two officers of the board with whom I have no doubt you are best acquainted, viz., the Sanitary Inspector and the Medical Health Officer. I am now speaking from experience, and would tell you that if they are prudent and diligent men they are the best friends your locality can have. On them devolves the duty of looking after your well being, as well as looking after your habits as to cleanliness, the removal of nuisances, the supervision of articles sold for food, and to see that measures are taken to check and protect you from the encroachment of any communicable disease, and to advise your board of the existence of the same.

Such is a cursory view of the duties imposed upon those whose business it is to look after the public weal, and I would now like to bring home to you some practical remarks concerning your duties as a people not only toward your health officers, but toward one another.

At the outset I may be permitted to say that I am not aware of any law less known, more wilfully neglected, more difficult to enforce, or one that requires to be more delicately handled than a law interfering with what is supposed by usage to have become the vested right of a people. Habit and custom do much to familiarize us with any condition no matter how degrading, and it requires not only time but tact and education to remove us from our own surroundings. That education we as a body of health officers are trying to impart, and are endeavoring to awaken in you a sense of your responsibility and the necessity for carrying out any health law, however apparently harsh, in the spirit in which it was enacted.

It is not the intention to enter largely into this matter, but to direct your attention to two matters, which at the present time form great hindrances to the check of disease.

There are many diseased conditions of the human body which from their non-communicable character require no attention beyond the individual affected, but there are others, apparently innocent at first, whose fearful ravages may bring desolation not only to the home, but to the whole community. In the medical profession we are too well acquainted with this stubborn fact and cannot lay too much stress on the necessity for thorough isolation not only of the patient, but of the family.

How carefully you guard the approach toward your own dwelling of any member from a family in which there exists diphtheria; how carefully you gather together the little ones and hurry them off to some convenient distance in the attempt to protect them from the dangerous contact, and thus you take every supposed precaution!

Yet in some respects you may be no better than your neighbor. One of your own family may be smitten with the disease, and you

in turn isolate the sick one. Did it ever occur to you how small this matter of isolation is? You proceed from the infected house and mingle with the congregation on Sunday and to public meetings on week days as well. Your children mix with other children at Sunday school, and it is not an infrequent thing with some people to take the money with which the sick child played to swell the amount on the collection plate, or to obtain the necessaries of life. As christians as well as sanitarians this matter ought to be carefully considered in all its bearings, so that perfect isolation may be had of all infectious diseases, in which I think the church through its ministers might very materially assist; as it is only by immediate notification that in many cases steps can be taken to prevent injury to others.

In relation to the propagation of disease, cities, towns and townships have an unenviable reputation, and perhaps justly so; but possibly you are not aware that the innocent country, with its healthy air, clean water and generally wide separation of one family from another may be the breeding place of many of the outbreaks of diphtheria and scarlet fever for which the cities and towns are blamed; because of the very isolation of the families and the tendency of many to adopt home treatment for the purpose, I am sorry to say, of preventing a knowledge of the disease, and why? Because the sale of any product of the farm, such as milk, butter, cheese and any article to be sold for the use of man, would be prohibited unless the articles and the people who handle them are completely isolated, not only from the sick, but from the dwelling.

I imagine I hear some one say, no one could be guilty of such a heinous crime as selling those articles already named from an infected house. Let me tell you there is nothing more simple, nor more frequently done; in fact the human family do not like to lose anything by which money can be made. On the occasion of one of my visits to a house three miles out in which five of the family were suffering with scarlet fever in its various stages, a young woman brought into the same room with the sick a platter containing a mass of butter fresh from the churn, to be prepared for market. Enquiry elicited

the fact of the mass weighing about 30 pounds, and that it was intended for sale in the town. On another occasion, when called six miles out, I found a child suffering from diphtheria. Upon a table in the same room with the sick one, were a number of pans containing milk, whose destination was to the general milk can. It is needless to say that the sale of both articles was prohibited and precautionary measures advised. In both instances this happened in families which, from education and natural advantages, should have known better; and it was more from want of thought than culpable carelessness of the lives of others.

Speaking of milk, there are few subjects that ought more seriously to engross our attention than a wholesome supply of an article upon which not only the comfort, but the future health, of the community greatly depends. It is intended by Nature as the sole food of the young, and contains nitrogenous matter, fat, sugar, mineral matter and water; in fact, all the materials necessary for building up the human frame.

The quality of the milk is influenced by the nature of the food, by the housing and condition of cleanliness in which the animals are kept, by the fresh pastures of country fields, which give a richness and aroma that cannot be surpassed by any other mode of feeding. The value of such milk from healthy cows that are well fed with good food and clean water cannot be over-estimated.

In cities and towns the supply is derived from dairy farms, dairies in the outskirts, dairies in the city or town, and milk brought from every available source and mixed; and its adulteration with water and other ingredients is extremely common. In some instances this milk is vaunted as the product of some highly prized breed of cattle famous for giving rich milk; but in all cases it is called country milk and so much superior to the milk of the city or town dairy, obtained from cattle stabled in small, ill-ventilated sheds, and fed most of the year on swill or brewery grains, a food at once unnatural to the cow and detrimental to the health of infants fed upon it. Milk, as it becomes easily tainted and liable to rapid

decomposition, readily conveys any noxious odor and contagion to which it is exposed. The dissemination of the different forms of fever, diphtheria, cholera and other malarial conditions has been ascribed to it, and in many cases has been directly traceable to the milk being handled by persons who were either ill or recovering from some of those diseases.

But we have yet a still greater question to deal with in so far as results are concerned. Milk may appear perfectly healthy and respond to all the tests and requirements, and still have lurking in its depths a small micro-organism which has caused more deaths and sickness in one year than all other diseases and accidents put together. The danger will be better appreciated when it is known that this bacillus can be detected not only in the lactiferous product of animals in whom tubercular lesions exist, but occasionally also in that product when the animal to all appearance is perfectly healthy; and this danger is the greater when it is borne in mind that such milk is not deprived of its infectivity until after considerable exposure to boiling.

The question of the infection of tuberculosis being conveyed by milk is of even greater importance than is infection by flesh, for the two-fold reason that the former is largely consumed by infants, and is imbibed in the uncooked state, to find a receptive soil in the plastic tissues of the child's organism.

Nor is this a mere question of theory, since it has been proven from time to time by taking young animals of the same age, divided in separate enclosures, one half fed with milk from healthy animals and the other with milk from tuberculous cows, that those animals fed on unhealthy milk were, in the course of a few months, seriously affected by the disease, while the others remained unaffected. Much publicity has of late been given to this disease of our milk and meat-producing animals, and much controversy has arisen, and prohibitory enactments issued by one country against another; but as these may have more of a commercial than a sanitary value, we shall leave them to quarrel over their bone of con-

tention, and confine ourselves to the actual fact that tuberculosis does exist, and that in the early stages of the disease particularly there may be difficulty in recognising its presence.

The origin of tuberculosis in cattle, or consumption in man, was until about a quarter of a century ago, but little understood. It was ascribed to some mysterious influence acting upon the tissues, or generated by exposure to inclement weather, propagated by something in the air, or by heredity and predisposition.

From the experiments of later times it is ascertained that the little microbe, requiring a high magnifying power to detect it, is contained in milk, flesh, and the mucous discharges of living animals; it is found in the dried state in the dust of our houses, schools, places of assembly, workshops and streets; and no matter how dry it may become, it is only necessary to have it applied to some moist surface with suitable surroundings to have it expand into one of the most fatal diseases to which the human economy is subject.

The tubercle bacillus is a small rod-like germ very persistent in the maintenance and form of its life, but so sensitive in its growth and reproduction, that it has no breeding place in nature outside of the bodies of those men and animals in which it has lighted up disease; and while its life may be destroyed by a few moments of boiling, or by contact with chemical agents, yet it may retain its vitality and virulence during months of drying and the ordinary exposure to the weather. When the bacilli are cast off from the body in the sputum of men, and in the discharges from the nostrils of cattle, they are closely imbedded in a moist tenacious material from which they cannot escape so long as the moisture is retained, and are still firmly held in place so long as the dessicated mass remains intact. But let this once be pulverized by the foot on floor or carpet, by rubbing between folds of cloth, or in any other way, and these virulent particles can mingle at once with other dust and become subject to the same physiological conditions of transport and diffusion. I cannot here do better than quote from a paper written by Dr. Prudden, in which he says, "How contagious tuberculosis actually

is, under the conditions that prevail to day, is not within the scope of my theme to consider now. But I do not see why it should not continue just as ominous, or become even more so, if the present unsanitary habits continue in public and private places. If the vile and increasing practice of well nigh indiscriminate spitting goes on unchecked in nearly all assembling places, and public conveyances; if the misguided women who trail their skirts through the unspeakable and infectious filth of our streets, are to be admitted uncleansed into houses, churches and theatres; if court rooms, school houses, and cars are to remain the filthy lurking place of contagion, which their ill ventilation, and their mostly ignorant and careless so called cleanings necessarily entail; if in sleeping cars and hotel bedrooms the well are to follow consumptives in their occupancy without warning or even the poor show of official disinfection; if in ill ventilated and ill cared for dwellings the well must breathe again and again the dust borne seeds of tuberculosis; if no persistent warning is to be given to the ignorant of the dangers which lurk in uncleanliness, then our task will be most complex as well as difficult in limiting the contagiousness of tuberculosis."

I shall not here enter into the scientific means by which the disease can be discovered, and the different processes by which it is attained, but refer you to the many works written upon the subject; and especially to the ladies would I recommend a little volume on the "Inspection of Meat," written by Walley.

As we have found that inoculation was caused by the imbibition of milk, so also does the same thing occur by the use of the flesh of animals suffering the disease. As the result of many experiments, it has been found that although the flesh of tuberculous animals may apparently be eaten with impunity, yet it is capable of producing the most disastrous results. Our present intention, however, is not so much to consider the results of inoculation from the use of deleterious food, as the best means to prevent its attacks. Slowly, but surely, we are learning that what was once thought to be hereditary transmission of the disease is only household poisoning, or at most an entailed vulnerability in the presence of the germs derived from

some external source. The main point that tuberculosis is a communicable disease and as such capable of being communicated from one individual to another is now an established fact, seeing that the micro-organism which causes it can be freed from the body of a diseased person and conveyed to the bodies of the healthy. It is an unfortunate circumstance that the most common notion of the contagiousness of disease is derived from those which are most dreaded and most liable to spread, such as smallpox, diphtheria, scarlet and typhoid fever; yet these and tuberculosis can be highly contagious or made scarcely at all so, depending upon the care or lack of care which is taken by the victims or their attendants in the disposal of their varying exudates or discharges.

That a certain amount of relation exists between the death rate of man and animals, respectively, from consumption, and that this relation is materially affected by the use of tuberculous flesh for human food, is afforded in a chart issued by the authorities of the Grand Duchy of Baden, in the year 1889. The chart applies to fifty-two towns, and shows that where tuberculosis is prevalent among cattle, it is equally prevalent among the human population, and is particularly prevalent in those towns in which the number of low-class butchers is greatest. One town—Wertheim—was remarkably free, but it was significantly pointed out that from this town large quantities of sausages made from flesh of an inferior character, are annually exported.

To give an idea of the dreadful ravages of this disease, it may be stated that for each year between 1881 and 1890 inclusive, there were over 5,000 deaths in the City of New York; and for the United States during the year 1890, the number of deaths was computed at 125,000. It is not necessary to multiply statistics, but we must consider that whilst so many died of phthisis during the year, they probably only represented a third of those affected living at any given time; so that we should not err if we were to consider that if we had been able to enumerate the number of persons in New York with consumption at any time during the year 1890, at 16,000 we would not have been far astray.

If, then, there is any probability of truth in the idea that consumption can be due to the contagion of a germ, if that germ can be conveyed from one person, or from one animal to another by the inbibition or contact of a germ, then, it becomes us, seriously to consider the means by which further injury can be prevented. It has been learned from the researches of Koch that the disease can be detected long before any appearance of sickness can be observed, and that by the introduction into the animal of a substance called tuberculin we have the means by which diseased animals can be detected in a herd, and it is quite within the scope of probability that in the near future those persons who desire to know whether they are in any way affected can with safety learn the result, and the time may come when inoculation may be used as a preventive measure. If science is stretching out her hand to help us, why should not we as a people use every endeavor in our power to limit the spread of the disease to future generations, and while we view with sadness any restriction placed upon the living, let us look forward to the enactment of such laws as will tend to develop healthy bodies and lessen the spread of contagion. Our humanity and feeling towards our neighbor is the great drawback to the enforcement of such laws. The task of reform is no less than colossal at best, nor is it by anything less than long continued and well directed labor that substantial good can come. It will not do to fold our hands because we cannot accomplish all we desire. Every little helps much, when each victim of tuberculosis may be discharging thousands if not millions of virulent germs every day upon our ill kept streets, and in places where the well must go. It is not humane to do nothing because we cannot accomplish all.

To make our way between the rigors of necessary legislation on the one hand and the demands of humanity on the other is a task requiring skill as well as wisdom, and large knowledge of the world as it goes on outside of laboratories. We read of a railway collision in which a few are killed, of a ship on the ocean going down with several hundreds on board, and we feel sick with horror at the death of so large a number. But we look with apathy upon the ravages of a disease which is sapping the health of our people ; which comes slow

but not the less sure. What then shall we do with it? The disease is so common, and the sympathies involved so great, that the ground must be tenderly trod; many means have been proposed, such as the isolation of the sick either on pleasant farms, or in homes provided for that purpose, the prohibition of spitting everywhere and anywhere, the destruction by fire of all sputum from the lungs and bronchial tubes, and to see that every part of the rooms occupied by the sick are frequently washed, ventilated and disinfected. And while we do all this can we not go much further? Why not ask our Provincial Board to place the word tuberculosis among the infectious and preventable diseases mentioned in the Public Health Act and have such precautionary measures taken to prevent its spread as they may see fit. Might they not advocate that it be the duty of the physician to report each of his cases to a central authority, and that printed rules or regulations should be provided and sent by such authority to the family or patient as the case may be.

Have we no interest in the food we supply our children? Must we go on from week to week feeding ourselves and our children upon milk and flesh utterly unfit for use simply because we have not pluck enough to advocate the necessary legislation? Can we not as a people petition our government to place competent men over sub-divisions of the province as inspectors of byres, cattle, and the water of the farm or dairy as to its source of supply, whose sole business it would be to keep constant supervision over all milk supplies and have the power to negotiate for the destruction of all unhealthy milk-giving animals whether the product be for sale in city, creamery or cheese factory?

Is it not possible to require every city, town and municipality to have all animals intended for sale as food slaughtered at abattoirs in central localities where inspection can be had as to the condition of health or disease? The Mosaic laws prescribed the conditions on which slaughtered animals were to be used, and the priests had the power of condemning any carcass, or portion thereof, as unfit for food; and why cannot we, with the small expense to each involved in a general tax, establish rules of a similar kind for the general good?

In this connection there is yet another matter to which I would like to draw your attention; to what may be called a false philanthropy towards our adopted country, the system of importing the superfluous children from the alleys and lanes of British cities. Waifs with tuberculous and scrofulous constitutions, generally the offspring of diseased parents, and the possessors of lives which we cannot destroy, but which are capable of entailing upon our fair Province untold misery. Can any of you imagine a farmer so thoroughly blind to his own interest as to place among his flock an animal having an infectious disease?

These are hard matters to deal with, the health of a locality depending, not on the action of individuals, but on the united action of the whole community. Our sympathy must not be allowed to run riot with our brains. Let us unite in a general appeal to the Parliament of our country for the adoption of such measures as will tend to do most good in the restriction of disease. We sanitarians are but a handful, and hence we appeal to the people for that all-powerful help by which alone any of those conditions may be remedied and laws enacted.

But whatever public or private measures may be decided upon as wise for the prevention of tuberculosis and kindred diseases, they must be so conceived that education will go hand in hand with law; wise teaching will show the degree of the dangers and that this depends largely upon the deportment of the victims themselves.

THE DISPOSAL OF TOWN GARBAGE AND REFUSE.

By Edwin F. Bishop, Chatham, U. S. Consul.

Gentlemen,—My excuse for presenting a paper to your learned body on the above subject is that, being greatly interested in the public health of this community, an interest largely aroused by my position obliging me to make weekly health reports to the Marine Hospital Bureau at Washington, and having recently enjoyed every opportunity to watch the methods and results of skillful co-operation between the Health Department and Bureau of Streets of one of our largest and most progressive American cities, I have become an ardent convert to municipal sanitation and especially to that form of disease prevention which effectually removes or destroys all offensive and putrefying substances.

I have to differ with those sanitarians who still cling to the old system of hauling garbage away from the haunts of men, only to dump it where its evils have every chance to increase and multiply, and return the products of its germ beds to afflict the human race. In experience it has been found that while garbage is a superb fertilizer, and several of the old world cities point to waste lands which have been rendered fruitful by it, still the cost of cartage has been enormous and the lands reclaimed by it were fortunately situated so that both the drainage and the air currents were away from the municipality and therefore did no harm. The usual practice, especially where the corporation is a small one, is to haul it out on the nearest unoccupied piece of land, where it forms heaps of rotting matter; by feeding to cows such portions of it as they will eat, whence it returns as typhoid fever germs in our milk; or by spreading on low lands in the vicinity, where it first poisons the air and then is washed off by rains or the rising of streams, whose subsidence leaves it an offensive and dangerous enemy, if, indeed, it does not directly contaminate the water supply of one or more towns or cities. This is, perhaps, what some of you have said in your papers on the

sewage or drainage questions, but at this point I cannot refrain from calling your attention to the recent experience of Buffalo, as showing the danger of allowing a water supply to become infested with disease germs. The city of Buffalo takes its water from an inlet tunnel in the center of Niagara river where the current is the swiftest. I think at that precise spot it is some eight or nine miles an hour. During February of the present year, prevailing north winds drove the water back into Lake Erie, and it became necessary to take water for five days only from the so-called Bird Island Pier Inlet, which is nearer the shore, although there is a wide steamboat channel inside of it. The water returning to its normal level, the use of this intake was discontinued and temporarily forgotten. A week or two later the attention of physicians was attracted to the unusual number of typhoid fever cases that were daily reported, and this number increased so rapidly that nearly 500 cases occurred in the first month. The epidemic continued for several months, about 1,000 cases being reported in all, mostly of a mild type. It was then discovered that at the extreme southern end of Buffalo's water front, and five miles away from the inlet temporarily used, there was a case of typhoid fever and that the excreta or articles infested with the germs had found their way into the lake. The current in that distance is very slow and the water deep, but the germs lived to reach the water mains and to cause many deaths. A curious feature of the epidemic was that the number of cases bore a marked relation to the distance from the intake, the greater the distance the fewer the cases.

I need not contend before this body that the diffusion of disease germs in our drinking water is as easily due to the wrongful disposal of garbage as to bad drainage.

All efforts to deodorize night-soil and make it into a valuable fertilizer have failed, a failure partially due to the cost and partially to imperfect methods. Even when perfectly buried, as it seldom is, it makes its presence known by offensive odors and eventually percolates into the nearest stream carrying its load of disease and death. It, therefore, when not carried off by a sewer system, should receive the same sanitary treatment as garbage.

I have heretofore alluded to the typhoid propagated by feeding garbage to milch cows, which has been prohibited by law in many of our States, but I suppose it is not as generally known that an investigation of the Massachusetts State Board of Health, contained in its report for 1888, showed that of swine fed upon garbage and house-offal from Boston over 12 per cent. within a radius of thirty miles of the city were infected with trichinosis, and that 17 per cent. of hogs maintained at the public institutions of that state and fed upon garbage were similarly affected.

Typhoid fever, diphtheria, smallpox, consumption and Asiatic cholera are nothing but the products of organic waste. It is asserted by high authority that over one-half of our death rate is due to filth diseases caused by the presence in some form of putrefying animal or vegetable substances. Our larger cities are at last aroused to the necessity of the sanitary disposal of garbage, but our towns and villages are still in the habit of throwing this disease-breeding waste upon adjacent ground or into the nearest water. In view of the comparatively low death-rate of these smaller places, destitute as they are of sanitary measures, I feel fully warranted in saying that it is due to the lack of crowded tenements, to the purer air of the country and to a more out-door life; but that if our towns took the same precautions that our cities are now adopting the death-rate would be given less than it is, and that longevity would be as common in the country as wild flowers. The necessity for these sanitary precautions I need not debate; the desire for life is too general for me to attempt to place the indisputable upon a logical basis, but the practical means of bringing about this general sanitation and the cost of it is the main purpose of this paper.

1st. What have we to dispose of? A large proportion of the human waste is composed of food products left from our tables, stores and markets, all of which is susceptible of speedy decay. This is garbage.

2nd. The sweepings of our homes, buildings and yards, the thousand and one worthless articles thrown away or abandoned by everybody

and which are not in themselves offensive but become so by accumulation and are the possible but not probable source of disease. This is *refuse*.

Referring first to the disposition of refuse and having in mind the limited means at the command of a small town, I wish to say that the same costly methods need not be adopted to get rid of it that our cities follow. If kept free from putrescible matter and infected clothing it may be put in some out of the way place, the more remote the better, and the danger to the eye is far greater than to the health. But with garbage proper no means of perfect safety exists except that of destruction by fire. After an examination of the different methods of burning in use and still bearing in mind the necessity of keeping the cost as low as possible, I venture to suggest the two following systems as being thoroughly effective and as cheap as any yet discovered :

1st. *The Peripatetic Method*. This was invented by a Mr. Wells, then Superintendent of Streets of the city of Chicago. Although Chicago had a garbage crematory he found the expense of collecting the garbage in the outlying districts and hauling it to the crematory to be too great and he devised a crematory on wheels which was drawn by two horses through the alleys in the rear of the stores and the two men in charge carried out the garbage previously deposited in barrels or similar receptacles and dumped it into the furnace which speedily devoured it. The apparatus resembled in appearance a portable boiler on trucks and carried enough fuel in the shape of coal to last during the working hours. No offensive smoke was given off, and the only possible objection to the use of such a crematory in a town where there are no alleys is its appearance. This, however, is no more objectionable than many other things seen on our streets, as it is entirely noiseless, does its work quickly and moves on. The only pre-requisite is the keeping of garbage separate from refuse, a condition necessary in all crematory processes, and in such cities as Buffalo the garbage is not collected where it is found mixed with ashes, etc., and the occupant of the premises must then separate it or be fined.

The cost of such a crematory sufficiently large to consume the garbage of a town of about 5,000 people weekly is approximately as follows:

Portable furnace	$1,100 00
Two horses	200 00
	$1,300 00

Cost of operations:

Interest and repair account, say	$1 00
Two men at $1.50	3 00
One-quarter ton of coal	1 00
Care of horses	1 00
	$6 00

2nd. *The fixed Crematory System.* This is usually contained in some building located in the suburbs, to which all the garbage is hauled in wagons. Some of these systems, such as of Mertz & Co., produce certain valuable products, but they are more costly both in erection and operation than a town can afford, and the one I would recommend produces nothing salable but ashes for fertilizing purposes, they containing phosphoric acid and potash in amounts varying from 9 to 12 per cent.

