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GENERAL SANITATION—ITS IMPORTANCE TO THE PUBLIC WELFARE, AND A PLEA FOR BETTER METHODS.

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(Read before the Grand Rapids Sanitary Convention, February 18).

The subject of general sanitation, assigned to me by the committee, is one so wide in extent, and so profound, that I cannot hope to do justice to it as a whole; therefore, realizing the fact that a long and heavy load is frequently lifted with the greatest ease when only one end is required to be raised at a time, and especially that when one end of a load is already well raised the most important work is the raising of the other end, I have decided to glance at the general character, scope and importance of the work, ask more particular attention to such parts as in my opinion are most sadly neglected in Michigan at this time, and plead for better methods and more methods than are now employed, especially in certain neglected departments of general sanitation. In doing this, it seems almost essential to consider the character, necessary acquirements, and duties of those who are to do sanitary work; aad these are the officers and members of local boards of health, particularly the health officers.

The end of the general subject assigned to me, which I propose to lift on at this time, in accordance with the expressed wish of the committee and with my own judgment, relates mainly to the restriction and prevention of diseases which endanger the public health, and whose causes and modes of communication and best methods of prevention are not generally well understood. It may be said in passing that the department of public sanitation, which I consider to have already received the greatest attention, is that which relates to general cleanliness, the removal of filth, in the many disagreeable forms in which it has forced itself upon public attention by reason of its intrinsic power of odor or unsightliness. Such nuisances exhale powerful arguments for their own abatement, and although there is yet room for an immense amount of work to secure this removal, those who habitually resist or disregard such arguments are lower in the scale of civilization than they to whom I appeal for the restriction and prevention of communicable diseases, and in regard to other less recognized sources of disease. Some of the dangerous agents to which I wish to call your attention are the contagia of disease. These are just as real as are the evident nuisances, but they are as a rule invisible to the naked eye; and though they sometimes generate odors, they are themselves usually without odor. And yet, though their power is not evident to the unaided senses, the earth is strewn with the dead because of these disease germs, and all our paths of life are peopled with crippled victims of the many communicable diseases which we neglect to prevent or restrict.

NEW REQUIREMENTS AND DEFINITIONS OF CLEANLINESS.

In speaking of the greater importance in the prevention of diseases, of other work than that for the suppression of ordinary nuisances, the question has been asked if I was not forsaking the time-honored doctrine that all our ills are due to filth, and that the single word *cleanliness* expressed the whole sum and substance of general sanitation. To this I reply that very considerable progress has been made in our accurate knowledge respecting the causes of many diseases, and respecting the conditions essential to different kinds of cleanliness. To illustrate this, it may be sufficient to suggest different standards of cleanliness, as follows:—The housewife has one standard of cleanliness, which requires that a dish for the table must be thoroughly washed with soap in hot water, rinsed with clear water, and drained or wiped dry with a clean cloth. If such a clean dish be given to the chemist for his most accurate work, he may object that the dish is not chemically clean; and he will rinse it in alcohol or in a strong acid, or a strong alkali, according to the particular form of matter which he fears makes it unclean for his purposes, after which he also will pronounce it clean. If this same dish which has been made clean enough for the chemist be given to the biologist, who is experimenting on the vitality or reproduction of bacteria, he will pronounce it unclean for his purposes, and he will not be satisfied until he has submitted it to boiling water for at least five minutes, or in dry air to a temperature of 240° or 250° F., and then he will require that it shall not be exposed for an instant to the ordinary air, for fear of its contamination by germs which sometimes float in the air. He will insist on these conditions because he has found by experience that ordinary clothes, ordinary air, and ordinary water generally contain germs capable of reproduction under favorable conditions, and *sometimes* contain germs capable of reproduction in the bodies of human beings, and of causing such diseases as small-pox, scarlet fever, diphtheria, etc. The experiments by Tyndall, Burdon Sanderson, Pasteur, and others, on the conditions of life and reproduction of bacteria are of very great practical importance in studies for the prevention of diseases, because they show the facts concerning lower organisms similar to those which are found to multiply in the human body during the course of some of the communicable diseases, and because they tend to reinforce our knowledge of methods of destroying the contagia of some of those diseases, such, for instance, as the virus of small-pox, and the contagium of scarlet fever, which are found to be destroyed under some of the conditions just stated—as by exposure in dry air to a temperature of 250° F. Further experiment may show that a lower temperature is sufficient; and this is to be expected, because of the comparative infrequency of extensive outbreaks of these diseases in the hot summer weather, and also because of the liability of vaccine virus to lose its activity during the heat of summer. Returning to our clean dish, which, with a little variation, might as well have been a clean article of clothing direct from a laundry, or even new goods from a store, I think it is now plain that what is perfectly clean, according to one definition, may be very far from clean according to this view of the subject, and with great certainty may convey the unseen causes of disease to any susceptible person.