The cost of this apparatus, which has a maximum capacity of 60 cubic yards a day, and is able to destroy the garbage of a community of 30,000 is about $8,500. Cost of operation $1,200 per annum Cost of collection about $1,800 per 10,000 of population. These figures are based on an initial cost of labor and material which is less in Canada, and I believe that such a furnace can be erected to consume the waste of towns of from 5,000 to 10,000 for not exceeding $5,000, and which can be operated and the garbage collected for $2,500 per annum.

The cost of collection is a varying one, depending on the location of the crematory and the space covered by the municipality. In

Savannah, Georgia, the average number of loads hauled per diem was 48, and cost, including destruction, 13 cents per cubic yard. Panama, Colombia, with certain advantages in fuel, the number of loads hauled per diem was 30, cost per cubic yard 10 cents. In this case the total cost of collection and burning was $2,263.93.

In conclusion, let me add that with the coming into general use of some such system will our mortality be greatly lessened as at Lowell, Massachusetts, where 42 per cent. of the total deaths were infants and the principal cause of this traced to swill milk; but the pleasure of living will be increased and the fears of Dr. Malthus perhaps come to pass. This achievement is one peculiarly the province of the English speaking race, and on you medical gentlemen whose profession is becoming more and more one of prevention as well as cure, depends the future stability of our health. That you are fully alive to this fact and eager for the fray in which you intend to conquer, this meeting is sufficient proof.

CREMATION AS A METHOD FOR DISPOSAL OF THE DEAD.

By S. Stewart, B.A., M.D., Thamesville.

Gentlemen,—The subject which I have the honor to bring before you is by no means popular, neither is it new; but it has, nevertheless, a personal interest for each one of us.

Cremation, as a method for disposal of the dead, has been practised in various parts of the world since very early times. It is a matter of history that it was practised by the ancient Greeks, and by the Romans who borrowed it from the Greeks at a somewhat later period, as well as by various Asiatic peoples. We find it referred to by both Homer and Virgil in their writings, as occurring during the siege of Troy.

The practice seems gradually to have fallen into disuse amongst the more highly civilized nations after Christianity was founded, and it is only within the last twenty-five years that it has been revived, and its adoption advocated among christian peoples.

The opposition of christians was probably due to the fact that some have thought it was antagonistic to the doctrine of the resurrection of the body; but Lord Shaftesbury has disposed of this objection by asking: "What would in such a case become of the Blessed Martyrs?"

At the present day, cremation of the dead in our country is repugnant to established usage; but to overcome this feeling is merely a matter of education, as many other modern customs which are popular in some countries, are repugnant to the tastes of the people living in other countries.

It has also been urged it would destroy the evidence of death by foul play. But this difficulty can be surmounted by requiring an autopsy in every case where there is not a clear certificate of the cause of death; and this would be a regulation of much advantage *per se*.

On the other hand, by cremation of the dead we accomplish quickly and inoffensively what we seek to do by the ordinary mode of burial. The body is decomposed into its original elements, the gases are driven off and are immediately free to be re-absorbed by plant life, while the ashes remain in the crucible, ready to be preserved in an elaborate urn or mingled with their kindred dust by being scattered on the soil, and so assist at once in the support and preservation of other forms of life.

It is not my purpose to enter into any elaborate description of the form and mode of operation of any particular crematory. Their details of construction vary, and although there is none to my knowledge in Canada, yet they are sufficiently numerous in the neighbouring Republic that any wishing to see one may easily do so.

On the ground of economy cremation is advisable, as the whole cost of a crematory need not be as much as that of a very modest graveyard for a small town, while the cost of individual cremations has been brought as low as seventy-five cents at the Gorivi Crematory in Milan. The cremation of the body of Baron de Palm, in 1876, which was the first public cremation on this continent, cost about seven dollars, and was performed in a crematory containing a reception room and a columbarium besides the furnace, the total cost of which was only $1,600. To save expense, there are portable furnaces.

On the ground of sentiment, too, it should be adopted, if we consider the repulsive appearance of the body during the various stages of decay after ordinary burial, and the horrors of being buried alive, which have much weight with some. The cremation process is also capable of being associated with religious funeral rites, and indeed a cremation ritual has been prepared.

Those who wish to spend money in erecting shrines of affection, have also an equal opportunity to do so, as costly and handsome urns and columbaria would there replace hideous gravestones and ill-kept cemeteries.

It is, however, on sanitary grounds that this Association will decide the value of cremation. Take some of the old churchyards in

the crowded districts of the old world, or even in some of the populous centres of our own continent, and we find the surface of the ground raised several feet, owing to the crowding of the soil with the remains of dead bodies, while in these localities the very air is heavy with disagreeable and unhealthy gases. Accidents, too, have been known to occur by the gases of decomposition finding their way into cellars near cemeteries.

Cemeteries have also been found to contaminate wells, and in this contamination we have not only the ordinary organic impurities, but we may have germs as well.

Again it has been proved that earth worms bring disease germs to the surface from a considerable depth, and disease may in this way be propagated.

Then, again, the changing of the resting-place of the ashes could never be made an occasion to excite public alarm, such as happened in a recent exhumation almost under the very eye of our secretary.

SEWERAGE AND THE DISPOSAL OF SEWAGE.

By P. D. McKellar, Esq., Registrar of Kent.

Gentlemen,—In attempting to lay before you some facts relating to sewerage and the disposal of sewage, I do not present myself in the light of an expert or as one possessing personal experience on that subject. I appear simply as a citizen who takes a deep interest in the satisfactory working out of all problems calculated to promote the health and bring increased comfort and happiness to the community.

I am inclined to present this paper in the hope and expectation that the discussion of the sewage question by your learned body will prove of material advantage to our town authorities in dealing with a question of such vast importance to the welfare of this community.

The subject matter of this paper has been gleaned chiefly from the writings of George E. Waring, Jr., Esq., on sanitary questions. His utterances are so pointed and so well expressed that I offer no apology for transferring some of them almost bodily to these pages.

In order that the members of the Boards of Health may enter upon a consideration of this question as it affects the town of Chatham, it is important that they should have a fair topographical knowledge of the town. I will therefore endeavor to explain its situation and surroundings. The town is situated upon the river Thames, a sluggish stream which divides it into two almost equal parts known as North and South Chatham. The south portion is again divided by McGregor's creek, which cuts off a triangular or V-shaped piece, which represents about one-fourth of South Chatham. The banks of the river and creek are well defined and have an elevation of about twelve feet above low water mark, with flats or bottom lands in the bends of the stream. The land falls gently from the river on both sides, but not to such an extent as to destroy

the fall for drainage from the suburban parts of the town to the river. The problem to be solved by this town is how they shall dispose of their sewage without injury or offence not only to their own citizens, but to the riparian owners below the town.

It has hitherto been, and, in fact, it still is, the practice of the world to consider its wastes satisfactorily disposed of when they are hidden from sight. In spite of an almost universal outcry against sewer gas, filth diseases and infective germs, the great mass even of those who join in the cry pay little heed to the defects in the conditions under which they are living, so long as they are not reminded by their eyes or their noses that their off-scourings are still lurking near them. It is now recognized that quick and complete removal is only the beginning of the necessary service, and that proper ultimate disposal is no less important to health, to decency and to public comfort. The organic wastes of human life must be finally and completely consumed. It is not enough to get them out of the house and out of the town. Until they are resolved into their elements their capacity for harm and offence is not ended. It does not suffice to discharge them into a cesspool, nor does it always suffice to discharge them into a harbor or into a watercourse.

The impurities of sewage are organic matters, which, having served the uses of the community, are relegated to the domain of waste. They are the product of life and growth in the vegetable world. They have served their uses, as food or otherwise, and they are now to be prepared for a new cycle of life, use and rejection. This preparation is effected by resolving them into their elements. Only thus can they be made available for new plant growth. Their organic condition must be completely destroyed before organic reconstruction can follow. Such destruction is inevitable, and is usually rapid. It has long been known that destruction is effected by oxidation, and the oxidizing agent is now known. Save in the case of actual consumption by fire, which is a rapid and intensified oxidation, or by the action of chemicals, the destruction of the organic condition is effected by the growth of infinitesimal living organisms, known by the generic name of "bacteria." These organisms live

and grow by the consumption of food, which, with the aid of oxygen, they convert into their own substance. This seems to be the last step before the final letting go of the control of life processes, which is followed by complete resolution.

When we have reduced the filth of our sewage to a condition in which it may be washed out of the soil, or absorbed by roots, then, and not until then, have we destroyed it as filth; but then it is completely destroyed. In the place of a particle of meat fibre we have carbonic acid and water and nitrates, all available for the nourishment of growing plants, and all reduced to what is probably the only form in which vegetation can take them up. The same action converts into plant food the other elements of the sewage. The result is no longer sewage or urine, or fecal matter, or animal or vegetable refuse. It is the renewed elementary condition of the substances of which these various forms of filth were composed. If a crop is growing on the land, some or all of these resultant products of localized and disseminated decomposition will enter upon their new cycle as plant food. In the absence of such demands they will be more or less completely washed out of the soil by water descending through it. In either case their career as filth is ended.

Under rude and careless methods, and indeed in the absence of methods in mere deposits of filth, this ultimate reduction to elements will follow in time, but the process will be offensive and in every way objectionable. With proper methods the desired end is reached more rapidly, and with an entire absence of offense or objection.

Those of the bacteria which are best known multiply by division, into two or more parts, each part growing to its allotted size and then dividing again. It has been stated that the bacterium termo divides thus every hour, so that at the end of the first hour each one becomes two; at the end of the second hour these become four, of the third, eight, and so on, until at the end of a single day they number more than sixteen million.

Sternberg illustrates this wonderful growth by the following statement: "Let us admit that the space occupied by the sea is equal

to two-thirds of the terrestrial surface. that its mean depth is a mile, the capacity of the ocean will be 928,000,000 cubic miles. The multiplication being continued with the same conditions, the bacteria issuing from a single germ, would fill the ocean in five days. The development of these organisms is limited only by the amount of material available as food, and by the supply of oxygen. It is resisted by the protective influence of life, by the presence of conditions unfavorable to bacterial growth, and by the actual absence of an organism to begin the growth. The organism is always abundantly present in sewage, and its development, under natural conditions begins at once, and continues until the last vestige of available organized matter has been reduced to an oxidized condition, and so made ready to serve again as plant food. This is the ultimate destiny of the organic impurities of sewage. The suspended matters may first serve as food for fish or insects or animalculæ, but sooner or later they must all pass through the final process of dissolution by oxidation. We may retard this process as by the use of chemicals and disinfectants, but we can only retard it. Its agents are always at hand, and when the proper conditions arise, they begin their work."

It is their work and practically only their work, that completes purification, and the art of sewage disposal consists in suitably subjecting to their action the matters with which we have to deal, in such a way as to favor their activity, and to obviate offensive and dangerous conditions. The methods at the moment most in vogue do not fully accomplish this. They are necessarily empirical. They have been developed under the slow growth of experimental knowledge, and they had proceeded far, and had become well established in practice, before it was known that oxidation depended on bacterial life. It seems, however, as though the scientific world had at last reached the threshold of real knowledge concerning the processes by which organic matter is converted into those mineral compounds, which inoffensive and innoxious in themselves, become, in the economy of life, the direct food of growing plants. It is these processes that we must employ in the successful destruction of all

organic waste other than such is consumed by fire. They go on in spite of us; we may delay them or conceal them, or change the seat of their activity, we may hasten them, or modify them, but we cannot prevent them.

Sooner or later, by combustion, by direct putrefaction, or by indirect fermentation, they will work their destructive ends, bringing all matter that has once lived, again back to the domain of life. The cycle is unceasing, and according to our action concerning, or according to our neglect, will its influence be good or bad.

Purification if effected by oxidation takes place in the film of sewage coating the particles of the filter with a sufficient admission of air to supply oxygen. The essential process is not straining, but bacterial growth. For example, while the paper filter of a laboratory removes practically all of the suspended impurities of sewage, it removes only eleven per cent. of the ammonias, and only eighty per cent. of the bacteria; the slowly moving films passing over the surface of stones, as large as the ball on one's thumb, loose ninety-seven per cent. of their ammonias, and ninety-nine per cent. of their bacteria.

Practically it was only after this clear definition, and demonstration of the processes involved, and of the methods of their application, that we are in a position to work with real knowledge. Only then could empiricism be made to give place to well established theory. Could we now set aside the influence of long years of practical work, the atmosphere would be greatly cleared. But practical work has a very persistent influence, and the art of purifying sewage will long feel the effect of experience with methods which would not have been devised in the light of what is now known.

The belief also prevailed that the chief source of offensiveness of sewage lay in the solid fecal matter that it contained, and this belief still finds much popular acceptance.

The fact is that fecal matter is of far less consequence than urine and the waste of the kitchen sink.

The purification of sewage is evidently on the eve of great extension in this country, and its success requires that the importance

of making it as thorough as possible should be generally appreciated. If the work is to be done at all, it is worth while to do it well. Half way measures, like chemical precipitation, may satisfy present legal demands, and they may in exceptional cases be advisable, but they will not meet the requirements of the better informed public opinion that is now growing up. The means for entire purification are within reach, and imperfect results will not long be accepted as sufficient.

In practical work two cardinal principles should be kept in view, and should control our actions.

1. Organic wastes must be discharged at the sewer outlet in their fresh condition before putrefaction has set in.

2. They must be reduced to a state of complete oxidation without the intervention of dangerous or offensive decomposition.

As the difficulties attending are chiefly due to the water in which the wastes are borne, sewage should be in the interest of economy no less than of efficiency, protected against an excess and fluctuation and volume, due to the admixture of storm water. This implies the adoption of the separate system of sewerage by which only the water necessarily fouled in houses and needed for the proper removal of wastes shall be admitted to the flow that is to be dealt with, other means being used for the removal of storm water, and the filth of streets being taken care of otherwise than by discharge into sewers with the gutter flow. Street dirt should be swept up, not washed away. This exclusion of storm water will perhaps never be reached in all cases, but wherever it is, or is likely to become necessary that process of artificial purification should be adopted, there at least the withholding of storm water and street wash should be secured. In the great majority of towns now contemplating sewerage, purification is sure to be demanded sooner or later, and sewerage systems should there be regulated from the outlet with that end in view. The fact is that no such great amount of land is required for the proper treatment of the foul elements of the sewage. If needed at all, it is needed only to meet the demands of

great floods of storm water containing more or less street wash, sand and clay sent to the fields at a time when they are already saturated with rain. Where all storm water is excluded from the sewers this difficulty does not exist, and the irrigation area may be limited to an amount that will when wet with rain still admit the volume necessarily resulting from the copious use of water in our houses. Just what this limit is to be cannot now be determined. With suitable soil, the sewage being entirely free from storm water and provision being made for occasional disposal by filtration beds, when the condition of the crops indicate the desirability of withholding the sewage from the fields, one acre for three hundred persons or more would be quite safe. With intermittent downward filtration alone, in its intensified form, one acre may be made to suffice for one thousand persons or more.

The methods of disposal to which recourse is now had are mainly:

1. Broad irrigation.

2. Intermittent filtration.

3. Chemical precipitation, sedimentation and straining, while resorted to in rare cases, have little to commend them to favor.

1. Broad irrigation consists in the flowing of sewage in thin sheets over the surface of the ground in such a way as to bring it into contact with the soil, and with vegetation growing upon it, and to allow the soaking of the liquid into the ground to a greater or less depth, according to its porosity or absorbent character. In its best application the flow is all absorbed before the limit of the area is reached. The water of the sewage is removed by downward filtration, by evaporation from the surface, and by being taken up by growing vegetation.

The impurities are oxidized in the absorbed or flowing liquid or are strained out by particles of the soil, etc., and are thus so exposed to the access of oxygen that purifying bacterial growth effects their rapid resolution. The rationale of the processes of purification with irrigation is practically the same as with filtration. The application of the sewage is intermittent, only so much being applied at once as

can be taken up by the land. The intermission of the flow is sufficient to allow the water to disappear, leaving the ground moist but not wet.

2. In intermittent filtration large volumes of sewage are applied to small areas of land, submerging it to a considerable depth, and soaking into the earth in the interval between doses.

A larger proportion of the impurities of the sewage attaches itself to the particles of soil below the surface than in broad irrigation and a smaller portion of the water is removed by evaporation. The success of this method calls for a much more porous soil than is required for irrigation and ample drainage is more important. The bacterial action extends to a greater depth.

No sharp line can be drawn separating irrigation from filtration. The differences are differences of degree rather than of kind. If an absorptive soil with good drainage is used for irrigation, so much of the flow will sink into the ground as to make it largely a filtration system, while with filtration through beds of considerable extent the surface exposure of the area, after the subsidence of the sewage, differs little from that which follows an irrigation flow.

With both methods the result is good, more or less good, of course, according to the skill of arrangement. Under the best conditions it is practically perfect, the effluent being freer from organic impurities and from bacteria than the purest river water used for the supply of towns.

In the application of irrigation and filtration processes the coarser elements of the crude sewage must be withheld. Solid fecal matter need hardly be considered in this connection. It is so broken up and macerated in its flow through the sewers as to almost entirely disappear. The amount reaching the field is inconsiderable and of no effect, and may be disregarded. There is, however, a certain amount of coarse paper, rags, vegetable parings—which would be objectionable on the score of appearance—and a good deal of paper pulp sediment and adhesive matters, which if allowed to flow over the land might so coat it as to interfere with absorption. This

latter is the only element of what in chemical process goes to make up the large quantity of sludge that calls for special treatment in irrigation. The coarser objects are easily retained by a screen placed near the mouth of the sewer—preferably a horizontal screen—over which the water flows and which has an outlet to the field underneath it.

The withholding of paper pulp and other fibrous matters may be effected by a method applied at Wayne, Pennsylvania, where the flow of sewage during irrigation is at the rate of about 10,000 gallons per hour. The field is divided into five sections of about two acres each for alternate use. The sewage reaches them over and through straining areas formed of broken stone (macadam) averaging about eight inches deep, seventy-five feet wide and ninety feet long. These retain most of the fibrous and gummy materials and they gradually disappear.

Just as the coarser parts of the sludge-forming material attach themselves to the surfaces of the earthly particles, grass, etc., over which the flow continues, and the sewage is thus clarified very early in its course. If the flow were uninterrupted, absorption and purification would soon cease. Fibrous and gummy materials would so accumulate as to make an impervious mat over the ground, preventing absorption and aeration. With intermittent application this does not occur; what has been deposited on the field by one dose of sewage is so changed during the dry interval as to lose its felting quality. There is no accumulation from dose to dose gradually to close the surface of the filter.

The oxidizing organisms are short lived. When their food has been consumed they disappear and their disappearance implies a reduction of oxidizing capacity. This can be maintained at its maximum only by keeping up the full working force that the soil we use can accommodate.

The practical results of broad irrigation in works of long standing show that the process, when well carried on, is devoid of all offence, and may be made to yield agricultural returns which will go far

towards paying the cost of maintenance. At Gennevilliers, where irrigation and filtration are combined, and where the soil is gravelly, the sewage of Paris is made purer than the best drinking water of that city.

Sewerage engineers are sometimes asked where it is best to "dump the sewage," and other expressions are used suggestive of the disposal of putrefied filth by night soil carts. Sometimes the owners of adjoining lands object to the establishment of a sewage field in the belief that it will become a nusiance.

The fact is that the "dumped" matter is fresh and inoffensive, is mainly invisible, save as it clouds the flow and is a thousand times diluted. If its treatment is properly regulated it is withdrawn from the diluting water and completely destroyed in a manner that is imperceptible to our senses, and in the case of broad irrigation with the effect of producing a luxuriant vegetation during the growing season. At Wayne, Pennsylvania, a protesting neighbor who had apprehended an insufferable nusiance, soon expressed a regret that his land was not so situated that the sewage could be made to flow over it.

As is usual when the separate system of sewage is used, the flow has no odor, and all of the retained matters are inoffensively destroyed under free exposure to the air. The effluent at the barrier last referred to is not only apparently pure, but it is nearly pure enough for admission to such a stream as is under consideration; that is, it is yet to be discharged, wherever the effluent of precipitation works may be discharged.

No sludge is accumulated, there is no outlay for chemicals, and over the lower two-thirds of the tract there is a strong growth of grass which thrives with three heavy floodings in one day, followed by a dry condition for two days.

The method of disposal by irrigation or filtration is an extremely flexible one. It is susceptible of modifications that will make it suitable for a great variety of circumstances and for a wide range of soil and surface conformation.

1. House drainage is practically odorless when first produced. It does not become offensive unless retained till it putrefies—only after a day or more.

2. If applied when fresh to the surface of suitable ground its water is removed in a condition fit even for safe drinking and its impurities are completely destroyed, both in winter and summer, without offence or danger of any kind.

In short, the bugbear of sewage disposal has been done away with, and we are now in a position to adopt simple and unobjectionable methods which will produce a very satisfactory result in all but very exceptional cases.

1. The evidence of Mr. Waring would seem to prove that the double system of sewerage is the best, that is, two sets of pipe, one for the conveyance of storm water directly to the river, and the other for the discharge of the sewage into the filtering beds.

2. That as to the disposal of sewage by reduction to its natural elements, filtering is the only efficient method.

3. The process of filtering is absolutely free from any noxious or offensive results, and may be carried on in the close vicinity of dwellings without being in the slightest degree objectionable or offensive.

4. The filtered water from sewage is almost pure, and so free from any injurious matter that it may be discharged into any water course without danger of pollution. Nature has kindly provided this town on both sides of the river with flats or bottom lands suitable for the construction of filtering beds. There seems therefore no obstacle in the way of our adoption of the filtering process, unless it may be the absence of sufficient fall for a process of this kind.

THE ECONOMY AND UTILITY OF THE SEPARATE SEWERAGE SYSTEM.

By Herbert J. Bowman, C.E., Berlin.

Gentlemen,—The problem that each town and village has to solve, is how best to remove the waste products from the homes of its inhabitants and from its manufacturing establishments, if any are located within its limits. It is usual to consider at the same time what special works will be required to remove the rainfall, whether from the surface or that portion of it which penetrates beneath the surface and forms what is called "ground-water" or "subsoil-water." Every municipality that is incorporated as a town, and therefore has presumably a population of at least 3,000 people, should have a public scavenger to remove coal-ashes, vegetable parings and other solid kitchen refuse. Where there are no sewers, earth closets should be used, and, where necessary, should be periodically emptied by the scavenger. Liquid kitchen waste and wash water may usually be disposed of, in small towns, by being thrown on the soil of gardens or by being run into shallow drains under the surface of the lawns.

As soon, however, as a water-works system is built in any town or village, steps should be taken to introduce a system of sewers or the place will soon be in a very unsanitary condition. At the same time it is well to remember that the introduction of a system of sewers will not do away with the necessity for the public scavenger, who will still be required to remove ashes, solid kitchen refuse, etc.

The first problem that presents itself in the designing of a system of sewers is, "What shall be done with the sewage?" and upon the solution of this depend to a great extent all further proceedings. In the past sewage has been run promiscuously into the great lakes and into rivers, streams and other bodies of water without any regard to the future; but the Provincial Board of Health must now approve of all plans for new sewerage systems before the works may be legally undertaken. Where a town is small and there is not much chance of growth, little harm can come from disposing of its sewage by discharging it into some large body of water, provided that no water

supply is endangered. However, if the conditions are reversed, the town being large and the body of water small, some method of purification will be required, either by application to the soil or chemical treatment. In these towns, which either now or at some future date will require to purify their sewage, the economy and utility of the *separate* sewerage system will generally be recognized. As the name implies, this system keeps the sewage proper separate from the rainfall, so that the quantity of sewage is almost constant and is not liable to large additions of comparatively clear water. However, the separate system is not a limited system, but when carried out in its entirety, and provision is made for the independent disposal of the rainfall, it accomplishes all that the old combined system can possibly be expected to do and in a more satisfactory manner. Most towns have natural water-courses within their limits, into which the surface water after rains (technically known as "storm-water") may be discharged directly. In a large number of these towns the existing street gutters are sufficient to discharge this storm-water, especially when all dilapidated culverts at street intersections are replaced by proper ones made of sewer-pipe. Before the business parts of the towns are paved, it may be necessary to put in some short lines of storm-water sewers laid just deep enough to miss the gas and water pipes, and discharging into the nearest water-course. In the great majority of our Ontario towns, the want of sewers to carry off the rainfall is not felt, and but few of them could stand the great expense; but all of them require small sewers to carry off the fouled water from the houses, and none of them are too poor to bear the comparatively small cost.

These small sewers are called the "sanitary" sewers of the separate system to distinguish them from the *storm-water* sewers, where such are required, and are usually of such small diameter that they may be most economically constructed of salt-glazed clay sewer pipe.

The Town of Waterloo is just now building a system of "sanitary" sewers, designed by the writer, in which the endeavor has been to follow the best modern practice. The storm-water finds its way quickly into the small creek flowing through the town, so that no special provision was required for its removal. The fouled water from several manufacturing establishments, as well as the discharge

from water-closets in some hotels and private houses, also found its way into the creek, and to prevent this pollution the system of sewers has been commenced. To purify the sewage filter beds have been constructed, about a mile below the town, and operated on the "Intermittent" filtration plan, as recommended by the Massachusetts State Board of Health, ten acres of land having been purchased for this purpose.

The main sewer follows approximately the small creek which drains the valley in which the town of Waterloo lies, and will intercept the sewers proposed to be laid on the different streets of the town. This main sewer is about 8,000 feet in length and consists of 15-inch sewer-pipe, which, with the fall available, is capable of delivering the sewage proper when the town reaches a population of 15,000. As the ground is springy, being near the creek, a subsoil drain is being laid below the larger pipe, so that the subsoil water is almost completely diverted. Without this lower drain the subsoil water would be sure to find its way into the larger pipe, and thus the sewage would be greatly diluted and the volume so increased that the filtration area would have to be much larger. The whole cost of this main sewer is estimated at $10,000, and for the purchase of ten acres of land and the preparation of the filter-beds an additional $5,000 has been provided. Thus only $15,000 has been required to be raised by debentures at 4½ per cent. interest to be repaid out of the general taxation of the town in thirty equal annual instalments. The street sewers will probably be built as local improvements and paid for by a uniform frontage tax upon the property benefited.

From the foregoing example, it will be seen that very few towns in Ontario are so over-burdened with debt that they cannot afford the moderate cost of the "sanitary" sewers of the separate system, leaving the storm-water sewers till absolutely required, which in some towns may never be.

THE RELATION OF SETTLEMENT, CULTIVATION AND DRAINAGE TO DISEASE, ESPECIALLY TO MALARIA, IN THE WESTERN PENINSULA.

By J. H. Duncan, M.D., Chatham.

Gentlemen,—It would prove me deeply ungrateful were I not to express, in a word, my appreciation of the honor conferred on me by your Committee in assigning to me the interesting task of bringing to your attention the subject announced for me by your President. My object in presenting to you this paper is to give, as briefly as possible, an outline sketch of the malarial progress of our Western Peninsula, including the counties of Essex, Kent and Lambton, and of showing the relations which certainly do exist between such progress and the presence and prevalence of disease.

In the year 1793 when Governor Simcoe and Colonel Talbot made their well-known winter march down the valley of the Thames; when Simcoe resolved to make the upper forks—now London—Canada's metropolis, and the lower forks, or Chatham, our empire's chief military post of defence in the west, the vast alluvial plain extending from the northern margin of the Sydenham valley to the remarkable gravelly ridge extending (within a mile or two of the margin) along the northern shore of lake Erie, was an unbroken forest; and such a forest, beech and maple, oak and elm, black walnut and white wood, had been growing for centuries to their then grand proportions, for the building of bridges and railways, and the decoration of the homes of a prosperous Canadian people. These higher forest levels sloped gradually to south and west to great forestless reed-covered marshes.

While the forests still covered the country, and the water crept slowly through the shallow creeks and runways from the marshy woods, there was practically only one disease—malaria—known to

the country. This prevailed mainly in the autumn, when the heavy vegetation and falling forest leaves began to feel the effects of occasional autumn rains, and the still warm days which linger through the Indian summer time. This forest malaria was not intense and mostly of a markedly intermittent type. In marked contrast to this was the malarial fever at this time occurring in the lower marshes. Its virulence was extreme, as may be gathered from an extract taken from an old manuscript to which Dr. Bryce kindly lent me access.

"The head of lake Erie is, I may say, of immense alluvials, in low water most pestilential, as I know from sad experience. At a council board held by the Commissioners, Colonel John Ogilvie, on the part of Great Britain, and General Peter Porter, on the part of the United States, Captain Douglas, Professor of Mathematics at West Point, was astronomer and surveyor on the part of the United States, as I was on the part of Great Britain. After we had settled the operations that were to be carried on, from the sickly state of the country and the accounts I had received of the great marshes on each side of the head of lake Erie, I proposed to Captain Douglas that each of us should take a hasty survey of these extensive marshes upon the opposite shores and give the number of square miles they contained. I had scarcely uttered these words when General Porter sprang up, saying 'The man who will dare to do it is dead, dead.' There was silence. He knew by sad experience the dreadful effects of these marshes. We did not. Captain Douglas very gallantly said, 'It is the cause of science; I will undertake to row around the marshes on the south side if you will do the same on the north side, and each of us will give the best estimate he can of the extent of these marshes.' To this I readily agreed. General Porter said: 'Gentlemen, you may do as you please, but I would not give a cent for your lives.' Each of us proceeded on the rough estimate of the extent of the marshes. Captain Douglas rowed round his side. He had, with his boat's crew, to sleep two nights on the beach, but on the third day he arrived at the Detroit river, where he met the steamboat proceeding towards Niagara. Himself and his men

embarked and were brought down to Black Rock in a weak state, from which they slowly recovered. The report of Captain Douglas stated that from the distance they rowed and the great depth of marsh to the main land, this marsh contained an area of 750 square miles. Into this marsh the Sandusky and Maumee rivers discharge their waters. Neither Colonel Ogilvie nor myself had the least idea of the fatal effects of the miasmata of these marshes, accustomed to live in cold and dry climates. We camped too long on Point Pelee Island; nearly the whole is marsh, surrounded by low shores, mostly sandy, very little above the level of the lake. On the north side of the lake I surveyed the extent of this marsh, part of it called the Rond Eau. It gave 120 square miles, part of which near the main shore affords much coarse hay. The whole shore next to the lake was a narrow strip of low land, seldom twenty yards in width, and on a level with the lake, which in high water must wash into it. But this was a season of very low water. The lake had lowered about two inches and left about forty yards in breadth dry, which I examined. It was closely strawed with various water insects, all dead, which caused a horrid stench. The grasses and all vegetable productions in this rich shoal alluvial appeared as if oiled. I had with me a man who had lived several years in the Detroit river, and so much accustomed to fits of the ague that he thought nothing of them. He warned me of the danger I was in by examining these marshes. My men all caught the ague, so that with a boat's crew of six hardy men I was often reduced to two rowers. The men would fall on the bottom of the boat as if thrown down. In the upper end of lake Erie are three fine islands well wooded with maple, called the East, Middle and West Sisters, each of which contains about three hundred square miles of rich soil. To the West Sister I removed our camp. This fine isle is sixteen miles from land, yet I could not help observing the leaves of the trees to be faded and shrivelled (early in September). Here we thought ourselves safe, but we had brought disease with us. We could do nothing; all were ill of the ague and a low fever, except myself and my servant Baptiste. The third morning I rose very weak,

but no pain. I had the lake fever as it is called. I could only sit up by leaning against a chest, Baptiste curiously watching me. About three in the afternoon this cold fit changed to a burning fever, upon which Baptiste remarked to me that there was some hopes that I might recover, for the cold fit was certain death. Fortunately the United States steamboat for Detroit hove in sight. Weak as we were we got all ready and in our boat pushed off to meet her. The captain very humanely took us on board. I was much exhausted. They laid me on the deck burning with thirst. I requested some acid liquor, but the sickness had been so great that they had expended everything. They offered me water. I refused it and my feverish mind looked with contempt on lake Erie as not sufficient to allay my burning thirst. On arriving at Amherstburg to my sorrow I found Commissioner Colonel John Ogilvie on his death-bed. He had been taken with the cold fit, which continued on him. We had long been friends. It was evening and I lay down on the floor close to his bed. Early next morning Colonel Hawkins, in command of the place, sent two surgeons for me. I left Colonel Ogilvie, but on parting with him I found that already his arm was stiff. A few hours afterwards he died; a gentleman of high, stern integrity, a martyr to what he considered his duty. The Americans were much wiser than we. Brave as they are, they had no idea of contending with an invisible enemy who was sure to conquer. Baptiste, my servant, and two of my men died; the others slowly recovered. As to myself, I was reduced so low that the two surgeons who attended me gave me over to the grave. James Holborn, an artilleryman, attended me. The most distressing symptoms of the fever were now leaving me. They came and enquired of him if I were not dead. He said no. 'Well, he must die to-day.' This was close to my bed. The next morning they came and enquired, 'Is he not dead yet?' The answer was 'No.' 'Let us go and see him.' They found me without any fever, but reduced to a mere skeleton. I could scarcely speak from weakness, but I had to see everything packed up and taken down to Montreal. Such

are the sad effects of the immense marshes of the west end of lake Erie. They are incurable, being on the same level with the lake."

Several points in this description show that the writer has not striven very hard to keep his statements well within sober limits, yet his scientific training must have been good, and his remarks are certainly worthy of credence. The marshes that were at that time so poisonous, are to-day favorite autumn resorts for the duck shooting sportsmen of our land, who generally return from their outing with happy, healthy faces and tales of brilliant sport.

The early days of the nineteenth century saw settlement begin in this section. The timber was gradually cleared away and the fresh soil turned up to the action of the sunlight and heat. As yet no deep drains had been cut, and the level of the ground water was so near the surface of the porous soil that malarial poison filled the air, specially during late spring and early autumn. Every new comer shook with ague, while bilious intermittent and remittent were very common and often fatal.

As the townships opened up soil was turned up in the building of roads, valuable timber was being constantly removed, while the branches and less valuable parts were left to decay on the ground. A constant increase of decomposing vegetable matter was taking place; the protection of the trees was passing away, while no improvement in drainage had come to ameliorate these conditions. Shaking ague and the remittent fever called bilious remittent were the prevailing types of malarial disease at that time, and they were terribly prevalent.

In 1859 the first municipal drainage provisions were enacted in Ontario, but the first important impetus to drainage was given by the McKellar Act in 1866. The Ontario Drainage Act followed in 1869, adding some important provisions. These Acts resulted in the various municipalities entering into extensive drainage operations.

The Government Drainage Act of 1873 was a great advance on previous legislation. Government drains were put through at

different points, opening wide and deep outlets for many municipal drains. These operations have been proceeding steadily since that time. New drains are put through and old ones deepened every year. Our rich alluvial soils are very porous; deep drains consequently lower the level of the ground water to a great distance in all directions. Hence the swampy lands have been dried, and wide, old marshy districts converted into fruitful farms.

One would have expected the dyking and artificial drainage of our plains, as they are called, or the lower swamp lands, which lie about on a level with the lake, and were consequently regarded as "incurable," to have produced a marked effect upon the health of the community; this, however, is not the case, for, strange to say, malaria has disappeared from our once poisonous swamps more completely even than from the higher regions. To appreciate this fact you need only go to the Rond Eau, or Erieau, to the south of us, to see, on the sandy stretch bordering the great marsh that Thompson surveyed at the risk of his life, the weary, the sick and the pleasure loving spending their summer holidays in gay tents and pretty cottages, seeking and finding health and happiness on those marshy shores which have, in the now long past, proved so pestilential. Why this wonderful change in these marshes? Why should they become health resorts and camping grounds for jovial sportsmen, instead of the death-dealing dread of early soldiers and surveyors? They are not drained, the reeds grow on them as of old, the wild duck makes the sedgy streams that wander through these marshes their homes, as a hundred years ago. No forests have been cleared away from these regions, for none ever grew there; and yet disease has vanished.

I offer the following as the true explanation of this apparently inexplicable fact:

It is universally known and admitted that three main conditions are necessary for the production of marsh poison or malaria proper —heat, moisture and decaying vegetable matter.

Before the forests were cleared from our higher lands, while large sections of these were stagnant swamps whose waters sought lake and river by shallow, wide and sluggish streams, we had in those higher forests swamps, moisture and vegetable matter in abundance, but the heavy shade prevented the heat of the sun from penetrating to the vegetable matter so abundant and otherwise ready for the kind of decay necessary to the production of malaria. So, vast quantities of dead leaves and ferns, of wood and mosses lay water soaked and cool in those higher marshes and their sleepy outlets. These waters necessarily became strong vegetable infusions, that sought slowly the lower, treeless marshes; here among the reeds and coarse grasses, the unimpeded sun's rays poured down the heat necessary to convert those poisoned waters into steaming sources of death. Now the conditions are changed. Our forests are gone. No water lies on our higher levels. The vegetable products of our marvellous soil are no longer left to rot in stream and marsh, but find their way quietly into barn and granary. The waters seeking the marshy margins of lake and river are clear and pure, finding their way quickly through the drains to their destinations. So those once poisonous regions receive pure waters from the high grounds on the one side, and pure water from lake and river on the other. The sources of malarial conditions having become comparatively pure, our marshes have also become wholesome and attractive.

Another cause of the disappearance of malaria from the west (for it has practically disappeared,) is the change in the sources of the drinking water. The open surface wells, almost universal forty years ago, are now fast giving place to artesian, bored or driven wells. In this regard I received kind and valuable response to enquiry from medical men in the various centres of the region under discussion. This change regarding water supply was noted in almost every district, and in several given as an important cause of reduced amount of disease. In regions where open wells are still the chief source of water supply, as in Ridgetown, Wallaceburgh, and in some

of the lumber districts of Tilbury and Raleigh townships, remittent malarial fevers are reported, but these remittent fevers I shall notice later.*

The above mentioned change in the water supply has at least had a marked influence on the prevalence of typhoid.

That drinking water is a direct cause of malarial intermittents is a matter subject to considerable doubt; but that bad water lowers vitality, damaging the power of the human organism to resist disease is a statement that will not admit of dispute. Lowered vitality is one of the greatest predisposing causes of malarial disease, hence the importance of the change, not in relation to typhoid only, but also to malaria, phthisis and other diseases.

I have, through the kindness of Dr. Bryce, been enabled to present you with tables, taken from our provincial health records, showing the percentages of deaths from consumption, typhoid and malaria in different parts of the county of Kent, during the last ten years. Considerable interest attaches to these tables in the light of our present subjects.

* Dr. Sampson, of Blenheim, in a letter to me, said:—I have the recollection myself of an ounce of Howard's quinine given to a man in 40 hours with double pneumonia. I shall always believe that half the amount would not have saved him. I have, many years ago, in a single day prescribed in every house in a little village of two or three hundred people, at the Rond Eau Harbor, where no one now ever has the disease, and where the chief change has been the cutting away of the forest that surrounded the marshy bay, thus letting the wind sweep away and dilute the miasm that the sun in other days could not raise above the tree-tops. Yes, drainage is the greatest enemy to malaria, but the germs of it are still with us in myriad thousands, and for another century, perhaps, it will find them multiplying in every spot where they are encouraged, and for a long time yet the prudent physician will discover the malarial stamp on many a case of mysterious disease. I can assure you the type of fevers has changed much in Western Ontario during the past 30 years. I can still remember the malaria of the early days with its awful aching and the terrific chill and shake that lasted an hour with four or five hours fever, and these all gone often in time for the patient to return to his work before night, or at least he often worked a few hours in the morning before the business began. The day following he would be at his work, and the next day repeat the catalogue of misery. This was the old-fashioned ague and prevailed largely. There was then also much of the true remittent fever, which continued even until recent years. A very severe fever, and often deadly, continuing many days with delirium, serious prostration, and well-nigh all the symptoms of typhoid, but still a purely malarial product, calling loudly for calomel and quinine, and literally scorning everything else. I have, 25 years ago, seen two or three instances of a patient at work, and in an hour the chill and in another hour dead. That much of the pneumonia of those days was related to malaria I have no doubt.

DIAGRAMS showing death-rate per 1,000, from typhoid and malaria, in Kent Co. in 1884-93. The first column in each municipality represents first five years; the second column the second period, and the third the average.

TABLE SHOWING

During pe

Municipality.	
Chatham Town :	
Consumption	
Typhoid	
Malaria	
Wallaceburg :	
Consumption	
Typhoid	
Malaria	
Dresden :	
Consumption	
Typhoid	
Malaria	
Camden Tp. :	
Consumption	3
Typhoid	
Malaria	
Dover Tp. :	
Consumption	33
Typhoid	9
Malaria	3
Ridgetown :	
Consumption	13
Typhoid	5
Malaria	
Raleigh Tp. :	
Consumption	45
Typhoid	13
Malaria	1
Romney Tp. :	
Consumption	9
Typhoid	2
Malaria	1
Bothwell :	
Consumption	13
Typhoid	1
Malaria	

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1. That the death ra
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2. That the consumpti
in nearly all our rural dist

TABLE SHOWING DEATH RATE PER 1,000 OF CONSUMPTION, TYPHOID AND MALARIA.

During past ten years—first and second halves of same.

Municipality.	Total.	Ten years.	First five years.	Second five years.
Chatham Town :				
Consumption	147	1.73	2.03	1.39
Typhoid	51	.60	.67	.50
Malaria	2	.02	.04	....
Wallaceburg :				
Consumption	43	2.02	2.75	1.54
Typhoid	12	.56	.50	.58
Malaria	1	.04	....	.07
Dresden :				
Consumption	29	1.43	1.73	1.06
Typhoid	6	.29	.48	.09
Malaria	2	.09	.09	.09
Camden Tp. :				
Consumption	35	1.12	1.28	.86
Typhoid	5	.16	.17	.13
Malaria	....	....	....	....
Dover Tp. :				
Consumption	33	.74	.55	.90
Typhoid	9	.20	.04	.36
Malaria	3	.06	.04	.09
Ridgetown :				
Consumption	13	.68	.74	.62
Typhoid	5	.26	.12	.35
Malaria	....	....	....	....
Raleigh Tp. :				
Consumption	45	.87	.97	.72
Typhoid	13	.25	.29	.20
Malaria	1	.01	.03	....
Romney Tp. :				
Consumption	9	.68	1.25	.26
Typhoid	2	.15	....	.26
Malaria	1	.07	...	.13
Bothwell :				
Consumption	13	1.39	1.38	1.11
Typhoid	1	.10	....	.18
Malaria	....	....	....	....

Municipality.	Total.	Ten years.	First five years.	Second five years.
Chatham Tp. :				
Consumption	41	.68	.38	.94
Typhoid	4	.13	.06	.06
Malaria	....	....	....	....
Howard Tp :				
Consumption	43	1.33	1.00	1.21
Typhoid	12	.31	.38	.22
Malaria	1	.02	....	.05
Tilbury, East :				
Consumption	17	.57	.39	.72
Typhoid	11	.37	.13	.59
Malaria	2	.06	.13	....
Blenheim Town :				
Consumption	17	1.16	1.57	.81
Typhoid	1	.06	.15	.11
Malaria	....	....	....	....
Harwich Tp. :				
Consumption	31	.49	.43	.56
Typhoid	8	.04	.08	.16
Malaria	7	.06	.10	.09
Orford Tp. :				
Consumption	47	1.29	.91	1.66
Typhoid	5	.13	.10	.17
Malaria	1	.02	.05	....
Thamesville :				
Consumption	2	.26	50	....
Typhoid	5	.65	.50	.77
Malaria	1	.12	.25	....
Zone Tp. :				
Consumption	13	.89	1.00	.71
Typhoid	1	.06	....	.14
Malaria	1	.06	....	.14
Tilbury Centre :				
Consumption	7	.79	.91	.64
Typhoid	2	.22	.45	....
Malaria	....	....	....	....

The special points of interest I would wish briefly to note are :

1. That the death rate from consumption in Kent has, during the above-mentioned period, lowered, and not risen, as might have been expected.

2. That the consumption death rate per thousand has increased in nearly all our rural districts, and markedly decreased in the towns

and villages. The reasons for these rather remarkable facts I will not attempt to discuss, as they will no doubt receive careful consideration in Dr. Bryce's paper.

3. The notable decrease that is shown in death from typhoid during the latter half of the decade here shown is most gratifying, and is no doubt largely due to the above noted change which has taken place in the water supply.

4. The recorded death rate from malaria is to me a matter of surprise. I have practised in the county of Kent for the past thirteen years, and during that time I have never seen a case of uncomplicated malarial fever terminate fatally; more than that, my experience here would lead me to doubt that any purely malarial disease has, in the county of Kent, during the past ten years terminated fatally. Within the past month or six weeks some fourteen or more medical men, practising in the main centres of these counties, have stated without one dissenter, that malarial diseases are fast disappearing from the regions in which they live; several state that they are a thing of the past. A few have stated that malarial intermittents have disappeared, but that remittents still occur during the autumn season. This belief in the existence of uncomplicated malarial remittent fevers occurring in our counties now is I believe a mistake, and is to my mind the origin of those abovementioned misleading records.

It is a fact, admitted by almost all broadly experienced students of malarial poison and its effects, that where the poison is of moderate intensity and concentration, the form assumed by the disease is that of pure intermittent type. While in regions where intense concentration of the poison obtains, intermittents are apt to assume the remittent type, and bilious remittents occur frequently as mentioned in Dr. Gray's paper, read in London before this society.

Now here is a country where malaria has ceased to strike terror into the people, where remittent forms on all hands admitted to be of malarial origin have become a mere matter of history, and where intermittents are fast disappearing. Under such conditions, is it conceivable that malarial remittents should still occur, and that, with severity sufficient to produce death? The tables give twenty-three

deaths from malaria in Kent, during the past ten years; eleven of those occurring during the first, and twelve during the second half of the decade just completed. This would show a rising death rate from malaria in a county where it is universally admitted to be almost a thing of the past. There is not a shadow of doubt in my mind, that these so called "malarial" fatalities may be traced to the remittents, which will, in nearly every case, drop into one of four classes, typhoid, tuberculosis, confined pus, and malaria complicated by disease, which has in itself a decided tendency to death.