NEW METHOD OF SANITATION DEMANDED.

What has just been said makes plain the necessity for new methods of sanitation. It may be well briefly to recapitulate these reasons in a slightly different manner, in order that they may more easily be kept in mind. One essential fact to be noticed is that, although the causes of the communicable diseases are material, "particulate" as it is said, they are invisible to the unaided eye, and consequently our ideas of cleanliness must be so cultivated that we can in imagination follow the dissemination of the specific contagium which we know exists, whether it spreads through the air and is taken in with the breath, is conveyed from hand to hand in shaking hands, from lip to lip in kissing, from one place to another in clothing, new goods, boxes or trunks, or in whatever way it is carried from place to place or in whatever manner, as for instance by the saliva or expectorations of careless workmen or inmates, it is kept in houses or hospitals.

DISEASE GERMS, THEIR SIZE, DISTRIBUTION, ETC.

One who has never seen in the microscope the "particulate" germs of disease may be aided in such a scientific use of the imagination as has been suggested, by fixing his attention upon a form of contagium in mass sufficient to be appreciable to the unaided eye. In the small-pox vesicle we have the contagium of that disease in considerable quantity; and bovine vaccine virus, as we all know, contains the contagion of cow-pox. If we imagine this to be made up of minute granules, of rounded outline, so minute that twenty thousand of them will be required to extend an inch in length, we shall have an idea which will aid the mind in following the course and spread of disease germs of this nature. We can then easily see how such disease germs may be floated off by the air, carried in a veil, scarf or handkerchief, be stored or conveyed in the clothing, beard or hair, appear as dust in a room, be sent in a letter or a paper, be boxed up and transported to a distance, washed off in water, carried into a privy, pass through the entire length of a sewer, or the water-pipes which supply pure water, go in the milk can in its round from house to house, or with the delivery man from the grocer, baker, market or laundry. This may serve to give us an idea of some of the problems with which the health officer has to deal, in connection with the restriction and prevention of communicable diseases, and some idea of

WHAT A HEALTH OFFICER SHOULD KNOW.

An efficient health officer should have clear ideas of the nature of contagia; he must have a good practical knowledge of the means by which, and the manner in which they are disseminated; he should know the conditions of their reproduction, within or without the body; he should know the conditions of their existence outside the body; and especially of their destruction, for upon this, in connection with what has just been mentioned, depends his success in restricting or preventing communicable diseases.

A MEDICAL OFFICER OF HEALTH.

Some of the cities in Michigan do not obey the law which requires that the health officer shall be a physician. No man can be of much use as a health officer unless he has a good knowledge of biology, at least of the general principles. We might better put a blacksmith in charge of a miliner's shop than to choose as our health officer one who does not understand the nature of those vital actions which human bodies undergo in health, and of those processes which are coincident with disease. While much of the knowledge of the physician is entirely inapplicable to the work of public sanitation, and while this work demands of a health officer much knowledge which the ordinary physician has had no occasion to acquire, still the fact remains that in order to become a useful health officer, one must have had a thorough training in the biological sciences which lie at the foundation of the medical sciences.

A health officer should be sufficiently familiar with mycology not only to know that certain kinds of fermentation are ordinarily harmless, and certain other kinds are generally harmful, but he should know how to stop the harmful fermentation. Inasmuch as nearly all the ferments are invisible to the naked eye, a health officer must have an educated imagination in order successfully to deal with his everyday work. This is so because much of his work should be a battle with some of the special ferments. Perhaps I can make this plainer by briefly outlining what, in the present state of our knowledge, seem to be essential facts in this connection. Active cells in the human body act as ferments, destroying organic matter used as food, and creating special products differing according to the functions of the particular organs in which the action takes place. In the healthy adult, the requirement seems to be mainly to get from the food employed force to use in brain-work and muscle-work, very little being then required for growth or development of the body, so that the process is one of destruction through fermentations which yield force, for the purposes of life, and poisonous products which should be thrown out of the body as fast as formed, and which should not be again taken into the body. A health officer should endeavor to see that all is done that can be done to prevent their being supplied to the people again in the water they drink, the air they breathe, and the food they eat.