In conclusion let me gather up our facts:

1. The forests were to our higher lands an important protection against the production of malarial poison, while being the source of intense poisonousness to our lower swamps.

2. The cultivation of the soil, and early drainage markedly increases malaria for a time.

3. Deep drainage and thorough cultivation, assisted by improved water supply, have nearly banished malaria from our midst.

4. Remittent fevers of a mixed type still occur, especially in regions where the open surface well is the main source of water supply. These remittents etiologically considered, are probably not malarial.

Finally in answer to the question "what means should be adopted to remove entirely what lingers of the malarial evil?" I would repeat what has become obvious to all:

(1) Deepen existing open waterways.

(2) Supplement open drainage by extensive employment of underdrainage.

(3) Keep a jealous eye on the outlet of our drains.

(4) Make sure that our water supply is pure.

(5) Develop agriculture so that our now vast production may be increased, by utilizing every foot of our precious alluvium for heavier crops and wider orchards.

(6) Plant trees along our roadways and line fences.

Let us do these things and we will never allow our peninsula to lapse, like the Roman Campagna, from being our country's granary to into a pestilential plain where no man may safely dwell.

SCHOOL SANITATION.

By J. Dearness, London, Inspector of Schools.

Gentlemen,—It is appropriate that at a meeting of a country's health officers considerable attention should be given the questions that concern the hygenic conditions of the public schools. Through these schools every citizen must pass and that at a susceptible time of life. "As the twig is bent the tree's inclined" is no less true of the physical than of the mental bias received in childhood.

The title of my subject offers a wide and varied choice of topics, but time compels me to choose but a few for notice. To start with the child from the home raises at the outset the question whether the latter is contributing its due share to the promotion of the health of school children. With proper and sufficient food, sleep and recreation we should not hear much of injury from over-pressure or multiplicity of studies, providing that pupils are not sent to school until they are at least seven or eight years of age. I am not one who believes in many or long school tasks to be prepared by home study. Instead of the note at the foot of the usual monthly school report requesting the parents to see that the child does his or her assigned home lessons in the evening it would be better to say: the teacher will guarantee five hours' active application to study daily in the schoolroom if the parent will secure that the child receive three nutritious meals, at least ten hours' sleep and one or two hours' recreation every day. Farmers know that it pays to care for and feed well the young stock on their farm; would that they were equally solicitous to see their children thrive well physically. At no other period in a person's life-time does he need more careful attention to his food, sleep and exercise than during his school days.

There is good reason to believe that Ontario has an educational system, taken all round, not surpassed in merit by that of any other country in the world; and what is a higher recommendation, we are not resting upon our distinction, but are still making progress. Yet I confess to the belief that we are moving pretty slowly along the line

of physical education; in fact, the rising generation, however superior it may be mentally, scarcely promises to be equal physically to the passing generation. Within twenty years I know that school seats, and desks and blackboards are greatly improved, lighting is somewhat better, text-books are better printed, but convenient supply of wholesome drinking water is not more general, outdoor closets are not more healthful, and certainly in the improved substantial school buildings the artificial means of ventilation in vogue are not equal in efficiency to the natural means of those times, when an open fire-place sucked the fresh air through countless chinks in the log walls, while the children wearing thick hodden-gray coats, heavy woollen socks, often two pairs, and stout cow-hide boots, little heeded the sharp drafts that swept along the floor. We learned then without teaching how to make a good use of recess. It is becoming the fashion now in some places to go to the gymnasium for recess. I think the substitution is a mistake. Precise gymnastic movements doubtless afford good training for will, eye, and voluntary muscles, but how do they benefit the involuntary muscular system. Let us have both—a good muscular development and a good digestion. If I may have but one I prefer the good digestion. Cheerful spontaneous play is better for heart and stomach than gymnastics. As a preparation for the next session's lessons I greatly prefer the old-fashioned jolly, rollicking, romping, spontaneous fifteen minute recess to twice that time devoted to club swinging or precise extension motions.

Speaking of recess takes me to the yard, and when there we might, if time permitted, notice the site, the source and supply of drinking water and the outclosets. Respecting the last mentioned the necessity for sanitary improvement is greater than I have words to express at this time and place. I shall only appeal to those officers of the Provincial Board of Health who are present to move that body to have prepared a circular of plans and specifications for the construction, with directions for the sanitary maintenance, of these necessary buildings, and to put such circular periodically in the hands of every board of Trustees. Distribution of such circulars among all the school officers in the province and the consequent improvement of school premises would educate the people generally upon an important sanitary subject.

Lighting.—Have you not again and again heard the remark made—what a large number of children wear spectacles now! I have heard the increase accounted for on the ground that it is the custom now for parents to take shortsighted children to the optician or oculist to have their eyes fitted with glasses—and that formerly this was not the practice. There may be something in the opinion quoted, but the chief reason is doubtless that formerly there was less need to take children to the oculist than now.

Investigation both in Europe and America shows that the disease, myopia, is increasing alarmingly in all civilized countries, and two leading causes are inherited tendency and the unfavorable conditions of schoolroom life. It is argued that inherited tendency counts for much because the examination of children in the higher social ranks, and consequently on the average drawn through a larger number of schooled generations, shows a larger proportion of nearsighted than the peasant and pauper classes of the same ages. In American cities white children show to a great advantage as compared with colored children in respect to nearsightedness.

In Europe some of the ablest scientists and sanitarians, as Virchow and Cohn, Conrad and Pflüger have given attention to this evil. In the United States eminent men like Agrew, Loring, Cheatham, Prout and Lucien Howe have practically studied myopia in the schools of the cities where they respectively reside. Ward McLean in the Popular Science Monthly, (Nov. '77) summarized the study of the available literature on the subject, furnishing reports upon upwards of 40,000 cases, and deduced the following "irresistible conclusions;"

(1) That among youths who have never attended school and among children when they first enter school the percentage of nearsightedness is very small indeed.

(2) That very soon after entering school some children begin to show symptoms of the disease.

(3) That the number of children afflicted and the intensity of the disease gradually but surely increase through the entire school life, from class to class, from year to year, until when colleges and universities are reached in many institutions half the students are more or less nearsighted.

The report made by Drs. Fitch and Kimball, upon an examination of the eyes of the children in the schools of Rockford, Ill., as quoted at a meeting of the National Education Association, gave the following results:

		Boys Myopic.	Girls Myopic.
Children aged	7 to 8 years	.8%	3.1
	9 to 10 "	3.5	5.9
	11 to 12 "	2.5	5.5
	13 to 14 "	6.3	13.0
	15 and upwards	17.7	16.8

If it be conceded that the present conditions of school life tend to produce myopic vision the question naturally arises—are such conditions as produce this evil necessary or irremediable? I think not.

Mere naming some of the conditions suggests a remedy, others are due to faulty architecture of the building, such as wrong arrangement of the windows of the schoolroom, causing front light or dim light. Windows and seats should be placed relatively so that the light may be admitted mainly backward from the left. In an ordinary rural schoolroom they may be massed on the sides in the rear half or two-thirds of the room, the nearest one to the blackboard sufficiently distant so as not to dim or obscure the writing on it by reflection.

Only those windows through which direct sunlight enters should be shaded. Shades should be of light color and the spring rollers bearing them, whether attached at the top or bottom, should always be attached to the sash, not to the frame, and be controlled by a cord that will not permit them to run the entire length of the shade.

Text-books ought to be on good paper, not bluewhite but unbleached, and the type large. I have not much fault to find with our Public School text-books, but the High School text-books are not all above criticism.

Those hard cheap lead pencils used so such now on the scribbling-book paper are ruinous to the eyes.

The position that nine-tenths of the pupils will assume at the desks unless the teacher exercises constant supervision over their attitude injuriously affects the eyes. I submit the question to the medical men here whether the engorgement of the cells supplying

the ciliary muscles caused by the suspended position of the head may not lead to inelasticity of these muscles.

In spite of the utmost care on the part of the teacher to habituate his pupils to maintain a correct attitude, the wretched construction of some school desks or the seating of a child too large, or worse still too small, at even a well constructed desk will cause the child to strain and injure the eyes. Defective seating is chargeable too with malformation of the spine and other bones, and with various injuries to pupils to which I have not time to refer.*

Long home lessons pored over with perhaps imperfect lamp-light cannot but injure the eyes, possibly in some cases contribute to myopia more than all the other causes combined.

To sensitive eyes bad ventilation is doubtless very irritating and injurious. Dr. Loring writes: "I am therefore of the opinion that bad air alone, acting as the primal cause, may set in train a series of morbid processes which may, and often do, affect not only the working capacity and integrity of the eye, but which may lead even to its destruction.

Dr. Loring's remark introduces the only other topic which I propose to take up in this paper, viz:

Ventilation.—Notwithstanding all that has been written and said respecting the necessity for the ventilation of inhabited buildings progress in general education upon this subject seems to be very slow, in fact inperceptible. Usually the ill-effects of bad ventilation which are cumulative and progressive are so remote in time from their cause that the popular mind fails to connect them, and hence the ill-ventilation of schoolroom, church or sleeping room, too frequently a contributing cause, is not thought of when mourning friends stand round the bier of one whose life has declined ere the usual years of adolescence had been counted. "The Lord gave, and the Lord hath taken away; blessed be the name of the Lord" are words not to be pronounced lightly over the grave of a child. I leave it to my hearers to give a name to the mistake that imputes to the Lord the sufferings and death of the little children whom he would have had to perform a miracle to

*Dr. Bremner, Toronto, in the paper given before the Inspectors' Section, and published in the Proceedings of the Ontario Educational Association, 1894, p. 198-201, shows how round shoulders, rotary lateral curvature of the spine and lordosis are produced by defective seats and desks.

save against our indifference to or ignorance of the natural laws of health. Great tragedies, teaching us the deadliness of our own breath, stand out on the pages of history, such as the death of 123 British men and women from eight hours' confinement in the Black Hole of Calcutta, and the death of 260 out of 300 Austrains taken at Austerlitz and imprisoned for a few hours in a cave, and the 90 passengers of the *Londonderry* suffocated by their own breath while the captain during a six-hour storm kept the hatches nailed down. Very probably it was the same agent that caused the Black Assize at Oxford when "speading from the jail there arose such a damp that almost all were smouldered, the jurors presently dying and shortly afterwards Sir Robert Bell, Lord Chief Baron; all died in forty hours, the Lord Chief Baron and 300 more."

The connection between cause and effect was in these dreadful instances sufficiently immediate to prove the truth "that our own breath is our greatest enemy." Multiplied instances are constantly occurring all around us differing from those in degree, not in quality, but yet that difference is so great as to obscure the likeness. Our living-rooms, bedrooms, churches, halls, and schoolrooms are too often reservoirs of foul air. Foul air reduces vitality, weakness, power to resist disease, in fact, causes disease and disease leads to death.

Consideration of certain careful investigations will enable us to understand more intelligently the nature of the vitiation of air that occurs from repeated respiration of it. Samples of out-door air taken at numerous places, at various elevations and at all hours of day and night, show on analysis a composition, varying within a very small range of:

Oxygen	20.96 per cent.
Carbon dioxide.....	.03 "
Nitrogen	79.01 "

besides vapor and traces of other gases.

In bad localities of large smoky cities it has been found that oxygen fell from 20.96 per cent. to 20.80 or 20.70, and the carbon dioxide went up from .03 to .07 or .08 per cent. Dr. Angus Smith found the average of 339 analyses of coal mines' air to be 20.26 per cent of oxygen and .78 per cent. of carbon dioxide; in places where

some of these samples were taken, candles went out, and men could not remain longer than ten minutes at a time.

Even this bad mines' air is pure when compared with breath as it issues from the lungs. Pettenkofer's extensive researches and analyses are generally accepted. He showed that expired air, dried, contains:

Oxygen	15.56 per cent.,	decrease of one fourth.
Carbon dioxide.	4.34 "	increase of 140 fold.
Nitrogen	80.10 "	slightly increased.

Death would quickly ensue in an atmosphere containing 20 per cent. of carbon dioxide,* but it is uncertain what proportion of carbon dioxide may be endured for the space of a few hours; Forster remained ten minutes in a room charged with four per cent., and Pettenkofer remained hours in a room with one per cent. liberated by the action of sulphuric acid on bi-carbonate of soda. But while he writes that he could remain hours in the artificially charged air, he is careful to state that air contaminated with one per cent. of carbon dioxide, due to the respiration of human beings would be almost intolerable.

The peculiar nature of respired air must be noticed here, for while the degree of vitiation is measured by the proportion of carbon dioxide, that is not the most poisonous substance present. The change effected in the air by its circulation in the lungs is not only loss of oxygen and increase of carbon, but there is also a portion of organic matter which may be shown by chemical tests to be nitrogenous and oxidizable. It is this organic matter that produces the foetid smell characteristic of inhabited unventilated rooms, and which was the really poisonous agent in those dreadful fatalities instanced from the pages of history. In addition to the organic matter respired other impurities are poured into the air of the schoolroom by insensible perspiration, by preventable uncleanliness of the person and clothing of some of the pupils, by dispersion of dust from the floor and walls and by chalk dust from the blackboard.

It has been found that in inhabited rooms when the proportion of carbon dioxide rises from .08 to .10 per cent. the organic impurities of the air are recognizable by the sense of smell, and further that

* See Dalton's Physiology, page 227, 4th Edition.

the same sense can but scarcely or not at all distinguish .10 per cent. from greatly increased degrees of vitiation by breathing. Again presence for a brief time in a foul atmosphere dulls the sense of smell so as to render impurity imperceptible. These causes conceal from us the cognition of the foulness of the air we are taking into our lungs and the danger of remaining in it. In this inventive age what a boon it would be were some one to invent a practical foul-air alarm that would warn the householder of the entrance of that most deadly and unseen enemy of human life—sewer gas, that would stop the schoolroom recitation or interrupt the minister even in the middle of his prayer by setting up a loud incessant whirr-r-r for fresh air. Think of a minister preaching on the sacredness of life in a crowded unventilated house while he and his hearers are busy killing each other by the poison of their own breath. I heard of a case that occurred near my own home. A Sunday schoolroom was crowded by the attendance at an entertainment one cold evening. With closed doors and windows the programme was proceeded with; by and by the lights grew dim and suddenly became extinguished. At this juncture the chairman arose and calmed the rising fears of the nervous ones by the assurance that there was no cause for alarm, it was only the foul air. No doubt the meeting was regarded a very successful one. It was certainly successful in showing the necessity for education of the people upon the importance of breathing pure air when they tranquilly remain in a room breathing air so foul that the flame of the lamp perishes in it. In a certain schoolhouse, close, well built, below the average height of ceiling and cubical capacity there were over 40 pupils in attendance. The inspector on the day of his visit found the ventilation very bad, and notified the trustees that the regulation laid down in the school law requiring provision to change the air in the room three times per hour should be carried out. The question of ventilating the schoolhouse was submitted to the annual meeting, the vote against ventilation stood 28 to 1. To maintain, in winter, a supply of pure air in a well-built dwelling costs money, and it would seem that the majority of our people do not yet know well enough the value of pure air to be willing to pay what it costs.

When we appeal to some school trustees and ratepayers to provide ventilation, we are met with such objections as: "There are not any

complaints of the children taking sick in school; children are young and can stand a good deal, the bit of bad air they get between recesses won't hurt them; they are to blame themselves, they keep on more fire than they need; they have far better schoolhouses than we had and the foul air never hurt us."

One may marvel that intelligent men could not even while they utter the words last quoted, perceive that the close substantial buildings erected now need artificial means of ventilation far more than the loose frame or log buildings in which they went to school. How general and long-lived seems the fallacy that cool air and pure air are identical. Even teachers who ought to know the difference are occasionally known to close the stove damper when they have been told that the air in the room is not good. To make bad matters worse, ventilation by the stove, the only means in the room, was shut off. I heard a teacher severely criticized because in the winter "he opened the windows and shoved more wood into the stove." Another common fallacy, probably honestly entertained, is that the ills, if any, arising from confinement in foul air during school hours are corrected and cured by breathing pure air outdoors and at their homes. Every experienced teacher can recall instances of delicate children who could not stand the conditions of schoolroom life. Again and again such have assayed to attend school regularly, but soon headache, or sleeplessness, or vertigo, or loss of appetite, or symptoms of other disease have constrained parents to take them from school. In a well taught school, hygienically furnished, I believe there would not be a single example of withdrawal on account of ill-health caused by the conditions of schoolroom life. On the contrary I have no doubt that social study and social recreation, reasonable in amount and appropriate to the age are conducive to children's health of body and mind.

But even though sickness were not produced by lack of ventilation the cost of providing it would be amply and doubly repaid in the more rapid and satisfactory physical and mental growth of children. No problem is solved, no fact is learned, not even a word is spoken without the appropriation of some oxygen. The purer the air breathed the purer the blood; the better the blood, the more easily and effectively can the child acquire, retain, recollect and reason. When the ideal days come parents will be as solicitous that the schoolrooms be supplied with pure air as with good teachers.

Were further argument in favor of ventilation needed, I could point to the rapidity with which infectious diseases have spread in unventilated rooms, and I would even at the risk of wearying you quote from official returns to show that teachers are of all classes the most subject to pulmonary and bronchial troubles, but that I trust, Dr. Bryce, will, in his paper on consumption, dwell at length on the share that the present conditions of school-life exert towards the development of that dreadfully prevalent disease.

I heard Dr. Oldright, a former officer of this Association, quote the Rev. Mr. Fairfield's adaptations of the congregation's appeal to the sexton. Part of that will bear repetition here:

O janitor of the schoolhouse, which sweeps,
And dusts (or is supposed to dust), and makes fires,
. . . there is one commoddity
Worth more than gold . . .
Worth more than anythink except the sole of mann—
I meen pure air, janitor, I mean pure air!
O, it is plenty out o' doors, so plenty it doant no
What on airth to do with itself, but flies about
Scatterin' leaves, and blowin' off men's hatts,—
In short, it's jest as free as air out dores.
But, O, janitor, in our schoolroom, it's scarce as hen's teeth.
U shut 50 girls and boys,
Spechally the latter in a tite schoolhouse,
Sum has bad breths, none ain't too sweet,
Sum is fevery, sum is scrofulcus, sum has bad teeth and sum aint over cleen;
But every one of them brethes in & out and out & in,
Say 50 times a minit, a thousand and a half breths an hour;
How long will a house full of air last at that rate,
I ask you? Say 15 minits, then what?
Why then they must brethe it all over agen. And wats more
The same indivíddible doant have the privilege
Of brethin' his own air and no one else's;
Each one must take whatever comes to him.
. . . air is the same to us as milk to babes.
Or water to a fish, or pendulums to clocks,
Or boys to girls. Air is for us to brethe,
What signifies who teaches if I can't breathe!
What's professors and professoresses to children who are half ded,
Ded for want of breath! . . . Let me beg of you
To let a little air come into our schoolhouse,
It luves to cum in where it can get warm,
And O how it will rouse the children up!
And spirit up the teacher and stop gapes
And yawns and fidgits! . . .

With the data supplied us by scientific investigations, it is not difficult to determine what quantity of fresh air must be drawn into a room occupied by a given number of persons to maintain the degree of vitiation below a given proportion. Approximately the depletion of oxygen proceeds as follows:

Each inspiration uses from	20 to 30	cub. in. of air.
16 to 18 inspirations per minute	480	"
50 persons "	24,000	"
50 persons per hour	1,440,000	"

20.96 per cent. of the inspiration is oxygen.
4.60 per cent. of the inspiration is oxygen abstracted by the lungs.

Hence fifty persons deprive the air of from 44,000 to 66,000 cubic inches of oxygen per hour.

But while the air is becoming impoverished of its oxygen, it is with almost equal rapidity being loaded with carbon dioxide, the rate being 4.3 per cent. as shown before and hence amounting to from 40,000 to 60,000 cubic inches of the latter gas.

Besides the above changes there is added an indeterminable amount of organic matter.

Various authorities on hygiene place the limits of allowable impurity of the air in dwelling rooms at from .07 to .10 per cent. of carbon dioxide. The Ontario School Law allows each child a minimum cubical capacity of 250 cubic feet; .07 per cent. of that space is 302 cubic inches. The child is respiring from 800 to 1,200 cubic inches of carbon dioxide per hour, and the original and incoming air contains .04 per cent. of its bulk of the same gas. The problem is, how much air bringing in .04 per cent. of gas will keep 250 cubic feet below .07 or .10 per cent. while the child is adding to the gas at the rate mentioned above.

Following Prof. Heymann's formula based on an exhalation of 900 cubic inches of carbonic dioxide per hour to keep the air below .07 per cent. of impurity, would require 3,035 cubic feet of inflow per hour; below .10 per cent., 1,270 cubic feet per hour.

The Ontario School Law directs that ventilation should be provided to change the air in the room three times per hour, or once in twenty

minutes. The greater allowable degree of vitiation, *i.e.*, .10 per cent. (= 1 part in 1,000), requires 423 cubic feet of fresh air per child in twenty minutes or 21,166 cubic feet in the same time for 50 children.

But allowance may be made for what is called "natural ventilation." This varies greatly according to the several circumstances, the most important one being the material and finish of the walls. Lang estimates the permeability of a brick wall to air at 99 cubic feet per hour for each square yard. Making the most favorable allowance for natural ventilation an ordinary rural schoolroom of 12,500 cubic feet (50 times 250 cubic feet) capacity would be tolerably ventilated, with provision to introduce and remove 10,000 to 12,000 cubic feet of air every twenty minutes.

To remove 10,000 cubic feet of air in 20 minutes, the flues should take away 8⅓ cubic feet per second. It is not difficult to set up currents in smooth flues moving at the rate of 4 to 4½ feet per second. Hence the minimum size of the ventilating flues of schoolroom attended by fifty pupils should be a cross section of two square feet.

The foregoing facts have been duly considered by engineers and architects when planning large school buildings in cities and towns which are to be heated with hot air, steam, or hot water, but very little has yet been done towards the proper heating and ventilating of the single roomed rural schoolhouses in which two-thirds of the children in the province are receiving their education.

In the two or three months of the school year when a fire is not needed, very satisfactory ventilation—precaution being taken to avoid draughts—can be secured by means of open windows and doors.

It ought to be made an Inspector's duty to test at least once a year whether the window sashes can be raised or lowered. If the upper sash has not been hung on weights a cord may be passed from a staple in the middle of the lower bar of the upper sash to a pulley in the frame above, by means of which the sash may be easily raised and lowered by a person standing on the floor. A board about four inches wide should be fitted closely against the upper part of the

upper sash so that the latter can be lowered sufficiently, even on the windward side, to make an opening between the sashes, allowing an upward draft between them without allowing the wind to blow directly in and produce a dangerous draught.

The following simple plan of heating and ventilating a room (see diagram), using the old-fashioned box stove as a heater, may be applied in either new or old one-room buildings. The principle consists in heating fresh air in a jacket constructed upon the back half of the stove and drawing off foul air at the floor through flues which obtain their draft in a drum lying upon the horizontal stove-pipe.

This appliance not only warms the room evenly and ventilates it, but, if the dampers and controls are properly employed, less fuel will be consumed than before the flues were put in.