Immediately upon entrance into the mouth of a healthy adult person, starchy articles of food are attacked by one of the useful body ferments, in the saliva, and starch is converted into one form of sugar. And here, upon the very threshold as it were, may begin the battle between useful and harmful ferments; indeed it may begin in the food before it is put in the mouth, for the yeast which the cook puts in the dough may contain other ferments than the harmless yeast plant, and therefore the bread may contain not only the *products* of other ferments than yeast proper, but also the special ferments themselves, multiplied greatly in number since they left their home in the foul air, or well-water. So, also, with the meat, which, however, is not fermented by the yeast-plant, but is decomposed in a manner somewhat similar, by bacteria and similar low organisms microscopic in size. And here the product is not so frequently sugar and alcohol, but sulphureted and phosphoreted hydrogen, butyric and carbonic acids, ammonia, etc., usually bad-smelling products; and the bad odor of the product should warn us of danger from those germs which produce decomposition.

In order better to appreciate the importance of the subject, perhaps some other of the useful ferments of the body should be mentioned. We have noticed only the first one encountered by the food in the saliva of the mouth. The food meets another in the healthy stomach, another in the secretions from the pancreas, and so on in different parts of the body. Suppose each and every one of these natural ferments in the body has to divide the food with another special ferment which goes into the body with the water or food, or enters the blood in some other way, as is believed to be the case in most communicable diseases. Suppose that special ferment to be the one which causes small-pox, the one which causes diphtheria, or the one which causes typhoid fever. We can thus see how the gases given off by the lungs, and how the other secretions, and the secretions of the body may all contain products not naturally present in them, and a person not only have a fever but be "sick all over" in every part of the body. The character of the sickness, from a communicable disease, depends, as we know, upon the particular special ferment, but we need to guard, and to have our health authority guard us, against danger from every one of these contagious and infectious ferments.

HEALTH OFFICER NEEDED FOR EVERY LOCALITY.

It is important that all classes of people understand what needs to be done by the health officer, because he is a public servant dependent upon all classes of people, sometimes for his official position, and always for that co-operation which will render his efforts most effective.

If the people of a locality do not think of anything for a health officer to do, they will not be likely to employ one, except as a form in order to comply with the State law, and will then endeavor to get the cheapest man. A prominent newspaper in Detroit states the case as follows: "It is doubtful if any Board of Health, howsoever elaborate and costly, could at present improve the public health of so healthy a city. While therefore we may be compelled to have a health officer, as the law seems to require, to report our vital statistics to Lansing, the Common Council should take care that he cost as little as possible, and meddle as little as possible with the people's private affairs."

The writer of that paragraph assumes that Detroit is a healthy city. I know of no way of proving what he assumes, because the city has no reliable vital statistics; but the reports of burials in the city cemeteries indicate that the deaths from communicable diseases are about two hundred and forty every year. How long must this slaughter go on before it will attract the attention of the newspapers? When General Custer's little band, numbering about the same as this, was destroyed, the news thrilled the people of this State with an awful anguish; but here are two hundred and forty deaths from preventable causes in a city repeated every year, and that city so healthy that its only need of a health officer is to report on vital statistics to Lansing, and the Council is asked to hire a cheap man to do that. This illustrates the necessity for more accurate and more general information concerning the deaths and the causes of deaths which are now permitted to destroy people by the hundreds, without attracting sufficient attention to start efforts for their prevention. We need vital statistics, and we also need to act up to the knowledge we already have as to methods of preventing the communicable diseases.

To be continued.

ON THE CAUSATIOH AND DISSEMINATION OF TYPHOID FEVER.

DELIVERED AT THE ROYAL COLLEGE OF PHYSICIANS OF LONDON, BY WILLIAM CAYLEY, M.D., F.R.C.P., PHYSICIAN TO THE MIDDLESEX HOSPITAL AND TO THE LONDON FEVER HOSPTAL; LECTURER ON MEDICINE TO THE MIDDLESEX HOSPITAL MEDICAL COLLEGE.

In proceeding to consider the mode of origin and propagation of typhod fever, we are at once arrested by the question, What are the nature and properties of the poison which is supposed to give rise to the disease?

Now, the typhoid poison has up to the present time eluded all attempts to isolate it or to demonstrate its nature either by microscopical examination or chemical analysis; we are only conscious of its existence by the effects which it produces on the human organism. Nevertheless, some of its properties are known with tolerable certainty: (1) when introduced into the system it multiplies; (2) it is contained in the alvine discharges of persons suffering from the disease; (3) it retains its activity for an indefinite time after it has passed out of the body, when placed under favourable conditions, these conditions being the presence of decaying animal matter and moisture. Hence its usual habitats out of the body are drains, sewers, cesspools, dung-heaps, wet manured soils. And there are some grounds for supposing that in these situations also it may possess the power of multiplying. Lastly, in all probability it is particulate, and not either liquid or gaseous.