The jacket to supply the warm air should be made to embrace the back half of the stove leaving an air passage of four or five inches on the sides and end, and to fit closely to the floor. Heavy galvanized iron should be used for the jacket (No. 22 at least) and the sides should be braced against the stove. The top of the jacket may be left open or wire-screened, but it is found to give a warmer, stronger current if it is continued into a drum around the lowest length of the stove-pipe, as shown in the diagram. A slide or door may be put in the top or front, but one must be made on the side, or better, one on each side, as large as practicable, to be left open at night when the fresh air supply is shut off, or when children come in with wet, cold feet and need access to all the heat-radiating surface they can get.

Pure out-door air is conducted into the jacket by flues usually made by boxing in two of the floor joists to an opening under the stove. A slide of galvanized iron is used to shut off when desired, or to control the quantity of fresh air admitted into the jacket. If a pair of joists are boxed through from side to side of the schoolhouse, an interceptor must be placed in the middle of the passage to divert the current into the jacket. All wooden parts below the stove must be lined with tin or zinc. No part of air space in jacket or inlet flues

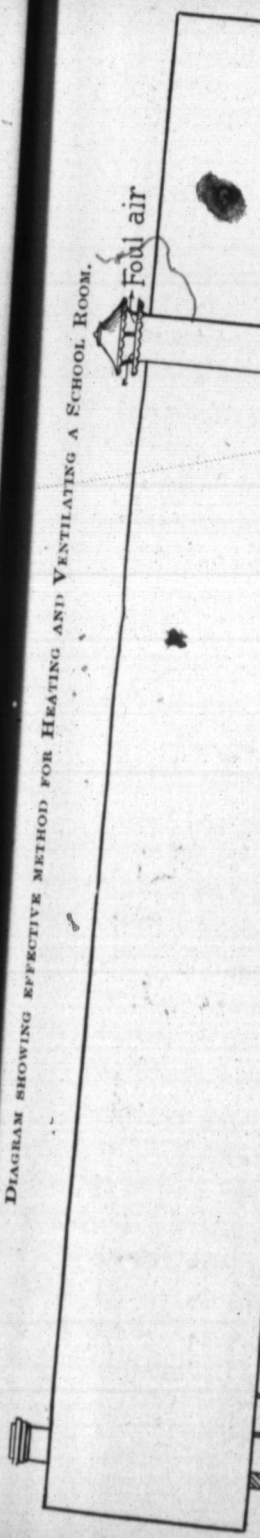

DIAGRAM SHOWING EFFECTIVE METHOD FOR HEATING AND VENTILATING A SCHOOL ROOM.

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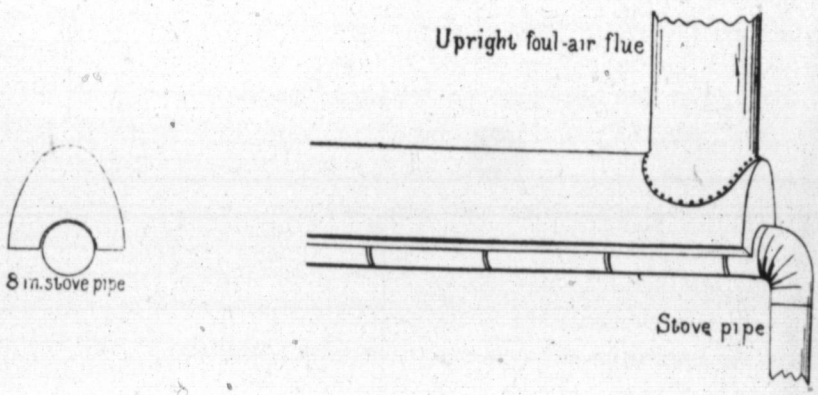
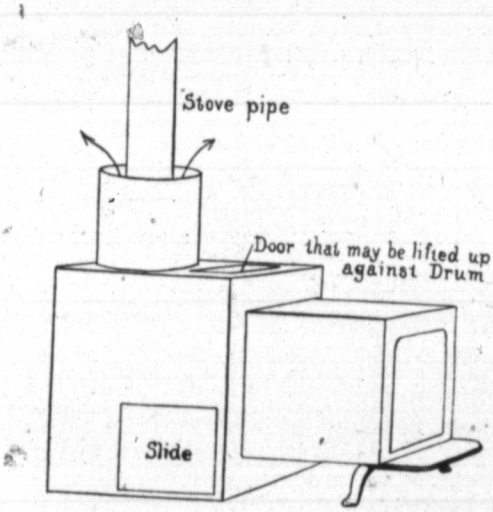
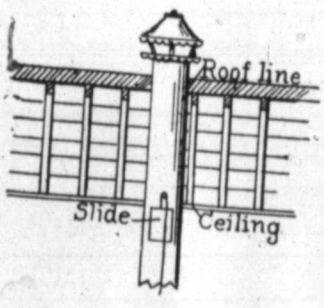






should have less than 200 square inches in area of cross section; outlet flues must be larger to allow for expansion of air in heating.

To get force to draw the foul air out of the room an inverted U-shaped drum is made to lie along the upper side of the horizontal stovepipe. This drum should be laid on the hottest part of pipe and from it a flue be carried up through the ceiling and out through the roof, as shown in the plan. The foul air is taken to the U drum by a pair of flues, one on each side, carried from near the floor up along the wall and horizontally across to the drum. A convenient shape for the upright part of the flues is oblong, 24x6 inches, the part carried across may be circular, 13 or 14 inches in diameter, and an interceptor should be placed in the U drum between the entrances of the horizontal flues. Each upright flue should have a (ratchet) damper to close it at night and to control the draught during the day. A slide in the central upright flue at the ceiling may be opened when the room becomes too warm, or used as a summer ventilator. The foul air flues throughout may be made of lighter iron (No. 26 or 28) than the jacket, and should have an area in cross section of two square feet.

In new schoolhouses a ventilating flue of say one square foot may be provided for in the chimney. In that case smaller flues on the sides will do, say 6x15 or 20 inches each, and these may be placed nearly opposite the elbow of the stovepipe and the central upright put at the opposite end from that shown in the plan.

All openings leading to the outside should be kept closed when the schoolroom is not occupied, and at such times the slide on the side of the jacket should remain open.

A ventilating appliance like or nearly like that described above has been put in several schoolhouses in my division. The cost has varied from $38 to $60. When the details are properly constructed and the slides and dampers controlled according to their intention, not only is the room ventilated but every part of it is evenly warmed; the jacket screens these pupils seated near the stove from being blistered. The quality of the heat is partly conveyed, as in

the case of a hot-air furnace, and partly radiant from the uncovered part of the stove and from the stovepipes, the heating is therefore more healthful than that from a hot-air furnace alone. It takes less fuel than the latter because no heat is lost in the basement. One of the trustees of Rosemond school told me they had burned but little more than half as much wood in the two winters since the ventilating apparatus was put in as they had burned in the two preceding winters. Where fuel is expensive it pays to provide double windows.

A ventilated schoolroom cannot be comfortably heated if open spaces under the doors, or cracks in the floor, or loose wainscoting tacked over unplastered brick permit frosty draughts to enter and sweep along the floor to the mouths of the flues. A room ventilated by flues cannot be made too close against the entrance of the frosty wind except by the flues entering the hot air chamber.

I have dwelt at length upon the subject of ventilation, believing it at present to be the one of most paramount sanitary importance to our rural schools. Pure air in the schoolroom and sleeping-room is essential to the robust health and mental vigor of the rising generation. Principal Austin pertinently asks, "Of what use, so far as life is concerned, is culturing highly the mind, if the body is too weak to bear the strain and pressure of life's battles? Of what use garnishing the jewels till their resplendent lustre dazzles the eyes of all beholders if both casket and jewel are so soon to be thrown into the pit? Why be anxious to increase the size and value of the cargo if the vessel is so poorly built that the storms will surely wreck her in mid-ocean?"

I heard Dr. Stanley Hall say at the N. E. A. meeting in Toronto a couple of years ago that investigations respecting the effect of school life on children carried on in different countries, show results which are appalling. They show a percentage he said of various kinds of ill health, 33, even 40, not to speak of seeds of ill health as yet indiscernible. He said in effect that the idea is beginning to dawn that health is the highest criterion of an educational system, and that if a school system injures the body it is bad, no matter how much good it may do the mind.

NOTES ON SCHOOL SANITATION.

By George T. McKeough, M. D., Chatham.

Gentlemen.—In setting down these desultory impressions and casual suggestions in reference to the hygiene of schools and school life, I am aware that I am probably reiterating thoughts and ideas that have been written about and talked of by much more experienced investigators and sanitarians.

But when we consider that the present generation spend at least one-fourth of their probable lives in schools, and that during the formative and developmental period of life; that health is an essential condition of the fullest bodily and mental work, a prime factor in the making of happiness, and an inheritance which should be transmitted unmortgaged to succeeding generations, the vast importance of the subject is at once comprehended and is my only apology for calling your attention to some points in connection therewith.

"Though old the thought and oft expressed."

There is a feeling abroad or at least a query in the minds of many parents whether or not our children are being overworked in the schools, whether the overpressure is not undermining the health and constitution of the children. Some go so far as to state that our system of education is entirely wrong, and requires modifying or rearranging, that examinations are too frequent and exacting, that the studies required are too many and excessive, that the teachers are oppressive, and that there are various other causes connected with the education of our youth tending to injure their health and strength.

This is the age, apparently, of examinations, and it is a question for the educationist, rather than the sanitarian, whether the kind and degree of preparation necessary to pass these examinations are compatible with true education, genuine study and true and efficient

work. For these, true knowledge is necessary, and thorough knowledge cannot be acquired by any mechanical habit. "It should be a living part of the living mind growing and developing as it is properly fed and exercised," and it is questionable whether the excessive training and cramming for the various grade examinations as at present exist in our Public and High Schools is conducive to the highest development of the mind; while the memory, which at the best is limited, may be improved and made more retentive; it may be at the cost of injury to the other mental faculties. Education should have higher aims than simply the memorizing of certain facts; the mind should not only be taught to observe, reflect, reason, judge and act, but to employ their powers in studying the problems of life and striving after their solution.

The course of study, however, in our schools to-day, I do not believe is too rigorous or detrimental to the health and longevity of our children. It is a principle, and a proper principle, in our public school work that it should afford the greatest good to the greatest number. The course of study is not arranged for the weak, sickly child, who cannot attend school regularly, but for the requirements of the vast numbers of robust, healthy children; and because there are an unfortunate few who are not able to avail themselves of the great privileges offered, and this should be used as evidence that the course of study is too severe and incompatible with health. Overwork in our schools and in life generally is one of the fashionable pretences of the times; but children, in my experience, are rarely injured by over study; they may certainly be injured by being kept in schools too long, or in schools overcrowded, with bad ventilation, defective heating apparatus, and other imperfect sanitary arrangements, but rarely by over study. Intellectual activity does not shorten life; the man, woman or child who exercises the brain as well as the body is likely to live longer than one who allows either to remain dormant. The brain, of all organs in the body, is perhaps the most easy rested, and if the health of the body be maintained, the brain will look after itself. Myopia, or shortsightedness, which

is said to be on the increase in children, has been blamed to over-studiousness; but Dr. Vaughan, Dean of the University of Michigan, and a high sanitary authority, asserts that shortsightedness in the children of our schools is due to improper sanitary conditions and not to over study.

If our school children have sufficient and proper physical exercise, not too long hours, plenty of holidays and properly constructed schools with every known sanitary requirement that science has divulged, we need have no fear of their being injured by over study.

Sir James Crichton Brown says "that education should be conducted upon sound physiological principles. The dual nature of humanity should always be held steadily in view; bodily vigor must not be sacrificed to the attainment of mere intellectual acuteness, and the cult of culture must not be altogether subordinate to the worship of the great god Biceps." It is necessary to steer safely a middle course, and our schools will send out men and women prepared to be not only men and women of thought, but of action likewise; to be good and useful citizens, to make the very best use of such faculties as they possess, and to draw from life the happiness that life never fails to yield to all those who have learned how to live truly. It has long been admitted that one of the first conditions of success in life is to be as Herbert Spencer has put it, "a good animal"; but we can now go further than that and affirm that muscular exercise is essential as a stimulus to brain growth. There is reason to believe that there are tracts in the brain that do not grow properly if the muscles over which they preside are not duly and properly exercised, and as these tracts have mental as well as motor functions, it has been considered by physiologists quite possible that if muscular activity is curtailed, brain evolution and intellectual development becomes stunted.

It should, therefore, be an important part of the duties of the teachers of our schools to attend to the proper development of the bodies of our children as well as that of their brains. During that period of school attendance known as recess, about the advisability of which there has been so much controversy, the children should be

under the supervision and training of the master as much as during the hours of study. The presence alone of a teacher on the recreation ground would have a decidedly salutary effect and most of the objections raised against the recess would be removed. Better discipline could be maintained; most of the cases of corporal punishment required are the result of discussions and conflicts between scholars during the recess; it would prevent bullies tyrannizing over younger and more delicate children, and it would have a wonderfully beneficial effect on the morals of the children. Their amusements, games, etc., could be better directed, and proper exercise during this period of recreation would overcome the monotony and tediousness of study, and there would be less complaint of overwork in the school-room. The ideal system of education is, I believe, alternate periods of study and physical exercise.

Attached to all schools, unless a large, dry, well-ventilated basement is available, there should be a large outbuilding covered and properly ventilated, such as we have connected with one of our schools in Chatham, where in inclement and stormy weather gymnastic and calisthenic exercises, Swedish movements, etc., could be indulged in by the scholars under the direction of a teacher. Far more disease is contracted by children improperly and insufficiently clothed being exposed during recess in cold and wet weather than by overwork in their studies.

I frequently hear it stated that there are too many school holidays. Many parents are often eager to get their children out of the way and throw for a time the responsibility and care of them on some other shoulders by sending them to school. This I firmly believe to be a mistake, and instead of increasing the number of school days they might be with benefit lessened, especially during the first week or two of September, when we usually have some hot and very oppressive weather. At all events the teacher in the country, who is taxed often more than the teacher in town and city and with fewer opportunities of change and recreation, should be put on the same basis as teachers whose duties are performed in towns or cities. Dr

Vaughan states that the average child grows more in the two months' vacation than he does in the ten months of school work. This statement is made from statistics based on the examination of 10,000 children in Sweden.

In this country the old log schoolhouse has long since given way to the more pretentious frame building, which has, however, been erected without the slightest regard for sanitary laws. Within the past decade in the better settled and more wealthy parts of the community a number of pretty brick buildings have been erected, but a certain amount of architectural beauty and outside decoration has seemed to actuate the trustees in their building operations rather than hygienic requirements and improvements. The school board usually leaves these matters to the architect, who in many instances is not competent. It has occurred to me that it would be well if the Provincial Board of Health would secure a number of plans of school buildings of various cost of construction to correspond with the financial position of the different boards of education, the plans to call for and insist upon all the latest sanitary reforms and requirements, or the plans of every new school building should be submitted to some authorized sanitary authority for examination and correction if necessary.

Some useful information as regards school sites and school buildings are given in the departmental regulations, but they are scarcely sufficient and are rarely carried out.

The school site should be in the most beautiful locality in the town or district and one surrounded by no influence hostile to perfect health. The spot should be thoroughly well drained. If in the country or town in which there is no water supply, care must be taken that a plentiful supply of pure water can be obtained easily. There should be no pools or ponds of stagnant water in the vicinity. It should not be near any railway station or noisy factory or establishment from which issue offensive gases.

The school yard should be ample in size, but not a dreary waste. A portion of it should be tastefully ornamented with shade trees and

flower beds. The school buildings, whilst not excessively or vulgarly ornamented, should not be uninviting externally, nor cold, dingy and repulsive within, but should be surrounded without and so arranged inside with those appointments that would not only render their health and constitutions unimpaired but would tend to cultivate the higher and better taste of the children. The schoolroom should be made not only the healthiest but the brightest spot of the child's life. A powerful and beneficent influence is exerted upon the mind of a child by pleasant surroundings, both from a hygienic and moral point of view. A childish nature will thrive better amid pleasant and cheerful environments, habits of cleanliness are more easily inculcated, a love for the beautiful cultivated, and a more cheerful and happy temper will be promoted. Would it not be well in this community that Arbor Day be revived or more generally observed?

Of the unhygienic conditions of the school the most important relate to improper lighting, inadequate or excessive heating and defective ventilation.

Shortsightedness is due in most instances to imperfect and defective lighting of schools. The proper rules for lighting schools and public buildings are pretty well recognized. Light should always be admitted at the rear and on one side, preferably the left, and thoroughly diffused. Pupils should never be allowed to face the light, nor should the eyes of pupils be subject to cross rays, by having windows on opposite sides of the room. Windows should be at least four feet above the floor, because light entering at the level of the eyes only dazzles and is useless for illuminating the tops of the desks.

The windows should extend to the ceiling and should equal one-fifth of the floor surface. Teachers should be constantly on the alert to detect any symptoms of shortsightedness, as they are in a position to observe this malady before it would be noticed by the parents, and at once inform the parents of the defect and of the necessity of giving it immediate attention. But most important of all probably and the most difficult to obtain is the satisfactory ventilation and heating of the schoolrooms.

It seems strange that at this stage of our civilization it should be necessary to say anything regarding the importance and necessity of pure air and the correlative necessity for the prompt removal of vitiated air. It has been said with some truth that man's worst enemy is his own breath. If one were to breathe into an empty jar until all the oxygen it contained was exhausted and the carbonic acid gas from one's own breath taken its place and then to place a lighted match in it the flames would almost immediately go out because there would not be enough oxygen left in the jar to keep it lighted. If a small animal was placed in the jar its life would become extinct for the same reason. So to leave the air unchanged in an average sized schoolroom for more than half an hour is to render every portion of it unfit for respiration, *in fact injurious and poisonous.* The children will soon suffer from headache, restlessness, lassitude, debility, impaired digestion, in a condition unfit for study or learning, but in a proper state to become the receptacle of any germs of disease contaminating the schoolroom.

In any system of ventilation there must be a place for pure air to enter and a place for foul air to escape, and this should be constantly going on without any intermittance. No very complicated appliance is required for this purpose, provided the flues are of sufficient size and their relative position such as to insure the proper diffusion of the pure air before its exit. In mild weather doors and windows can be allowed open for the introduction and removal of air, but in cold weather this is impossible, and if other avenues of sufficient capacity are not provided the teacher's intelligence and skill will be sorely taxed to keep the atmosphere of the room fit for respiratory purposes. One can scarcely imagine a more deplorable condition of affairs than a room filled with young children heated by a stove and depending upon lowered windows in midwinter for ventilation; yet most of the schools in this progressive town, which prides itself upon the character of its schools, are heated and ventilated in this way. The temperature of the room should be such that every occupant is comfortably warm, whatever part of the room

he may occupy. With a stove in the centre or at one end of a room this is impossible.

No more defective plan of heating a room than this could be devised. Those in the immediate vicinity of the stove are too warm, those near the walls are too cold. The Smead system with which one or two of our schools are heated is not unsatisfactory so far as it relates simply to heating and ventilation, but so far as it is connected with the disposal of excreta, it is most objectionable and dangerous. It is unsafe to have fecal matter which may be loaded with the germs of typhoid fever or other dread contagious disease in a room with children. Besides, the excreta in the Smead system is dried, and any germs which it may contain are carried up into the air in a condition to be distributed and contaminate the surrounding neighborhood.

The ideal method of heating and ventilating public buildings is yet to be discovered, but much progress has been made towards perfection.

Some authorities maintain that the most perfect system of heating is by steam or hot water, with an artificial or mechanical method of moving the air; others claim that the proper solution of the question is the connecting of the system of heating and ventilation into one. The advantages of steam and hot water for heating is that they will not give off any of the gases that arise from the combustion of fuel. With the hot air furnace on the other hand, it is difficult to construct one that will not leak carbonic acid. Still the hot air furnace is much to be preferred to heating by stoves, which simply heats the air that is in the room and provides no way for its removal. Time, however, will not permit going more fully into the advantages of one system over another.

The school is the centre at which every portion of the community, and all classes and conditions of children and homes are represented. It is the centre more than any other that germs of contagious disease are likely to be carried to and from it spread and scattered among

children absolutely secure at home. Too much care cannot be taken by teachers and health inspectors to guard against the possible entrance into and from it of contagious disease. In this respect great regard should be had for the proper cleanliness of the school. The school building itself, the yard, outbuildings should be kept free from everything that is unwholesome and offensive. The schools in Chatham are swept thoroughly once a day, but only washed and scrubbed twice a year. This is not sufficient, the wood-work of all schools should be washed once a month at least, and a thorough disinfection by the health authorities should be carried out once every three months. The walls of a school room should never be papered or white-washed, but painted and rendered impervious and polished so that they can be washed, cleaned and disinfected, and not allowed to become saturated with organic matter from respiration, and possibly infected with germs of disease.

The seats of a school are important factors both in the comfort and health of the scholars. They should conform to the curves of the body and should be of a height suitable to the occupant; the child's feet should always be placed firmly on the floor and never allowed to dangle, and the desks should be arranged so that an erect posture may be assumed while writing upon them. Single seats have so many advantages that they should always be used.

At the risk of exhausting your patience I wish to add a word as to the responsibility of the parents. The duties of the parent are important in the preservation of good health in the child during school years. They should see that they are clothed properly and comfortably; that they will not reach school in inclement weather with wet feet. They should see that the children when out of school should have plenty of physical employment and not spend their hours in idleness; good reading should be in every home and none but of a high literary and moral character should be permitted in the hands of children. Children's parties which rob night of its sleep and the body of needed rest, excite unduly the nervous organization, overload their digestive organs with material of food ill

fitted for them, are potent causes of ill health ; besides, after a night's festivities, pupils come to school exhausted and often better subjects for the sick chamber than for the school room. These and many other features of modern child life under the control entirely of the parent, are the cause of more breakdowns and bad health among the rising generation than overwork at school.

In conclusion let me say that whatever promotes the physical welfare of the school children is a public blessing, and whatever tends to a contrary effect is a public calamity.

HOW CAN WE LESSEN CONSUMPTION?

By P. H. Bryce, M.A., M.D., Secretary of the Provincial Board of Health of Ontario.

Mr. President, Ladies and Gentlemen,—As many of you are aware, there has gone on within the last few years much discussion of, and increasing interest in, not only the question of the curability of consumption, but still more concerning that of its prevention. These discussions, I think, may be said to mark the commencement of a new era in the history of this disease, which from the earliest times has seemed by its very name to tell the story of progress toward an issue as certainly fatal, as if the Fates had spun their webs around its unfortunate victims.

At times during the last century a belief in the contagious character of consumption existed, and in Italy and Spain even legal enactments were made, and lazarettos for the isolation of cases of consumption were established, in the same way that leprosy has been dealt with in the present day. Never, however, till the present, has the idea of the curability of the disease had any important place in medical or public opinion; and hence with Christian resignation and fortitude, we have been accustomed to bow in sadness to the hand-writing on the wall, proclaiming the death decree as certainly as the silken cord from a modern Sultan, or the fatal gift of a Roman Nero.