The actual nature of the poison—whether it be, according to the hypothesis most generally accepted, some kind of fungus, or microzyme, or protoplasm, in a word, a *contagium vivum*, or whether, as maintained by others, it is some derivative of albumen, capable of exercising a catalytic action on other albumen,—I do not propose to discuss, as it is a question at present rather of theoretical than practical interest, and it is one, moreover, for whose final determination the data are hardly yet sufficient.

A subsidiary question to this, but one of considerable practical importance, is whether the poison can be generated *de novo* from decaying organic matter, whether it be pythogenic, as was so ably maintained by Dr. Murchison, or whether it can only arise by continuous propagation, as was maintained no less ably by Dr. William Budd.

The arguments on both sides may be very briefly stated.

In favour of its origin *de novo* it is asserted that typhoid fever has often broken out in isolated situations—as solitary farm-houses, far removed from, and holding no communication with, places where the disease exists; and many such instances are given by Dr. Murchison. On the other hand, it has been proved incontestably, by many instances, both in this country and on the Continent, that all the conditions supposed to be required for its generation may be present for an indefinite time—as percolation of sewage into wells supplying drinking-water,—and yet the disease does not show itself till the poison is introduced by the arrival of an infected person, when an outbreak at once takes place.

Now, I would submit that this latter argument far outweighs the former; for otherwise, if it be proved that all the conditions necessary for the origination of the poison are present, as shown by its subsequent development when the germs are introduced, and yet it does not develope, we should have to admit that the same causes are not always followed by the same effects.

The instances in which persons in the latent stage of typhoid fever, or actually ill with it, have carried the disease to distant places, and caused it to spread, are so numerous that I believe that this mode of propagation is now universally admitted; the communication of the disease taking place not by direct contagion from the sick to those brought into immediate contact with them, but by the ordinary mode of sewage contamination.

I will quote in illustration three instances which have occurred in this country.

One is the famous epidemic at Over Darwen. The water-supply pipes of the town were leaky, and the soil through which they passed was soaked at one spot by the sewage from a particular house. No harm resulted till a young lady suffering from typhoid fever was brought to this house from a distant place: within three weeks of her arrival the disease broke out, and 1,500 persons were attacked.

Another well-marked instance occurred at Calne. A laundress occupied the middle one of a row of three houses supplied by one well, into which the slop of the laundress's house leaked. She on one occasion received the linen soiled by the discharges of a case of typhoid fever, and after fourteen days cases occurred in all three houses.

At Nunney a number of houses received their water-supply from a foul brook contaminated by the leakage of the cesspool of one of the houses, but no fever showed itself till a man ill with typhoid came from a distance to this house. In about fourteen days an outbreak of fever took place in all the houses.

Many equally striking instances might be quoted from foreign sources; I will, however, only adduce the well-known one of Lausen, as it illustrates some other points of great importance in the etiology and prophylaxis of the disease.

Lausen is a village through which, I have no doubt, most of my hearers have passed, as it lies on the railway between Basle and Olten, shortly before coming to the great Hauenstein Tunnel. It is situated in the Jura, in the valley of the Ergolz, and consists of 103 houses, with 819 inhabitants; it was remarkably healthy, and resorted to on that account as a place of summer residence. With the exception of six houses it is supplied with water by a spring with two heads which rises above the village at the southern foot of a mountain called the Stockhalder, composed of oolite. The water is received into a well-built covered reservoir, and is distributed by wooden pipes to four public fountains, whence it is drawn by the inhabitants. Six houses had an independent supply—five from wells, one from the mill-dam of a paper factory.

On August 7, 1872, ten inhabitants of Lausen, living in different houses, were seized by typhoid fever, and during the next nine days fifty-seven other cases occurred, the only houses escaping being those six which were not supplied by the public fountains. The disease continued to spread, and in all 130 persons were attacked, and several children who had been sent to Lausen for the benefit of the fresh air fell ill after their return home. A careful investigation was made into the cause of this epidemic, and a complete explanation was given. Separated from the valley of the Ergolz, in which Lausen lies, by the Stockhalder, the mountain at the foot of which the spring supplying Lausen rises, is a side valley called the Furlenthal, traversed by a stream, the Furlenbach, which joins the Ergolz just below Lausen, the Stockhalder occupying the fork of the valleys. The Furlenthal contained six farm-houses, which were supplied with drinking-water, not from the Furlenbach, but by a spring rising on the opposite side of the valley to the Stockhalder.

Now, there was reason to believe that, under certain circumstances, water from the Furlenbach found its way under the Stockhalder into one of the heads of the fountain supplying Lausen. It was noticed that when the meadows on one side of the Furlenthal were irrigated, which was done periodically, the flow of water in the Lausen spring was increased, rendering it probable that the irrigation water percolated through the superficial strata and found its way under the Stockhalder by subterranean channels in the limestone rock. Moreover, some years before, a hole on one occasion formed close to the Furlenbach by the sinking-in of the superficial strata, and the stream became diverted into it and disappeared, while shortly after the spring at Lausen began to flow much more abundantly. The hole was filled up, and the Furlenbach resumed its usual course.

The Furlenbach was unquestionably contaminated by the privies of the adjacent farm-houses, the soil-pits of which communicated with it. Thus from time immemorial, whenever the meadows of the Furlenthal were irrigated, the contaminated water of the Furlenbach, after percolation through the superficial strata and a long underground course, helped to feed one of the two heads of the fountain supplying Lausen. The natural filtration, however, which it underwent rendered it perfectly bright and clear, and chemical examination showed it to be remarkably free from organic impurities ; and Lausen was extremely healthy and exempt from fever.

On June 10 one of the peasants of the Furlenthal fell ill with typhoid fever, the source of which was not clearly made out, and passed through a severe attack with relapses, so that he remained ill all the summer ; and on July 10 a girl in the same house, and in August a boy, were attacked. Their dejections were certainly, in part, thrown into the Furlenbach ; and, moreover, the soil-pit of the privy communicated with the brook. In the middle of July the meadows of the Furlenthal were irrigated as usual for the second hay crop, and within three weeks this was followed by the outbreak of the epidemic at Lausen.

In order to demonstrate the connexion between the water-supply of Lausen and the Furlenbach, the following experiments were performed :—The hole I mentioned above as having on one occasion diverted the Furlenbach into the presumed subterranean channels under the Stockhalder was cleared out, and 18 cwt. of salt were dissolved in water and poured in, and the stream again diverted into it. The next day salt was found in the spring at Lausen. Fifty pounds of wheat flour were then poured into the hole, and the Furlenbach again diverted into it; but the spring at Lausen continued quite clear, and no reaction of starch could be obtained, showing that the water must have found its way under the Stockhalder in part by percolation through the porous strata, and not by distinct channels.

Besides showing the necessity of the introduction of the specific poison in order to render sewage contamination capable of giving rise to typhoid fever, this case is remarkable as an instance of the extreme dilution to which the poison may be subjected without losing its potency, and also the uselessness of irrigation and any ordinary filtration in separating it or rendering it inert. Here the dejections of two cases of typhoid are thrown into a stream; the water of this stream is used to irrigate extensive meadows; a portion of it sinks through the superficial strata, and probably finds its way into subterraneous channels, and passes through a distance of many thousand feet under a mountain, partly, no doubt, by mere percolation; it then takes an insignificant part in feeding one head of a copious spring, which has another head that is not contaminated, and, nevertheless, it gives typhoid fever to 130 persons out of a population of 800. The dilution must have been almost infinitesimal, unless we assume that a multiplication of the poison took place after its discharge from the intestinal canal of the first two cases—possibly in the reservoir at Lausen.

The apparently spontaneous origin of the disease in isolated places may, doubtless, be in part explained by the very long time the poison may lie dormant, still retaining its essential properties, and capable under favourable conditions of developing its activity.

The poison, too, may be introduced in quite unsuspected modes. It is well known that the typhoid poison by no means always produces what is usually recognised as typhoid fever. In very many cases its only effect is to cause some malaise, together with slight intestinal catarrh, which is not necessarily attended by diarrhœa. These cases are only recognised as typhoid when they occur during an epidemic, and among persons who have been exposed to infection; but if we may judge by the analogy of scarlatina, diphtheria, and other contagious fevers, where similar slight unrecognisable forms are not uncommon, these apparently trivial cases should be as potent in communicating the disease as the severe well-marked forms. Hence it is quite possible that the typhoid poison may be introduced into a locality by a person whom no one would suspect of being infected with the disease.