But we have begun to take courage and, in some slight degree, perhaps, to shake off the shackles of custom, or belief, and from the observation of facts to verify the truth of the words of the fabled Iole, speaking in loving pity to the divine Hercules. "Nothing good is ever reached without labour; nothing great is ever won without toil. If thou seek fruit from the earth, thou must tend and till it; if thou wouldst have the favour of the undying gods, thou must come before them with prayers and offerings; if thou longest for the love of men, thou must do them good." And to these holy words Hercules bowed his head and sware to follow her counsels; and so aptly do the labors of this mythical hero of antiquity, to whom the "Father of the Gods" foretold "Thou shalt be the mightiest of the sons of men," illustrate the answer

to the question we are discussing to-night that I shall, as opportunity occurs, endeavour to teach wisdom through the words of the oracles of that olden time.

There may be present to-night some who in younger days have lived in some of the densely populated districts of an European city, such as Liverpool or Glasgow, or who have known life in some of the fishing villages along the British coast. They will remember seeing not only consumptive-looking women and men moving in and out of their cold, dark and comfortless dwellings, but here and there also, large-headed children, knock-kneed and hunch-backed, wandering up and down the wynds and closes—wretched and melancholy specimens of an hereditary taint, cultivated and developed in these congenial haunts of disease. Such are consumptives and their children. Since the days when some here knew these old country towns many changes have been brought about. Whole rows of old buildings have been pulled down; the pig from the parlor in the seventh storey has been unceremoniously removed by way of the window, and many model tenements have taken their place. But even in Glasgow, with its many improvements, according to its Health Officer, Dr. Russell, there was the following mortality in 1888.

DEATH RATE PER 1,000 OF POPULATION.

	1 and 2 Roomed Houses.	3 and 4 Roomed Houses.	5 Roomed and Upwards.
Zymotic Diseases.....	4.78	2.46	1.14
Acute Diseases of Lungs (with Consumption)	9.85	6.09	3.28

Coming nearer home we find, in keeping with our more intelligent, more industrious, and better fed people, not crowded together in any great degree, a higher degree of freedom from consumption, taken as a province; but having, nevertheless, one death from consumption in every nine deaths in the province, and in certain districts an increase over the average for the whole, so marked and distinct as to cause us to examine carefully into the causes for this increased mortality. For comparison I have had tabulated the

total mortality in some of our cities over a series of years, as well as the relative amounts of consumption in them. Here are some of the results in the year 1892 :

Cities in Ontario.	Deaths per 1,000 from Consumption in 1892.	Cities in Ontario.	Deaths per 1,000 from Consumption in 1892.
Toronto	2.4	Belleville	1.4
Windsor	2.7	St. Thomas	1.4
Kingston	2.2	St. Catharines	1.3
Hamilton	1.8	Ottawa	1.2
Brantford	1.7	Guelph	0.9
London	1.6	Stratford	0.8

The relative positions of some of these cities in the matter of consumption are at once made apparent, both in their proximity to the Great Lakes, in their low level, in the relative flatness of the soil, and in their relatively more imperfect drainage. I need not dwell exhaustively on the point, since the subject has been fully dealt with by my friend Dr. Duncan, in the paper read by him this afternoon. The statistics then given by him, supplied from tables I have had collated, illustrating the diseases in this western district, have a much wider and more general application.

Dr. Buchanan, late President of the Local Government Board of Great Britain, years ago stated that the drainage of the Lincolnshire fens, and the sewerage of certain towns in Surrey, Kent, and and Sussex, had caused a falling off of the deaths from consumption of, in Salisbury, 49 per cent.; in Ely, 47 per cent.; in Rugby, 43 per cent.; and in Leicester, 32 per cent.

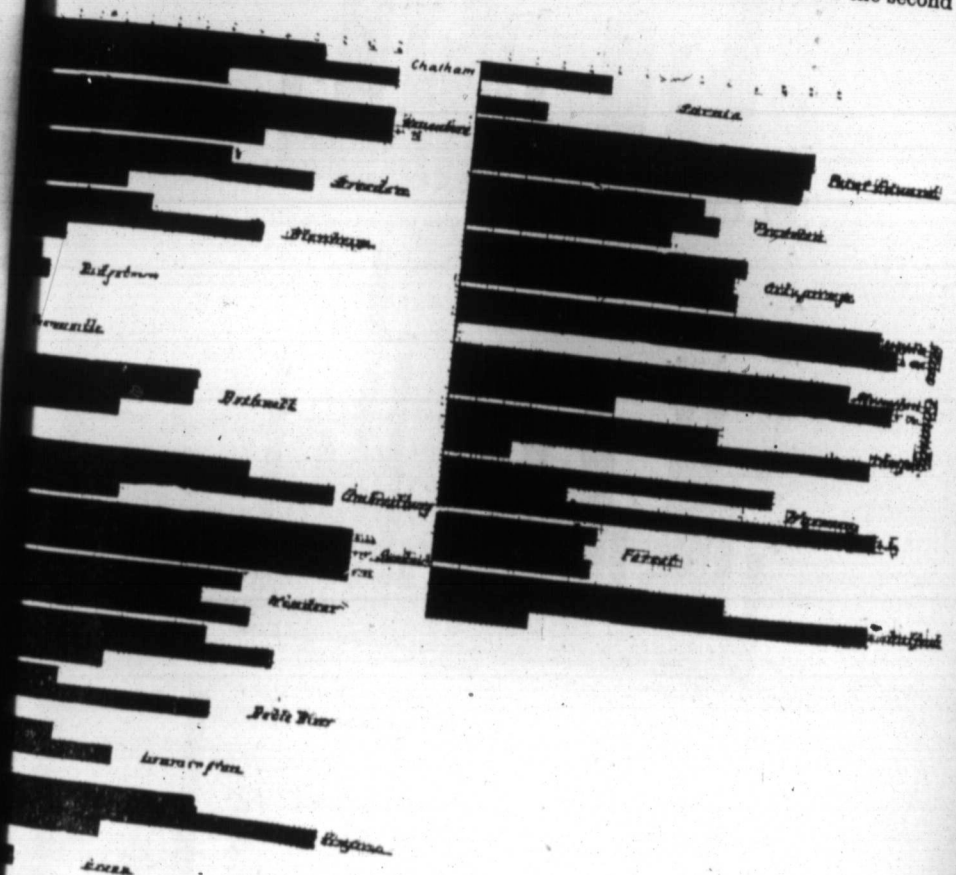
The story of the drainage of Kent and Essex counties in Ontario is familiar to everyone here. We have with us in our meetings, taking part in the papers and discussions, in the person of our friend the County Registrar, an example of hereditary tendencies. He has to-day presented a most interesting paper on the

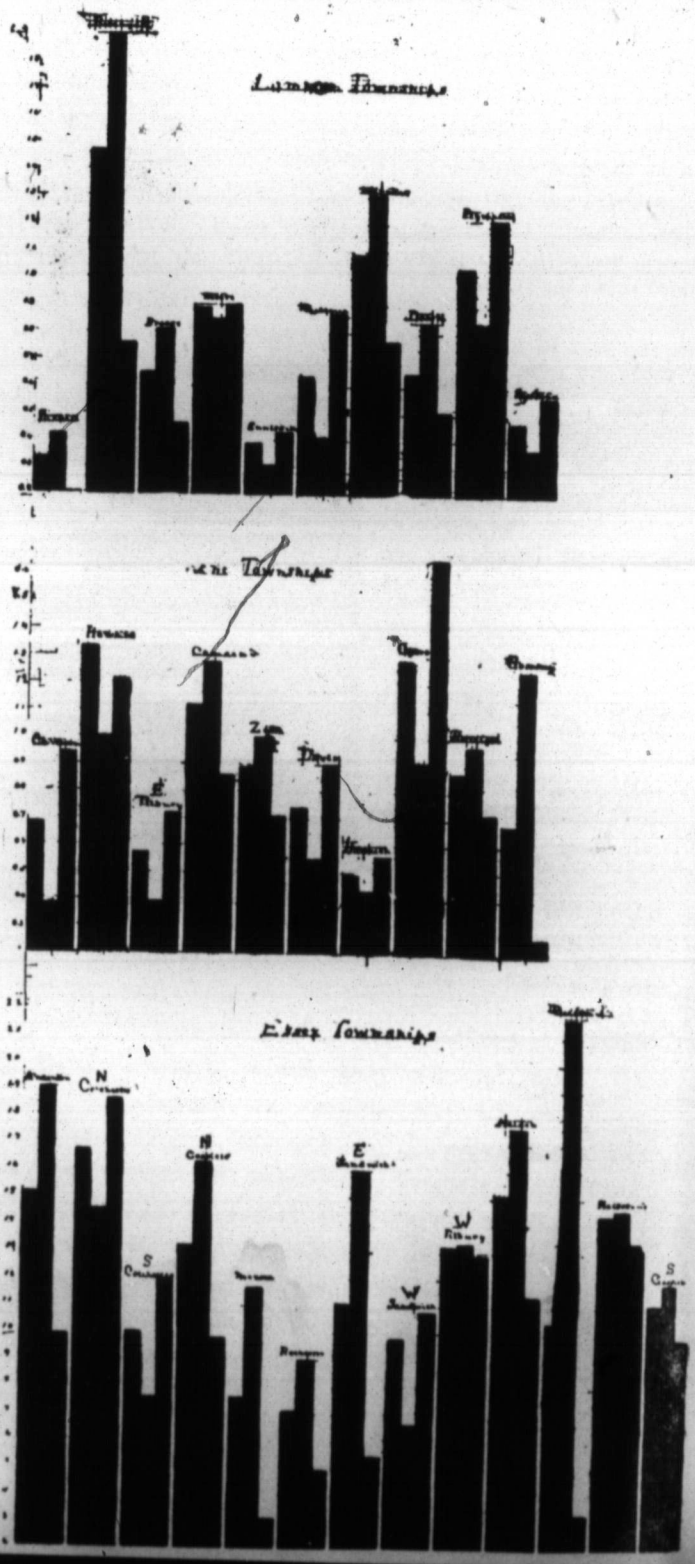
sewerage of towns, while twenty-two years ago, and more, his father, the late Hon. A. McKellar, introduced and developed the legislation which has brought results so remarkable both from the agricultural, financial, social, and sanitary standpoints to this district, whose admirers delight to designate it the "Garden of Canada," or even of "Eden." But whatever it may be now, it certainly was at one time made unhappy, like that other Eden, by the presence of its evil demon. Students of the ancient myths tell us that the demon of Paradise took in the minds of the people the form of a serpent, from the windings of the Euphrates, whose low banks and sinuous course gave its demon an easy opportunity for venting his rage on the people of the plain of Eden by pouring the raging waters in the rainy season over the devoted lands of the peninsula between the rivers. That old land too, must, have had its hero, its Hon. Mr. McKellar, for we are further told that the Pishon, that other river of Paradise, is but another name in Chaldaic for *canal*, it being the great aqueduct connecting the Euphrates with the Tigris, and on which canal Babylon was situated.

We may further turn to our old hero Hercules, who, we are told, was so great and good, and we find that of his many difficult labors, the most difficult were those of slaying the hydra of the Lernæan marshes and the monstrous birds of the Stympalic swamps. Hercules was evidently one of our earliest engineers; for with some newly invented dredge or spade, which he alone could handle, he must have drained the marshes and swamps, causing the hydras and harpies to disappear, and so the thankful people worshipped him as a god.

But if we are able to see in the condition of the Western peninsula many changes, which have affected most favorably the resident population, we cannot fail to recognize other conditions to some degree counteracting their beneficent tendencies. We have seen centres of population becoming established and people being collected together on the narrower areas of towns, and we have to enquire whether measures for their well-being are keeping proportionate pace. In examining the death returns for the last ten years, as seen in the accompanying diagrams, I find that in Chatham, Wallaceburg, and Windsor the deaths from consumption

RAMS showing death-rate per 1,000 population from consumption for 1884-93, in Kent, Essex and Lambton Counties, Ontario. Comparison on first page is of towns, of townships on second. The st column for each municipality represents first five years; the second column the second five ars, and the third shows the average.





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are relatively higher than in most of the neighbouring townships. We therefore naturally enquire as to the reasons for this. Taking Chatham as we know it, and we at once realize that its low site on a clay soil demands adequate drainage. Is it not true that there are many cellars damp and undrained; many places where no subsoil drainage and no sewers give free outlet to the water of the soil? In addition to the natural rainfall we have the house-water in many cases thrown out and serving to maintain a dampness, which statistics show, is invariably associated with an increased prevalence of consumption. These influences will be shown in another paper on the programme by Mr. Mackenzie to be amongst those affecting in a notable degree the immunity of persons against disease. In this same category of influences is that of the water supply. Chatham has very recently made a strenuous, and to some degree successful, effort to deal with this question; but until an abundant and wholesome public water supply is introduced into every house, as well as provision made for its rapid removal, the malign influences from the combined conditions may be expected to operate.

The question of house-dampness is, if one were to select a single cause, that which demands especially the attention of every citizen. Its effects are manifold. The confined area within such a house creates with the movement of air upward into the house not only a damp air, but inevitably a foul air. Dark, damp spaces are peculiarly those where fungoid and other organisms causing the decomposition of organic materials, develop most freely in the absence of free air and sunlight. The nomads of the desert, like our native Indian races in their early history, have a great immunity from this disease of indoor life, and the principal reason for this is to be found in the absence of those conditions we have referred to.

Turning, however, to the conditions of existence in communities and families where consumption is actually present, we have to ask ourselves what there is in our habits of life tending to perpetuate this fatal malady? Primarily it is assumed that we have, here and there, centres or cases of the disease in certain families. To the statement that such have always been present in communities one needs only to quote from many observers in the highlands of Tennessee, the mountains of Colorado, or the *mesas* of Mexico, to indicate the practical immunity of the residents in such climates from

this disease, except where cases have been imported. Thus in a paper by Dr. J. Brena, of Zacatecas, Mexico, it is stated: "In all my practice I have only seen one case of evident death from pulmonary phthisis amongst the best class of people born here," and the statement is further made that in the convalescences from acute disease, wherein phthisis so often elsewhere makes its appearance, no fear of such a sequel ever occurs to physicians in Zacatecas. The city is nearly 7,000 feet above the sea.

A relative immunity as before noted, exists in the high land of this province, as seen in the statistics of towns and many townships of the central plateau of the province and of the highlands to the north of the Great Lakes.

In the most interesting and practical address of our President just presented, we have had set forth in a most succinct manner both the existing menace to the public health and the past fatalities from the disease I have been referring to. We have likewise had set forth in the paper of Mr. Dearness some of the anomalies of existence in the life which our modern civilization forces children to undergo in school. The conditions which I have already referred to, viz., the external physical surroundings and the conditions of no drainage or of bad drainage of habitations as tending to develope tuberculosis have already been illustrated, so that it is wholly unnecessary for me to dwell at length on facts already set forth. But it may not be unimportant that the influence of school life in its relation to consumption should be referred to.

Many parents and every physician will have remarked in some children certain peculiarities of physical and mental development, varying from what some might call the normal type, and forming what popularly is called the sanguine temperament. To-day Medicine ascribes such a temperament, as other temperaments, more or less accurately to some hereditary cause; but what we note in such children especially is a clearness of skin, an overactive arterial circulation, a thinness of skin and of mucous membranes, with perhaps even a thinness of the walls of the blood vessels. Associated with these conditions is what I may term an undue impressibility of the nervous system which many will have noticed even if they have not understood its meaning. As babies such children have been irri-

table, they have slept badly, they have got teeth with difficulty, they have assimilated imperfectly, cold has most readily disordered their digestion, and withal they have been precocious, have talked early, but were long in walking. At this stage the proud parents begin the education of the child; and in the dozen ways made possible now-a-days this irritable nervous system is stimulated until such a child of precocious intellect, but often physically small, pale and irritable is placed in the school, say a kindergarten at the age of four or five years. Its tendencies, already indicated, here become more marked. Confinement for four or five hours with no chance for free physical movements, in an atmosphere limited in its oxygen, but with its maleficent gases in excess, not only checks nutrition but even actively poisons. I have known children with the nerves which supply the mucous membrane of throat and nose so sensitive that five minutes exposure to the odors of a stable have set up an irritation resulting in a coryza or catarrh with sneezing and asthmatic spasms lasting sometimes for two days. To such ammoniacal odors are children exposed in many badly cleaned and crowded rooms, along with the odors from the unclean clothing of many children. Such mucous membranes are congested still more in many instances by the abnormal dryness of the air heated by furnaces. With all this, the child goes on existing for nine months of the year, and from year to year, the daily task being regulated on the principle of the farmer, who beginning by lifting the calf daily, was able to perform the miracle when it had grown into an ox.

At ten and eleven these irritable short-sighted children, since anaemia shows itself more readily in the most delicate organs, and the eye-muscles are strained accordingly, are placed on their mettle in the trial of strength of preparation for the High School. Once admitted there the Sisyphean task of many lessons is taken up and the stone whose rolling was begun with the rising sun is still far from the hill-top, when the sun has set. Such are the children who within the succeeding several years develop into men and women, each fated to work out his or her appointed task.

Consumption by some physicians of prominence has been set down amongst the nervous diseases, and so completely does the tubercular poison involve the nervous system within its influences,

that such writers have found good arguments for their theory. It is peculiarly at the age of the awakening of the child into manhood and womanhood that the normal predominance of the nervous system asserts itself; and it is especially at this stage that the second period of increase, after babyhood, in tables of mortality from consumption is found.

How have we with our compulsory education prepared our boys and girls blossoming into manhood and womanhood to resist influences peculiarly active in anaemic, nervous constitutions? The picture of school life given is not overdrawn. It could be embellished with photographic and illustrative descriptions from real life which might furnish a title for the next novel "The White Slave." In the direction then of our schools wherein is found year by year twenty per cent. of our population, we have to move, if we wish to lessen a tendency to inoculation with the germs of this disease. This draft on the nervous system, however, does not cease with school age. Our people have begun crowding to the towns and cities. (See statistics.) Twenty-five per cent. of the people of Ontario are in cities of 5,000 and over. With this town-life comes the excitement and dissipation incident thereto. Partially healthful, this aggregation becomes deteriorating when the fierce struggle for existence makes long hours with low wages necessary for obtaining the means for gratifying the tastes developed. The President in his address has given figures showing the mortality from tuberculosis in New York; but if the statistics be compared with those of the census of even ten years ago who can doubt as to the meaning of the notable increase. Increased population, its overcrowding, its smaller rooms as in Glasgow, its increased misery, its increased infectibility and susceptibility thereto; such multiplied in a dozen directions illustrate the Nemesis which seated in her victorious car not only follows, but drives the too frequent victims of this phase of modern civilization. Such then are some of the dominating influences which must be recognized in the work which this with other communities must undertake in any honest and serious endeavor to lessen the ravages of this *world's pestilence.*

Never before in the world's history have events, social and political, succeeded one another with the rapidity seen in this, the end of the nineteenth century. When this continent in its original

natural beauty of a hundred years ago is compared with its artificial development of the present; its few hundred thousands of people, living then their simple lives, with its teeming of millions of to-day; its then almost universally rural life with as now the twenty-five or more square miles making up one of its cities; its then relatively common level in the social scale, judged by the standard of wealth, compared with the infinite distance between the plutocrat with his billions, and the seamstress struggling for a few cents a day; and the intellectual elevation of the many compared with the mental narrowness and obscured vision of the thousands, lifted scarcely above the level of purely animal wants, it must be evident to all that the very complexity of the social life of the present forces upon the people of this continent, questions so momentous in their relation not only to the well-being but even to the existence of society, as to demand the most serious attention of all to whom the Almighty has given the power both to think and act.

The past has seen its great heroes arise and in a single life conquer empires and built up world-wide monarchies. A single mind has dominated continents; has controlled the destinies of millions. Such can no more be. Individualism is to-day as possible, and in the physical sphere, as seen in an Edison and a Pasteur, more potent and awe-inspiring than ever; but the very discoveries of such are within a decade made common property, and are but drops from the well of infinite truth, and are as rapidly lost sight of in the kaleidoscopic scene which is constantly passing before our vision. "*Knowledge comes but wisdom lingers*," and this it is which forces upon us the unpleasant truth, that no real evolution of social advancement, no uplifting of humanity is possible, until the individualism of the units in the human family becomes merged in the altruism, which makes them simply atoms to assume each their relative position, and to play each their separate part in making up, using still the chemical metaphor, a definite and highly organized compound with potentialities, hitherto unknown and undreamed of. In other words the highest ideal of a human society, is expressed in the words of that man, the world's only Teacher, "Bear ye one another's burdens;" and nowhere is His example so sweetly and beautifully illustrated as in that sublimely simple story of the good Samaritan.

Our worthy President has indicated in a few sentences, the practical direction of the sanitarian's work in staying the ravages of

consumption. He has pointed out its cause, and the method of its operation. He has indicated how the germ of the disease is cast off from the body; how the virus is communicated to others, whether animals or man. He has traced the dangers from animals to man through meat and milk; he has pointed out how personal habits, how vain fashions, how slovenly house-keeping, influence its spread, and how the traveller in railway train, in ocean steamer, or in the wayside inn is ever exposed to the danger, is still as it were ever pursued by the demon of destruction. Death has in a hundred ways been figuratively described, as in the ruby goblet, as riding on the victor's triumphal car, as in the serpent's folds, or as in the sweet voices of the sirens floating seawards from the sands of the Campanian shore; and when we think of the labyrinthine walks where the multiform activities of our social life lead daily our unconscious footsteps, we are inclined in our despair of escape to adopt the Epicurean adage, "Eat, drink and be merry, for to-morrow we die." It is needless, however, to illustrate the folly of such an attitude; and certainly none can be either a sanitarian or philanthropist, whose philosophy is based upon such teachings. Social duty and individual safety both alike direct us to the quarter-deck of the *Victory* for our motto, the single thought, the united effort, the forgotten self, the commonweal—all summed up in the words, "England expects every man to do his duty,"—not as individuals, but as parts of an organic whole.

What, then, is this duty of every man? The answer is that of the Sphinx—"*Know thyself!*" This necessarily implies that we—

1. Find out hereditary tendencies. Insurance companies are careful to find out all about our grandfathers and cousins and aunts. It would be well for each person for himself and yet more for his children, to find out what are their hereditary weaknesses, and thereafter to apply to nature and art to remedy, as far as possible, inherited defects.

2. Examine at once the sources of our food. As a social unit we must demand wholesome milk and meat for ourselves and children, and adopt such suggestions as are pointed out by the President for securing the same.

3. Cleanliness of person and surroundings are superlatively demanded; whether it be in the air of the house and cellar, whether

of the yards and streets around it; whether in the schools our children attend; or in the rooms, workshops, factories and stores where we and our children study or work.

4. As a social unit we must urge and force upon our legislators the necessity for similar safety on our railways, street cars, and other public conveyances, and in the boarding houses and hotels, where we are forced to lodge. We have within recent weeks heard of new organizations for freeing the people from the thraldom of old political superstitions, but I have not yet observed as a plank of any political platform, old or new, any determination to take up as a battle cry for the people the words, "Personal Protection against Consumption."

5. Passing on to two positive lines of action which to us as a body politic, as citizens and practical sanitarians, come within the sphere of practical politics, I would urge what the President has already hinted at, that the public and the medical profession be called upon to aid the health boards, sanitary officers, philanthropic and charitable societies by giving information, when cases of consumption have been diagnosed, to the proper officer, so that they can be supplied with such circulars of instructions, as will best serve not only to protect their own families but the public as well. In such a case the drainage of the premises would be closely enquired into, and if the first case cannot be prevented, the householder may feel comforted in knowing that others do not necessarily follow. Such public use of notification is not only readily practicable, but it will at once lead up to the investigation of the health conditions of stores, workrooms and factories. Similarly hotels and boarding-houses, where one after another of the floating population are housed, should be under such definite supervision that reasonable grounds for assurance of safety to their occupants may be had.

The other practical line of action is the establishment of "Homes for Consumptives." This is truly a field with the widest scope of action for the lover of his kind. We have Infant's Homes, Children's Hospitals, Old People's Refuges; we have Mutual Benevolent Associations, with their sick funds and death benefits, and some even with their codes of signals and passwords and litanies; but as yet it is only in our dreams that we have known of breezy, southern hillsides, exposed to the haematinic rays of the sun, a hero and philanthrophist, who as Phœbus Apollo born in the Lykian land of light,

was deified beauty, light and music in one, and, who amidst all his fabled wanderings ever returns in the morning with undiminished splendor. Only so too in our fancies have we seen our vale in this Latmian land where the hillsides are clothed with Delphian oak and sweet-scented fir trees, and where the placid surface of some crystal lake reflects the glowing face of some modern Endymion or fair Œnone, erstwhile thin and pale and wan, as victims of disease, but now through the good graces of the fairies and wood nymphs borne away from gloomy shop or crowded work-room, to enjoy the gifts which the Almighty Father intended should be theirs along with the wild deer and the birds.

Surely we shall soon see some large-hearted and open-handed son of Ontario whom fortune has been kind to, setting apart some hundreds of acres of the thousands of square miles which can yet be had almost for the asking, for a real Home for Consumptives. Such exists in the New York Adirondacks solely as the realized dream of philanthropists; such too are found in the Engadine and in the forests of Brittany. My dream is to see in some Canadian forest a microcosm. We have in the province some six colonies, hundreds of acres in extent, set apart for our 4,000 mental unfortunates; but which instead of mad-houses are becoming for them "abodes of Paradise." How much easier, how much more possible with a class of sufferers, with faculties intact, with in many cases, the fairest forms and splendidest intellects, to establish a village where agriculture and horticulture, where tree-planting and apiaries, with other occupations, might all be carried on in the outdoor air; while a dozen useful occupations might be found for indoor employment.

To me the hospital idea by itself for consumption is just as repellant as the mad-house idea of former times for the mentally deranged. What more depressing than sending a consumptive girl to an hospital to die? What more beautiful or pleasing than sending this bud of womanhood to live amidst a garden of flowers; or what sweeter sadness, what more desirable euthanasia, if die she must, than to see her in life's early morning fade away as the summer roses, passing peacefully to the Home of the Blessed?

Ladies and gentlemen with you I hope and pray that this dream may be fulfilled.

THE IMPORTANCE OF WATERWORKS FOR TOWNS AND VILLAGES.

By J. A. McLeay, Watford, Medical Health Officer.

Gentlemen,—I know of no question in sanitary science that should be of more general interest and positive importance than that of a wholesome water supply. Good health demands it. The two prime factors in good health are fresh air, and pure water. Of these water contains by far the greater proportion of disease germs, for it is the home and incubator of disease.

The gases hydrogen and oxygen, which compose water, when pure, are colorless and have neither taste nor smell; and pure water, the wondrous union of these gases, is clear and tasteless, inodorous and colorless; but because it is the best solvent known it is hard to obtain it without some impurities.

The origin of nearly every epidemic is a want of pure water, and the familiarity that the world has had with unwholesome water makes us careless regarding that which most vitally concerns our existence; for disease is the costliest of all conditions for a corporation and expenditure on sanitation is the wisest economy. Disease is always lessened by the introduction of pure water. Of this we have abundant proof. In the city of Jacksonville, Florida, disease was lessened 50 per cent. on the introduction of their waterworks.

Water is the scavenger of the human system and has for its physiological effect to maintain all the tissues of the body in healthy action; and if it is unfit for domestic use our constitutions, although they will become somewhat accustomed to it, will inevitably suffer and be weakened. When we remember that 75 per cent. of our whole body consists of water, that not less than 95 per cent. of our blood, and not less than 80 per cent. of our food consists also of water, we readily acknowledge the importance of a pure supply.

Vigor is essential to the uniform success and happiness of every individual, and strength and happiness of the people are essential to good public government and to sound public prosperity. Sanitary

improvements are therefore the first duties of public officers, for the prevention of disease is pre-eminently above the curing of disease.

Up to the present time sanitary science has been almost unknown by the majority of the laity and therefore unrecognized, and it is only during the last decade that the medical profession began to take an active interest and to give an impetus to hygienic reform with results that cannot be doubted. It is the duty of our Association to keep the subject of sanitation constantly before the people. This would be a much easier task were all of the different Boards of Health represented by one or more delegates, and for the benefit of the country that should be compulsory.

It is now 160 years since the first waterworks were constructed on this continent and since then there has been a grand increase in the systems in cities; but little progress has been made in the smaller towns and villages.

In a new or uncultivated district, where the population is scattered, it is possible to obtain a wholesome supply of water if care is taken in locating the well, but in the limited bounds of a town or village the supply from dug wells is more liable to contamination. Then waterworks for the collection and distribution are a necessity for the preservation of health and promotion of cleanliness. The true prosperity and development of a place require a good system; for capital is cautious of investments where the elements of safety and health are lacking and industry dreads frequent failures of a water supply. As this is about the only way that pure water can be supplied to towns and villages, is it not essential that the smaller places should be thus favored?

False economy of municipal councils has militated very much against their introduction, and even our statutes forbade assistance to any waterworks company until recently, when I had the municipal law amended, and now any waterworks company can be aided by a bonus; but the law is still faulty, for it does not allow municipal councils to grant a private individual the right of way or permission to lay pipes, nor can it grant a franchise even to an incorporated body. But aside from the sanitary aspect as a protector of life and property from fire it is of prime importance.

At Columbus, Ohio, the average loss by fire for the four years preceding the completion of the public waterworks was 65/100 of one per cent. valuation. The average loss during the four years after the completion of the works was 13/100. These statistics show a probable saving in the first four years of the entire cost of the waterworks.

Then again, the introduction of waterworks anywhere lessens the fire insurance rates so materially that in time this saving will pay for the outlay, so that even as a business speculation the investment to the corporation would be a paying one.

The majority of our water supply reports show that the income from the water rates exceeds the operating expenses and interest on the capital expended, or, to put it more plainly, almost any town or village can have a good system of waterworks without cost.

In providing a supply the two important problems are quality and quantity, wholesome quality and adequate quantity, not only for the present but for prospective uses.

If a corporation is so favorably situated as to be able to have an abundant supply gathered by nature at an elevation sufficient to give a pressure of 70 lbs. per square inch the gravitation method ranks first. Then fire pressure is always at hand and there is no delay waiting for steam to rise in the boiler. The expense of operating this system is very small. Next to this system comes the elevation of water into a reservoir and then delivered by gravitation, and thirdly pumping with direct pressure. This system is most unreliable and most expensive, for it necessitates continual consumption of fuel and the constant care day and night of a relay of engineers. Another disadvantage of this method is that it delivérs the water to the consumers as it comes from its source without giving its impurities an opportunity to settle.

Even in villages where there is no sign of springs, and water in dug wells fails in the summer, there is generally an abundant supply in the immense subterranean basins, the results of many years' percolations.

Although these basins sometimes fail to supply cities, it is seldom they refuse to supply towns and villages, for their demands are much less. The water from this source contains no microscopic plants, no vegetable fibres, and no animate organisms, as particles in

suspension are removed by natural filtration and organic matters are oxidized and eliminated in the passage of the water through the ground; however it frequently contains sulphurous gases, but these soon escape.

Probably the simplest method of procuring a supply for a small place when there is no elevated supply is by the deep well system.

The many details of waterworks construction for cities have been often and fully explained, but in works on hydraulic engineering no reference is made to waterworks for villages.

With the assistance of Mr. Arnold Cook I am putting in a system of waterworks in Watford, a village with a population of 1,500. We put down an 8-inch hole to the rock, a depth of 103 feet, and the water rose to within 42 feet of the surface. This well is now supplying 20,000 gals. per day and at present stands 40 feet from the surface. A single acting steam pump of the Blake pattern is placed down in a curbed well to about the level of the water and the suction pipe taps the 8-inch well. The steam is supplied from a boiler at the top. On account of the water being murky the method employed of clarifying it is by means of two settling tanks of 20,000 gals. capacity each. The temperature of the water as it comes from the well is 49° F. and in the settling tanks 49° F. After it settles it is pumped to a tank elevated 60 feet. This gives sufficient pressure for domestic purposes and in case of fire the steam pump can force direct into the mains. The principal mains are 4-inch wrought iron pipes, and the smaller mains are 2-inch tubing. These pipes were purchased from Van Tuyl and Fairbanks, of Petrolea.

Besides the usual water rates there is also an income from the sprinkling of the business street. This is done after the method employed on the boulevards in Paris, by means of hose attached to the hydrants along the street. This system is far superior to the sprinkling cart that is commonly used.

Then again an income can be had from water motors and public baths. And considering the fact that public baths are self-sustaining we should have more of them.

The great improvements and comforts which follow the introduction of waterworks make a place more attractive, enhance the value of property and save life, and all this adds to the importance of waterworks for towns and villages.

ARTESIAN WELL SUPPLIES.

By Alan Macdougall, M. Can. Soc. C. E., Toronto.

Gentlemen.—Water forms such an important part of our daily existence that the theme may be said never to grow old or to prove unattractive; and despite all that has been said and written on the subject, there is ever some fresh matter to be added to the information we already possess. From childhood to the most advanced age, water forms the most important part of our domestic economy. We require it for all the purposes of our daily life, and we know now that we have to go further and have also to consider and exercise care in the quality of water given to domestic animals, as tainted or impure water is capable of exercising very injurious effects on many animals whose products are necessary to the daily life of man. This is particularly noticeable in the case of our milk supplies. It is very satisfactory to everyone engaged in guarding the public health to notice the extension of proper sanitary precautions in all establishments where milk is produced in large quantities, whether for direct consumption or for creamery or cheese factory purposes.

The writer was engaged on the construction of a large public work some twelve years ago, where water was very scarce in the sense that there were no springs, running streams or rivers, and very abundant in surface water found in swamps, sloughs and coulees, the remains of the spring inundations over the country. Towards the end of summer, in August, the water became scarce and full of bacterial growths, diatoms and desmids being abundantly prevalent. By the strict use of boiled water in the form of hot tea the human part of the encampment were able to escape the evil effects, but the unfortunate animals, horses, mules and oxen were seriously affected. Many valuable horses succumbed to a form of low fever and died after a few days illness.

Such an important adjunct to human life as pure water could not escape the attention of our well organized Provincial Board of Health. It is only a natural sequence to expect some utterances from the Board on this all important topic, and it is a delight to everybody, as it is an encomium on the action of the Board, that this all engrossing subject was handed over to the energetic and accomplished Secretary, Dr. P. H. Bryce, to deal with, as only his talented pen, guided by mature experience and deep study, is capable of expounding.

Looking over the various reports of the Board, there are constant references to water supply; warnings without number are uttered against the use of polluted sources, and sound words of advice given as to the means to be adopted further to procure and preserve wholesome pure water. The most important of the papers are to be found in the reports of the Board for 1890, 1891 and 1892, and in a bulletin issued in 1891.

In our own Association we can find the same lively interest displayed in this very important subject. Nearly every meeting has had some discussions on water supply, water pollution and water analysis. Water supply in almost every form and from every source has been discussed, and yet there is always a fresh interest in the subject; it is like some fascinating game in which the players having finished one game are ready to commence another for the sake of the evolutions which create and intensify the interest and call forth the skill of the players.

The Provincial Board of Health has drawn attention to the value of underground water supplies, the sources being entered under two classes, deep water supplies such as are obtainable by borings and commonly known as artesian well supplies, and springs, which include springs proper and springs and galleries. The geological features of the province are treated at considerable length in the publications referred to. It will not be necessary to enter into a description of them or go over that portion of the subject; the writer's object being to confine the discussion to-day to the results

obtained in various parts of the province by the different methods adopted for securing underground water supplies.

At the Trenton meeting our Ex-President, Mr. W. Chipman, C. E., presented a paper on "The Public Water Supplies in the Province of Ontario," in which he collated with much labor and presented in simple tabular form the sources from which the several water supplies were drawn. He also framed tables of the several classes of supply, favoring the supply drawn from springs and galleries and artesian wells, all of which he places as supplies of undoubted purity.

In the list of towns so supplied it was eagerly expected, at that time, that the city in which we are assembled to-day would be counted and that an abundant supply of beautiful water would be at the command of every citizen. It is a great misfortune to the community that this result has not been obtained. On this subject we are likely to hear from some member, a resident of this city, who will be able to give the history of the undertaking and the causes of its failure more satisfactorily than the writer.

In the portion of the province influenced by the limestone formations, deep well water has the tendency to be hard and unfit for many domestic purposes, amongst others for washing purposes. Marked differences in the quality of water are also found, wells in close proximity to each other are not necessarily of the same quality; one may be delicious palatable water and the other impregnated with mineral salts. The most fortunate examples of this class are found at Barrie and Newmarket. Both of these towns have ample supply at all times.

Barrie draws its supply from two wells, 125 feet deep, terminating in sand and gravel. The wells are close to lake Simcoe, and commence about lake level. They probably draw water from gravel beds under the lake level, as several wells sunk in the higher portions of the town have been unsuccessful, and yet the water levels of several private wells in the town are not affected by the draught on the main pumping well. The water is soft, free from smell, and is used for all domestic purposes.

Newmarket wells have been such a surprise that they have been fully commented upon in several reports of the Provincial Board, and especially in the bulletin of 1891, on "Underground waters as sources of public water supplies in Ontario." It is not necessary to quote from these papers since they are within the reach of everybody. There are two wells, each 145 feet, one 260 feet deep into gravel, and one 275 feet into rock. The quality is good, does not affect the pipes, has no odor or taste, and is used for all domestic and commercial purposes. The main takers are the G. T. Ry. Co.

Members present at our meeting in Trenton many remember visiting the flowing wells which form the town supply. The water issues from a crevice in the rock, which is presumably fed by some springs under the bluff or hill about 200 yards off. The water is cold and sufficiently soft to be used for all domestic purposes. Trenton has not yet made much use of the visit of our Association in promoting public works for the improvement of the public health. The writer is informed that the existing waterworks system is being enlarged and extended, a tank being constructed on the hill to which the water will be pumped and a gravitation supply secured. The writer has been asked to mention one important feature, viz. : that *not one case of diphtheria or typhoid has occurred where this water has been used*, though prevalent in other and apparently healthier locations in the town.

Reference is made in the bulletin of 1891 to wells impregnated with sulphur at Kingsville. They do not appear to be in use, as the present supply is drawn from surface wells 8 to 16 feet deep driven into quicksand. The water appears to be of medium quality. A new supply from the lake is now being put in.

Essex Centre has a well 121 feet deep, terminating in rock. The water is not too hard for washing purposes, is slightly odorized with sulphur when first drawn or pumped. It appears to give general satisfaction.

Shelburne has an excellent supply drawn from a well 500 feet below the surface of the highest part of the village. The water is

pumped by windmill to a frost proof tank 80 feet above the ground at the well. The supply is ample for the needs of the place and the quality of the water satisfactory.

Orangeville has a well owned by a private corporation, 400 feet deep, but it is not used as a public supply.

Waterloo possesses a number of flowing wells, averaging 120 feet in depth, driven into rock. They are used for private supply. The water is not used for washing purposes. It is not impregnated with sulphur. The town water supply is obtained from Berlin. As the capacity of the Berlin waterworks has apparently reached its maximum, it is probable that an increased supply will be drawn from wells put down to the rock either in Berlin or Waterloo.

In London there is a well known sulphur well. It is about 100 feet deep. At the Provincial Asylum for the Insane, about three miles east of this well, a well 120 feet deep supplies the whole establishment with a pure odorless water which is used for all purposes.

In St. Thomas a well was bored 290 feet for a supply to the county buildings. The water was not used to any great extent, as it possesses the disadvantage of corroding iron vessels very rapidly. An experimental well sunk on the flats, 100 feet below the county buildings, missed the gravel bed overlying the rock, and entered a black shale, from which a free flow of water was obtained, but it was so strongly impregnated with sulphur as to render it useless. Last year a private company put down a test well for gas to the depth of 3,038 feet into the Trenton rock. A small quantity of gas was struck in the Clinton rock which was of no commercial value. The well was shot in both strata of rock, but with no beneficial results. A small quantity of water was found in this well near the surface, and it was impregnated with sulphur.

A boring put down at Stratford for natural gas has developed a fine flowing well with a liberal discharge. The company is being wound up, and the well is no longer in the hands of those who bored it. I am unable at present to give any information regarding the strata, depth and other particulars.

Goderich has been supplied for some years with water drawn from wells bored to a depth of 240 feet. They are situated on the low land, and the pumps, as at Barrie, are a few feet above lake level. The water is very hard, which renders it unfit for many domestic purposes. It also contains a large proportion of mineral salts, which affects its value for dietetic purposes.

The Provincial Government has, within the past week, obtained a supply of water at Rockwood Asylum, Kingston, at a depth of 2,000 feet, which promises to supply all the needs of this great institution.

From information received from Dr. C. McDonald, Medical Health Officer, I learn that there were a number of borings put down round Tilsonburg during the oil excitement in 1867, from several of which there are to-day flowing wells. The most important so far as the town is concerned, is near the business portion of the town, and near the junction of Otter and Stony Creeks, and is about 650 feet. An iron pipe carried this water from the ravine in which the well is situated to the top of the hill, for several years, when Mr. Tilson bored a well about 200 feet deep at the other end of his pond on Otter Creek. This diminished the pressure so much that the water would not discharge at the top of the hill. This well was plugged, and the former well commenced to flow as it had done formerly. There is another well on Otter Creek situated below the confluence of Clear Creek, it is the deepest and strongest in this vicinity, it is about 1,763 feet deep, the water being strongly impregnated with common salt, petroleum and sulphur.

A favorite theme with every writer on water supply is a proposal to improve the Toronto water supply. The subject was referred to in the bulletin of 1891, and has caused a great deal of comment and interest ever since. It has led to wonderful assertions of the quantity and quality of water to be found between the city and Oak Ridges, and many a divining rod has been carried over the land immediately to the north of the city, from Deer Park to York Mills, to discover the hidden rivers ready to supply Toronto. The bulletin referred to also suggests deep wells as a probable source, from which large supplies could be obtained, capable of making

material augmentations to the present supply, or a supply to be obtained from underground sources lying between the city and Oak Ridges. Prior to the date of the bulletin, there was only one deep well in the city so far as the writer can ascertain, which was sunk on the premises of the Copeland Brewing Company, to a depth of about 1,200 feet. The well was unsuccessful, a small quantity of salt water only being obtained; the well was never used.

A deep well has been lately bored on Toronto Island; and a mineral water carrying strong medicinal qualities was reached at a depth of about 300 feet. The well was continued for a considerable distance below this; but no water was obtained, and the well is now dry. This well was bored through rock for nearly the entire distance.

On the Don flats the Taylor Bros. Co. put down a bore, to get water, gas or oil, any of which they could use economically in their mills. At a depth of about 700 feet a layer of gas was struck, in which a heavy shot of dynamite was fired. A rush of oil followed the explosion and rose to a considerable height above the ground, but it was never followed by oil in paying quantities. The bore was continued to 1,200 feet; but no water or gas was obtained and the well was abandoned and is now dry.

The Government sank a deep well at the Provincial Asylum for the Insane at Mimico, which was a failure as a water well. A moderate amount of natural gas has been obtained and is used in some departments of the buildings.

Several deep wells were sunk over this neighborhood by a company to discover natural gas, in which they were not successful. One or two wells gave a limited supply, but not enough to make it of commercial value. No water was met with in any of the wells, except in the last one put down, which struck a vein of gravel bearing a strongly impregnated mineral water, which has been turned to profitable account and placed on the market under the name of "Obico" water.

The village of North Toronto has obtained a small water supply from a deposit of gravel on the Jackes farm. The water is pumped to a frost proof tank from which a gravity supply is obtained. The

well and its surroundings have been fully described in the report of the Provincial Board for 1891. It was 23 feet deep, 12 feet 6 inches internal diameter, and collected water to a depth of 6 feet. The demand increasing, the well was enlarged and deepened last year, and is now 20 feet deep, and 18x6 feet in size. The supply is limited; the gravel bed is not as extensive as is generally imagined, and from what we know geologically of the formation of the alluvial clays and underlying shales of the Don valley, this supply would not be increased by deep boring.

The phenomenon of the unexpected supply of abundant water from gravel beds at Newmarket, has tended to create a belief in abundant supplies on this side of the Oak Ridges, with grand possibilities for gravity supply to Toronto, from gravel beds with springs and from the Bond lake area. The writer has made a close examination of the country between Toronto and lake Simcoe for a considerable distance on each side of Yonge street, and he confesses his unbelief in the several pretty theories which have been advanced as to ample supplies hidden under gravel deposits. One common belief as to the depths of the water of Bond lake was presented to him quite lately, which he wishes to dispel. Some years ago, armed with 900 feet of sounding line and a deep sea lead, he had soundings taken over all the lakes of that district, when the unfathomable depths of Bond lake, the deepest of all these lakes, succumbed to the depth of 150 feet.

The City Engineer of Toronto has reported at considerable length on proposed sources of supply, and amongst others on a proposed source of supply from springs and artesian wells in the township of Erin, about which he says: "The springs are 36 miles from Toronto, and are about 1,000 feet above lake Ontario. The water is as exceptionally hard as it is bright. A boring had been sunk some years ago for oil, which was unsuccessful, but at a depth of 80 or 90 feet the boring tool suddenly dropped about eight feet and water immediately rushed to the surface. The bore hole is not now accessible, as it has long since been filled in and ploughed over, and nothing is to be seen except a puddle of water in a field to mark the spot." Needless to add he reported against it.

Supplies from Springs.—Underground waters from springs are liable to be of uncertain quality, and more or less tainted with mineral salts or sulphur. The most noted examples of spring water of unblemished character of which the writer knows, are the springs which supply the city of London and the town of Galt. In both cases the water is drawn from galleries driven into gravel, above the level of the adjoining rivers, and therefore dependent upon the supply from the springs. The city of Brantford draws from galleries drawing their supply from the sub-soil waters coming from the higher levels of the river valley.

The galleries at London collect 4,000,000 gallons per day; the capacity at Galt is about 400,000 gallons, whilst at Brantford the supply is amply sufficient to allow 540,000 gallons to be pumped daily, without affecting the supply. Owen Sound is supplied from natural springs coming from the rock; the water appears to be of good quality, gives general satisfaction and is used for all household and manufacturing purposes.

Mineral Springs.—There are a large number of mineral springs in different parts of the province, which have medicinal properties, and are used largely by persons suffering from different ailments. A few of these may be named, as illustrating the presence of large quantities of mineral water in the province, which has a bearing on the question of deep well supplies.