It has been ingeniously suggested by my colleague, Dr. Robert King, that the typhoid poison is derived solely from decomposing albumen, which is not present in healthy stools, and that it can therefore only arise from morbid stools which contain albumen, as is the case in some forms of catarrhal diarrhœa, and he has published a case where the poison seemed to be generated in this manner. This theory might certainly account for long-continued sewage contamination of water without the production of typhoid fever, as the special material from which the typhoid poison is generated might be absent. But it is hardly likely that any such derivative of albumen would remain undecomposed in a drain or cesspool for so long a period, as we have reason to believe is the case with the typhoid poison.

We have next to consider how long the typhoid poison can thus retain its activity out of the body in a suitable locality. One of the clearest pieces of evidence on this point is the well-known instance related by Dr. von Gietl. To a village free from typhoid an inhabitant returned suffering from the disease which he had acquired at a distant place. His evacuations were buried in a dunghill. Some weeks later five persons who were employed in removing dung from this heap were attacked by typhoid fever: their alvine discharges were again buried deeply in the same heap, and nine months later one of two men who were employed in the complete removal of the dung was attacked and died. Here we have distinct evidence that the poison retained its powers for nine months.

Dr. Murchison, in his work on Fever, gives an instance in which six cases were spread over a period of eight years. I have recently seen an instance in which an interval of two years occurred without apparently any fresh importation of the poison. Supposing the germ theory to be correct, there is, of course, no reason why the poison should not preserve its vitality, by continuous propagation, for an indefinite time.

On the whole, though the point cannot be regarded as finally determined, I think the weight of evidence is against the *de novo* origin of the disease.

We have now to consider a question about which much difference of opinion still prevails, viz., the contagiousness of typhoid fever. That the disease is communicable from the sick to the healthy is, I believe, universally acknowledged, the point in dispute being the mode in which the transmission takes place, whether directly by emanations from the patient, or from his fresh evacuations, or indirectly from eating or drinking, or inhaling the emanations from the stools, modified by their having undergone some kind of decomposition or fermentation outside the organism. Although the point in dispute is a narrow one, it is of considerable importance, and erroneous views may lead, on the one hand, to the adoption of unnecessary restrictions, which may seriously incommode the patient and his attendants, while at the same time it is only too likely to cause a neglect of the really essential precautions.

I have myself witnessed an outbreak of typhoid where the belief in its contagiousness—shared, I may say, by the medical practitioners—was so strong as to excite quite a panic, so that difficulty was found in procuring attendants for the sick. In consequence I had on one occasion myself to carry a patient from one room to another, and a man who volunteered to help me was regarded as having done something rather heroic. I need hardly say that, at the same time, the utmost recklessness is commonly shown with regard to the real causes of its dissemination.

On the other hand, a disbelief in the direct contagiousness of the disease might, if not well founded, lead to unnecessary exposure of the patient's friends.

The arguments against the direct contagiousness of the disease are in the main these :—1. In hospitals we rarely find that typhoid fever spreads either to the attendants on the sick or to the other patients. When it does thus spread, persons in other parts of the building, who have never been brought in contact with the typhoid cases, are attacked about as frequently as the immediate attendants themselves.

Dr. Murchison has published the evidence on this point afforded by the London Fever Hospital for a period of twenty-three years, up to 1870. During this period 5,988 cases of typhoid were admitted, and seventeen of the resident staff took the disease, but of these seventeen only five were in communication with the typhoid cases, and twelve occurred at a time when there were serious defects in the drains; twelve patients also admitted for other diseases became infected. But since 1861, when the patients were so classified that the typhoid cases and the patients suffering from other acute diseases, not fever, are placed in the same wards, not a single instance has occurred in which the infection has spread to the non-typhoid cases, though the same night-stools and water-closets have been used by both classes of patients, and the use of disinfectants have been exceptional. This shows pretty conclusively that the emanations from the recent stools are not capable of communicating the disease.

Since 1871, 1,447 cases of typhoid have been admitted and treated in the same wards with 692 patients suffering from other diseases, and during this time only three nurses and no patients have acquired the disease. On several occasions, however, cases of scarlet fever lying in other wards have become infected. So far as the London Fever Hospital is concerned, it would seem that the risk of becoming infected with typhoid is rather less in the typhoid wards than in other parts of the building.

The experience of other hospitals is for the most part in accordance with that of the London Fever Hospital.

Liebermeister states that up to 1865, neither at Greifswald, nor Tübingen, nor Berlin, had a single instance been known of the disease spreading to other patients in the hospital or to the attendants on the sick. The Hôtel-Dieu and La Pitié at Paris, the City of Glasgow Fever Hospital, and the general hospitals of London show much the same results.

During the past year sixty cases of typhoid fever were admitted into the Middlesex Hospital, and six nurses took the disease; but of these six, five were on duty in the surgical wards and never came into contact, directly or indirectly, with the typhoid cases. I need hardly say how unlike this is to the behaviour of a contagious disease. I have no doubt but that in all these six cases the disease was due to the condition of the drains of the dormitory.

It is also found that when persons suffering from typhoid fever are removed to distant places, it is the exception, and not the rule, for the disease to spread; and when it does spread, it quite as commonly attacks persons who have not been brought into immediate contact with the sick, as it does the attendants themselves. It may, I think, be laid down as absolutely certain that an epidemic of typhoid is never caused by the disease spreading by direct contagion, as epidemics of small-pox, scarlatina, and typhus are. On the other hand, it is argued that sometimes, in hospital practice, typhoid does spread to the attendants on the sick or the other patients; and, not at all uncommonly, persons suffering from typhoid, when removed to a distance, do communicate the disease to those brought into contact with them.

Thus, in the hospital at Basle, 1,900 cases were admitted in six years; and during this period forty-five residents in the hospital became infected, and a large number in addition suffered from a non-febrile intestinal catarrh which in all probability was due to the typhoid poison. But of these forty-five cases many had never been brought into contact with the patients, and of the nurses it was found that those were especially liable to be attacked who occupied a particular room where they were exposed to the emanations from a leaky choked soil-pipe. Probably there is no city in Europe, not even Munich, and no hospital, so saturated with the poison of typhoid as Basle and its hospital; and, moreover, the hospital drains are or were in a very unsatisfactory condition; and thus there is every reason for believing that the contagion in all these forty-five cases was indirect.

The same argument applies to the spread of the disease in private houses. In the great majority of instances where the fever is imported from a distance it does not spread; where it does, some defect in the sanitary conditions favouring indirect contagion can generally be detected: and it is therefore almost certain that the same is the case in the other instances; otherwise we should have to admit that typhoid fever is sometimes contagious and sometimes not—nay, that during the same epidemic the disease is contagious in one house or institution, and not contagious in another house or institution, though they may be situated close together.

I have seen many instances of supposed direct contagion, but have generally succeeded in tracing them to an indirect source.

A boy was admitted in the Middlesex Hospital under my care, on March 27 of last year, suffering from a very severe attack of typhoid. For several days he lay in an unconscious condition, and during this time he had very profuse diarrhœa—twelve to twenty liquid motions daily, which were for the most part passed in the bed. In the next bed was a boy aged six, who had been admitted on April 16, with acute renal dropsy and bloody urine. He was kept strictly confined to bed, and never got up to go to the water closet down which the motions of the typhoid case were thrown. On May 11, when he was convalescing, the dropsy having disappeared and the albumen much diminished, he was seized by typhoid fever, and passed through a moderately severe attack, with a well-marked rash and characteristic symptoms. This at first sight appeared to be a case of direct contagion, but I have no doubt that the true explanation is this:—The bedding of the first patient was constantly kept saturated by his liquid motions, and, though every care was taken to change the linen frequently, it was obviyus, from a distinctly fæcal smell which was always present, that the bedding or mattress remained contaminated, and thus time was given for the poison to develope its infectious properties. Another patient in the same ward, admitted for acute rheumatism, was also attacked by the fever. He occupied a bed on the opposite side, and never came near the first case, but, being convalescent, he used the water-closet down which the motions of the typhoid case were thrown; and it so happened that at this time the closet was out of order, the contents were retained, and an offensive smell was constantly present. Hence, I think, there can be no doubt but that he was infected by the emanations from the evacuations of the first case.

The first case affords an example of a very common mode of infection; and many of the cases attributed to direct contagion are really produced in this way, especially among the lower orders or where skilled nurses are not employed. The bed-linen or mattress, or the patient's own person, become soiled by the liquid alvine discharges. These soon dry, and are left undisturbed, and in a short time the poison developes its infectious properties. Soiled linen is well known to possess very active contagious powers, and to retain them for a long time.

If these views are correct, it becomes an important subject of inquiry as to how soon the stools acquire contagious properties. I am not aware of any observations which would enable us to decide this point with certainty, but the time is probably a short one. The frequency with which washerwomen have been infected by soiled linen points to a very short duration, as such linen is seldom retained for any length of time. Some facts which have come under my own observation, though not conclusive, are also in favour of the period being very short.