The London sulphur spring has already been referred to. At Port Stanley, the springs are of black sulphur, whilst those of Tilsonburg whiten the surfaces of everything with which they come into contact. The well known springs, at Caledonia Springs, rise through about 100 feet of tenacious clay, with occasional thin sandy strata overlying the Trenton formation; there are the carburetted hydrogen gas spring, the saline, and the white sulphur spring. At Preston, the water rises from rock, 360 feet below the surface. The special quality of the water is sulphur. The water has a remarkably low temperature, 42.50°.

Summing up in a few words, the results of deep well supplies in our province, the chances appear to be in favor of water tainted

with some mineral ingredient. Still there are a sufficient number of deep wells supplying pure water to make this source of supply worthy of careful investigation.

Effect of Deep Wells.—In the bulletin of the state agricultural college, on artesian wells of Colorado, reference is made to the effect of wells acting on each other, lowering pressure, and sometimes drying up wells. Prof. Carpenter, engineer in charge, remarks on this subject, as follows:

"Throughout the artesian basins of the state it is the rule, rather than the exception to meet with wells whose flow is decreasing. This may be due either to the increase in the number of wells so as to overdraw the local supply, or to defects in the individual well. When the latter, it is generally due to a partial filling of the well with particles which may have been brought in with the water, or may have fallen from the walls above. In either case, the flow is partially stopped."

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"The Denver basin is instructive because it shows the effect of putting down many wells in a small area. The early wells were nearly all put down for domestic purposes and were small in size. The water was excellent for boilers, and the increased demand led to the putting down of larger wells, and to the use of pumps for factories, hotels and other large users. The result has been that nearly all have ceased to flow. In the Charles well, which was the first to reach the 600 feet stratum, the pressure was quite constant, and about 70 lbs. per square inch. When the Daniels and Fisher well was sunk to the same depth, not far away, the pressure was immediately reduced to about one-fourth as much. The sinking of the McLelland well still further reduced it. The well is now pumped."

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Whether the water is intended for irrigation or for domestic use, the supply is so important that it is a matter of great concern to know whether the limit of the supply is being reached, and whether it is affected by increasing the number of wells or not.

There is a limit to the number of wells which may be sunk in any basin, which, if exceeded, will cause a decrease in all the existing wells, and may cause some to stop flowing. Because a well ceases to flow, is not necessarily an indication that this limit has been reached, for the stoppage may come from other causes. The best practical test is the observation of the pressure, which depends principally on the height of the water level above the point where the test is made. If this level remains the same the pressure is unchanged. But if this level falls as in case where so many perforations are made that the water flows out faster than it enters, the pressure falls until equality between the flow into the strata and out through the wells is again attained. A diminution of the pressure is therefore to be looked upon with some anxiety.

Mr. T. Harry Jones, City Engineer of Brantford, makes mention of the effect of severe pumping:

"It was found that when the centrifugal pump, used during the construction of the well, was discharging water from the well at the rate of 2,000,000 gallons per day, the water level, 100 feet up the collecting gallery, was lowered one foot, whilst at the westerly end of the gallery the water level remained constant."

The effect of the pump wells at Chatham, on wells situated over a large area, is another instance of the method in which water can be drawn through the substrata for considerable distances. These facts are lessons we cannot afford to lose. If one deep well has such far reaching effect, and can empty wells miles off, no one will surely be found who can say now, that water once polluted will not find its way into a well within a moderate distance of the source of pollution.

The unfortunate experience of the city of Chatham, has demonstrated clearly the fact that underground water can be influenced at great distances from a pumping station. It also demonstrates the fact that if the water carries pollution, it will enter into and destroy the purity of wells in the same water-bearing strata. With this experience before us, no license should be allowed to any one to maintain and use for domestic purposes water drawn from a polluted well.

THE CONTAGION OF SMALLPOX.

By Charles Chamberlain, M.D., Leamington, M.H.O., Township of Mersea.

Mr. Chairman and Gentlemen,—In writing a paper on the subject of the contagion of smallpox I propose quoting no author on the subject, as in so doing I would be merely taking up your valuable time in listening to what you already are aware of. I will endeavor to give you a little of my own experience and observation in the treatment of cases under my care, and during my student days while attending hospital, where I contracted the disease in 1862. I was exposed to the contagion on the last day of March of that year, and was not aware at the time that the patient's trouble was smallpox. As the disease had not sufficiently developed to enable Dr. Aikins, who had charge, to form a diagnosis, I left the hospital on the evening of that day to remain with my father a couple of weeks. On the seventh day of my visit I experienced a severe pain in my back and head with rigors, fever, rapid pulse, and a peculiar nervousness, that can be much more easily remembered than described. On the fourth day of my illness a number of vesicles appeared on my face (nearly all of which were on the right side), which my father diagnosed as smallpox. Of course my case was one of varioloid. Having been vaccinated on the left arm about twenty years previously I made a rapid recovery. But four other members of the family were prostrated with it, one of whom had smallpox, the others varioloid. My mother, who had been successfully vaccinated forty-five years prior, was one of the number, and on her face and chest I observed the same peculiarity of location of the vesicles that my own case had, namely, being nearly all on the right side, while the vaccination mark was on the left arm. Being housed up with the four cases I had ample opportunity for observation. I had a good magnifying glass which enabled me to observe every stage of development of the vesicle, pustule and scab. I opened the vesicles on the face of the patient who had smallpox every six hours during their formation being careful to open every chamber in a longitudinal direction, carefully avoiding the wounding of the cutis, which procedure avoided the necessity of inflammation, in order to throw the virus free from the tissues underneath. The consequence was

there was very little suppuration and no pitting worth mentioning. Thirty days elapsed after the febrile symptoms set in before the scabs were all removed.

In the fall of 1862 I entered the hospital again, which I attended regularly during the ensuing six months. During the whole of this time there was at least one patient in the smallpox ward. Having had it myself I considered it a good opportunity to learn as much as possible in study at the bedside. Armed with my microscope I watched every change in the different cases. I found that several of the varioloid cases presented the same phenomenon regarding the majority of the vesicles being on the side on which vaccination had not been performed. My next experience was in the County of Norfolk in 1865, where we had twenty-two cases. But by reason of a residence six miles distant from them I had not the same opportunity for investigation. In March and April of 1882 I attended sixteen cases in the town of Leamington and township of Mersea, with one fatal case, which afforded another opportunity for investigation. The case was of the confluent variety, and when the patient, a boy, was moribund, I noticed that when the nurse had grasped him by the arms in moving him, the skin and areolar tissue had become detached from the muscles and torn. Inquiring if he experienced any pain from it, he replied in the negative. I removed more of it in order to examine the part with the magnifying glass, finding a large number of the minute branches of nerves were not broken but of a very extraordinary appearance. They were larger than usual, and of a bluish red tint, and appearing not unlike small worms. The patient being so near death I could not be certain whether any sense of feeling existed or not. Eight of the cases I had on that occasion were varioloid, five of which had many more vesicles on the opposite side to that on which vaccination had been performed. Since that time I noticed the same thing in Dr. Snider's case on Pelee Island and one other case in the Township of Mersea. The observance of this peculiarity led me to try the experiment of vaccinating on one arm as often as I could get it to take, and then trying the other arm which, in some instances, took effect nicely. These observations and experiments have led me to the conclusion that the location of the smallpox virus is in the nerve cells and not in the blood. And I might just say here that I believe that if ever

the smallpox microbe is proven to exist it will be found to have its location in the nerve tissue. We find that from the outset of the disease until the end of the primary fever the base of the brain and the spinal cord suffer more than all the rest of the system.

We find that we cannot effect inoculation with the blood of a smallpox patient, and that the virus very closely resembles the nerve fluid and an admixture of two parts blood with one of virus destroys its inoculating power. At least this is my experience regarding the fact of the necessity for vaccination on both sides in order to enjoy immunity from smallpox. I believe the matter can be fully explained in this way, viz., each half of the human system has an almost complete set of nerves of its own, and one side may become affected by vaccination while the other may be able to repel the virus in its weakened condition. We see similar manifestations in other diseases. For instance, in paralysis we frequently see one side totally paralyzed, while the other retains its full power. Then in herpes zoster we find the eruption usually confined to one half of the body. It will go to the median line, both in front and rear, but seldom any further. Cynanche parotidice presents another instance of a contagious disease affecting only one side at a time. A person may have mumps on one side at one time, and after the lapse of years have it on the other side, but not on the same side a second time, and if metastasis to the other organs occurs, it is sure to go to an organ on the side that the disease started in the parotid gland.

Again, you who have practised your profession in malarial districts must have noticed the fact that sometimes persons have ague on one side, which goes through the chill, the fever and the sweating stage in regular order, while the other half of the body presents no indication of being affected. We often see cases of neuralgia, which are evidently due to malaria, affecting one side, while the other side is exempt. These peculiarities in other diseases are generally recognized as nervous affections, and with my observations in cases of smallpox have led me to believe that the virus of the latter disease is located in the nervous system. There are other things that I would like to say with reference to contagion in clothing, etc., but my paper is already too long. Hoping that I have not wearied your patience, and that my deductions are in keeping with the experience of others who have had to do with the disease, I conclude.

IMMUNITY IN ITS RELATIONS TO PRACTICAL DIFFICULTIES IN DEALING WITH THE INFECTION OF CONTAGIOUS DISEASES.

By J. J. Mackenzie, B.A., Toronto, Analyst Laboratory Provincial Board of Health.

Gentlemen,—Ever since man began first to observe the peculiarities of his environment, and began to seek a reason for these peculiarities, it has been noticed that disease and death visited certain individuals or communities whilst leaving others free. Savage man explained all such phenomena by a reference to supernatural causes, and modern civilized man still quite frequently returns to the same explanation.

Observations on immunity and susceptibility are by no means new; they are as old as man himself; but it is only within the last few years that we have begun to have a rational and scientific explanation for them. The rational treatment of the subject begins with the early work of Pasteur, and is coincident with the rise and development of the science of bacteriology. In fact we may now say that the chief aim of bacteriological work the world over is to endeavor to elucidate all the laws which govern immunity and susceptibility, with the ultimate end in view of being able to produce, against all zymotic diseases, an artificial immunity.

It is not my purpose, in this paper, to discuss the various theories which are held as to the inherent causes of immunity, but I will briefly outline the two chief views. The one, upheld by German bacteriologists, is, that the immunizing principle lies in the blood-plasma. The others, upheld by Metchnikoff and the French school, is that this principle is in the cellular elements of the blood, or more broadly in the cells of mesoblastic origin.

It may be possible that there is truth in both theories. As a proof of the former may be given the results attained in the production of artificial immunity in diphtheria and tetanus by the work of Behring and others. As a proof of the latter are the long series of researches carried on in Paris and other schools on anthrax, tuberculosis and other diseases. As I have said above, however,

it is not my purpose, here, to discuss this subject, but rather to give you some idea of the conditions which we know lessen natural immunity or heighten susceptibility.

Immunity to a disease may be either natural or acquired. Natural immunity may be inherent in a race of animals, or it may simply be a phenomenon presenting itself from time to time with greater or less frequency in individuals of a given race. It is certainly a condition which varies in degree enormously, even in races inherently immune, and in so far as it does, it brings into consideration another factor, viz., the virulence of the infecting germ.

A few examples of these facts may be of interest. The brothers Klemperer, of Berlin, as well as others since them, have found that the human race enjoys, in comparison with the rabbit, a considerable immunity to the micrococcus of pneumonia. The Klemperers found that when they inoculated themselves with a sufficient amount of this micrococcus (taking into consideration the body weight) to produce in rabbits an extremely rapid and fatal septicæmia, they themselves experienced only a very slight local inflammation. Sternberg and other bacteriologists have shown that this micrococcus is an inhabitant of the mouth in about 15 per cent. of all healthy individuals. Vignal, in his interesting work on mouth bacteria, found that this germ was constantly present in his mouth for about two months of one year, when it disappeared, and was not again found until the April of the following year, when it was present for about fifteen days, after which it again disappeared. If the human race did not enjoy this comparative immunity to pneumonia, we would have many more cases than we have at present. But when it is found causes will readily occur to all of you, which might explain the temporary lowering of the resistance to it: I have only to mention the numerous cases of pneumonia and otitis media (usually caused by the same germ) which followed as sequelæ of the influenza epidemic.

Another very striking example of this variation in immunity is offered by the researches of the past two years upon cholera. It is generally conceded, I believe, that only a little over thirty per cent. of all those exposed to the contagion of cholera contract the disease.

This certainly points to a certain amount of immunity in the human race to the cholera germ. But this has been shown very conclusively by the experiments which were performed last year by many observers, some of them with the object of discrediting the cholera spirillum as the *causa vera* of the disease.

You will possibly remember that many different experimenters drank varying quantities of pure cultures of the cholera germ, in most cases without producing more than a passing diarrhœa; but that in every instance the germ was found in the stools. Although these cases were looked upon by many as proof that the spirillum of Koch was not the cause of cholera, the experiments were not numerous enough to warrant that conclusion. Amongst them, however, was one (performed in Paris, in Metchinkoff's laboratory) which throws considerable light on the subject. A student in this laboratory took internally a quantity of cholera culture from a race of the germ, which on experiment animals had not appeared at all virulent. This individual acquired an attack of true Asiatic cholera, which ran its accustomed course with all its characteristic symptoms.

It will be seen from these two examples that there must be other conditions aside altogether from the entrance of the germ into the body, which must determine in most infectious diseases whether an individual shall acquire it or not. It is my purpose in this paper to give you a brief outline of the facts at our disposal at present, bearing upon this side of the subject.

Perhaps the first point which would attract our attention is that of heredity. Its influence must be enormous; and although, perhaps, in general practice men are apt to ascribe more to heredity than to other factors, which may in particular cases be quite as important, still, when we shall know all the facts with regard to the bearings of heredity upon immunity and susceptibility, we will certainly find that in many cases they have not been over-estimated. In some diseases, *e.g.* tetanus, the inheritance of immunity by offspring may only be apparent, as Ehrlich has shown in this disease that it is due to the immunizing value of the milk of the immune mother. It is

considered by some biologists heretical to believe that any acquired character may be transmitted to offspring, but certainly an inherent immunity or susceptibility will be inherited.

As far as officers of public health are concerned, however, the importance of heredity in this respect is considerably less than the other factors, for as yet their power does not extend to the regulating of marriages, though who shall say that it would not be better for the future of the community if it did.

The factors which we must consider most important, from a public health standpoint, are those physical factors which it is possible to a large extent to control.

As I said above, many races of animals are naturally immune to certain diseases, yet we find this immunity disappears immediately the animals are subjected to unfavorable conditions.

Animals immune to anthrax have taken the disease if inoculated after an artificial anaemia was produced by bleeding. The loss of about one-tenth of the total blood caused fowls to lose their natural immunity to anthrax, so that when infected with the germs they succumbed. In other animals, blows upon the muscles, sufficiently severe to produce bruises, have caused the natural immunity to disappear. Fatigue, produced experimentally by causing the animals to run on a revolving drum, has been found to cause a complete disappearance of natural immunity to various diseases. Pasteur first, and other authors later showed that exposure to cold caused fowls to lose their natural immunity to anthrax, so that when inoculated with the germ after artificial chilling they succumbed to the disease as quickly as non-immune animals.

The action of anaesthetics and narcotics has been studied by Klein of London, and others, and the same results obtained. Anaesthetism or narcotism caused a complete disappearance of both natural and acquired immunity.

Perhaps the most interesting results, however, are those which show the effects of bacterial poisons upon immunity. This is shown by the simultaneous inoculations with two different microbes, or after we have introduced into the body the sterilized culture of one microbe we inoculate with another living microbe.

For instance, the rabbit is naturally immune to symptomatic charbon, but Roger showed that this natural immunity disappears if the animal is simultaneously inoculated with either living or dead cultures of *bacillus prodigiosus*. Bouchard attributes many cases of furunculosis to the resorption of substances secreted by the microbes in the alimentary canal, antisepsis of this canal arresting the disease. The most interesting and instructive experiments along this line are those of Sanarelli upon the bacillus of typhoid. This bacillus, when cultivated in the laboratory on our ordinary artificial culture media, rapidly loses its virulence, so that when introduced into the body of a guinea-pig it no longer produces death. Sanarelli has found that he can cause this bacillus to regain its virulence by the following method: the animal is infected with a non-virulent variety of the typhoid bacillus by introduction into the peritoneal cavity; at the same time the animal is inoculated subcutaneously with a small quantity of the sterilized products of the growth of *bacillus coli communis* (the ordinary intestinal form), or of *proteus vulgarus*, one of the ordinary putrefactive organisms. When so treated the animal dies inside of forty-eight hours, and a post-mortem examination shows the typhoid bacillus in all the organs. If from such an animal fresh cultures are made and inoculated into another animal, or if a fresh animal is infected with a minute quantity of the peritoneal exudate of the animal first infected, the typhoid germ is found to have regained its virulence so that it will cause death in a few hours, without the addition of the *bacillus coli communis* or the *proteus* cultures. This virulence is retained as long as the germ is passed from animal to animal; but it is lost quickly if simply cultivated on nutritive jellies. Some of Sanarelli's observations are interesting as bearing upon the clinical features of typhoid, especially in regard to relapses. As he had typhoid cultures which were non-virulent, and others which apparently had reached their maximum virulence, so he had cultures at various stages intermediate between these. Some of these when introduced subcutaneously into a guinea-pig, produced only a local abscess; but he

found that if, when the abscess was just on the point of healing, he introduced subcutaneously a small quantity of sterilized culture of *bacillus coli communis*, the animal died with all the symptoms of laboratory typhoid, and a postmortem examination showed the presence of the typhoid germ in all the organs. That is, the introduction of the *bacillus coli* culture determined a return of virulence to the germs situated in the healing abscess, and there was produced a relapse. The bearing of this upon the treatment of typhoid in practice is readily perceived, when we remember that *bacillus coli communis* is the ordinary inhabitant of the intestinal canal.

But soluble products of putrefaction have not alone been found to bring about an infection with an otherwise non-virulent typhoid bacillus, for some recent observers have found that animals which were so caged as to be compelled to breathe the gaseous products from the putrefaction of their own excreta, more readily acquired experimental typhoid than control animals which breathed pure air. Other observers have found that animals which were compelled to breathe sewer air showed a similar susceptibility.

It is evident from these experiments that all these adverse physical conditions play an extremely important part in determining susceptibility. But it is also to be remembered that susceptibility is determined partly by the condition of the animal infected and partly by the virulence of the infecting germ. How much each factor plays in the establishment of virulence of a certain germ we cannot say with certainty at present, but it will readily be seen that bad sanitary arrangements and adverse conditions of life will render possible the infection of an individual with an otherwise non-virulent germ.

Infection once established, however, we have plenty of evidence to show that the transmittal of this infection from individual to individual will often intensify or preserve the virulence. Sanarelli's experiments in typhoid point that way. Ferraci and Salsano, two Italian observers, in studying the relationship of fowl tuberculosis with tuberculosis of the mammalia, found evidence of the same thing. guinea-pigs will not ordinarily contract fowl tuberculosis; but, if their life conditions were rendered adverse, *e.g.*, by keeping them at

blood heat for a month, they succumbed to it, and the germs isolated from their organs would infect ordinary guinea-pigs ; and carried from animal to animal, was just as virulent for this group as ordinary mammalian tuberculosis. The work of the Pasteur Institute, upon rabies, has shown that passage of the rabies from rabbit to rabbit has developed a type of rabies very much more virulent and rapid in its course than that produced by the bite of rabid dog, the so-called street rabies. Dr. Stewart, of the Ontario Vaccine Farm, Palmerston, tells me he finds that if he inoculates his calves directly one from another, he obtains altogether too strong a vaccine virus, which shows itself not only upon the human patient but also on the calves. In order to avoid this he finds it necessary, in inoculating each fresh calf, to go back to virus obtained say a month before, and in this way he preserves the vaccine virus in a favorable condition of virulence. Evidently, here, the drying out of the virus in some way lessens its virulence.

This peculiarity of disease germs losing their virulence, whilst leading a saprophytic life, is of extreme importance from a public health standpoint, for we see how it is possible for a non-virulent pathogenic form to exist for a long time, and when the conditions arise becoming again virulent. The non-virulent typhoid germ is the common variety found in our laboratories, similarly with cholera, pneumonia and other disease germs.

Flügge, in a late paper of his upon diphtheria, mentions a fact which has been observed several times—a non-virulent diphtheria bacillus growing in the mouth of an individual, and yet not producing disease. That individual might infect another person who might be in such a condition of susceptibility as to allow the germ to regain its virulence, and determine an outbreak of an epidemic.

Perhaps no better example can be given of the practical results proceeding from a recognition of the variation in the virulence of the same germ, than those from the treatment of cholera in Germany during the late epidemic. Shortly after the Hamburg outbreak began, the authorities there adopted the precaution of making a

bacteriological examination of the stools, not only of cases or suspected cases, but of all those who had been exposed to infection. This examination resulted in the discovery of a number of cases in which the stools were found to contain the comma bacillus in quantities, yet no sickness had resulted. All such cases were isolated exactly as if they were cholera cases, and as a consequence every outbreak was stamped out with marvellous success.

We have, then, in the prophylaxis of zymotic diseases, to take special account of these two conditions—the condition of virulence of the infecting germ, and the condition of susceptibility in the person exposed. They are, in fact, by far the most important conditions which we have to deal with.

When a zymotic disease breaks out, we have it in our power under the Health Act, and the public are sufficiently educated to enable us to carry out all the proper precautions with regard to disinfection and isolation, so that with well-marked cases it is possible to guard against infection and spread of the disease. But before we can hope for perfect results, we must take like precautions with regard to those slight manifestations of disease, which may be due to germs of a low degree of virulence. How we are to diagnose and discover such cases is a difficult question to answer, and a question which in many cases requires much wider knowledge than we have at present to solve; but it is nevertheless extremely important.

In one disease, however, there are greater possibilities than in many others, that is in diphtheria. The bacteriological diagnosis is possible in diphtheria, no matter how mild the case. In fact it is the only safe and certain method of diagnosis; and I doubt not that if we could carry out in diphtheria such a method as has been carried out in Germany in regard to cholera, viz., the bacteriological examination of the fauces of everyone who has been exposed to contagion, we would have many more cases similar to the ones I have cited, in which the germ was present in the throat of some individual without the manifestation of the disease.

On the other hand we may still be as careful as possible in regard to the hygienic surroundings of the community, because of their

effects upon the condition of susceptibility of the individuals. Before the development of bacteriology as a branch of hygiene, the great end and aim of that science was to render as cleanly and hygienically pure as possible the surroundings of the community. In the rise of bacteriology, and from our first knowledge of the role of pathogenic germs in zymotic disease, there was a tendency in ultrabacteriologists to look upon the germ as the most important object to be considered in the causation and prevention of disease. Its importance can never be over-estimated, but bacteriology has given a new and more scientific knowledge of the effect of bad hygienic surroundings, and we recognize that bad air and dirt may be as important on account of increasing susceptibility to disease, as in the old days when they were considered the actual cause of the disease.