At the Middlesex Hospital it was formerly the custom to preserve the stools of cases of typhoid, which the physician wished to inspect, in pans which were placed in the water-closets of the wards. Now, the time during which such stools would be so kept would hardly ever exceed twelve hours; nevertheless, several instances have occurred in which other patients using these closets have become infected. Supposing the cause of the infection to have been these reserved stools, we should have a period of not longer than twelve hours for the contagious properties to become developed. The experience of the London Fever Hospital pretty conclusively proves that the fresh stools are innocuous.

The practical conclusion to be drawn is, I think, this: that we have in all cases a few hours during which it lies in our power to render the poison innocuous, and to prevent the spread of the disease by direct infection.

(*To be continued.*)

CONTAMINATION OF DRINKING WATER BY FILTRATION OF ORGANIC MATTER THROUGH THE SOIL.

READ BEFORE THE SANITARY CONVENTION AT DETROIT, JAN. 7, 1880, BY VICTOR C. VAUGHAN, M.D., PH.D., LECTURER ON MEDICAL CHEMISTRY IN THE UNIVERSITY OF MICHIGAN, ASSISTED BY P. E. NAGLE.

There seems to be a wide-spread belief that in disposing of decomposing organic matter it is only necessary to remove it from sight by burial in the earth. All through the rural districts and in the towns and many small cities of this country, privy vaults, cess-pools and even cemeteries are located in close proxomity to cisterns and wells. A few feet, or at most a few rods of intervening soil are considered as sufficient to prevent the contamination of the water from these receptacles of decomposing matter. There is a general belief in the power of the soil to retain or to remove in some way all organic matter from solutions. Not infrequently a privy vault may be seen located within 10 or 20 feet of a well or a cistern, and often the slope of the land is toward the well or cistern. During the past three months the authorities of a growing village in the interior of this State have, in spite of the remonstrance of certain citizens, located a cemetery within a few rods of a deep well, the water of which is used for household purposes.

During the summer of 1878, the sanitary condition of certain premises in Ann Arbor was as follows: The cistern located at the rear of the house was about 20 feet deep, and about six feet below the surface it leaked. Of course if water could pass out it could as readily pass in. Fifteen feet back in the yard, and slightly elevated, stood the privy. As soon as the warm months of the summer came on, the water of the cistern became so offensive that it could not be used. The odor was that of the privy, and the water swarmed with microscopic animalculæ, and with others large enough to be seen with the unaided eye. All the water was removed and the cistern thoroughly cleansed. A few days later a heavy rain refilled the cistern, but within a few weeks more the water again became unfit for use, but was not so bad as it had been before the cleaning. During the remainder of the summer and fall the family obtained their drinking water from another source. During the winter season the water of the cistern so improved that after being filtered it could be used. But as soon as the warm weather of the following summer approached the water again became unfit for use, and was almost or quite as bad as it had been during the previous summer. This is only an illustrative case, and I know of similar ones in Ann Arbor.

Such instances as this caused us to doubt the power of soils of completely preventing the filtration of organic matter in solution. We determined to endeavor to answer, by experimental investigation, the following questions: (1.) To what extent are organic substances removed from solution by filtration through soil? (2.) Do different soils differ in their capability of thus removing organic matter? It must be noted here that the organic substances to be removed are held in solution, and not merely in suspension. The principal object in the filtration of natural waters for the supply of towns and cities is the removal of suspended matter. Again, the waters with which our experiments are concerned, and with which, as we shall endeavour to prove, drinking water is often contaminated, should be designated as *polluted* water, *i.e.*, the amount of injurious substances which they contain is sufficiently great to render their direct use dangerous.

The first thing necessary to an investigation of the first question, was to select some soluble organic substance, for which there are known exact methods of quantitive determination ; for it would be necessary to determine the amount removed from solution by making quantitive determinations of the amounts in solutions before and after filtration. For this purpose urea was selected, and, in order to have the conditions as natural as possible, the solution selected for filtration was urine. Urea is also easily discomposed, and experiments performed with this substance would have the advantage of the conditions being most favorable for the the removal of the organic substance. It is well-known that urea is not far removed from inorganic matter and that its transformation into carbonic acid and ammonium is easily accomplished.

One cubic foot of the ordinary gravel soil, from four feet below the surface, was obtained and so arranged that fluids could be poured upon its surface (which was one square foot) and the filtrate collected. The amount of urea in a specimen of urine was then estimated with mercuric nitrate (the chlorides having previously been removed), a measured quantity of this specimen was poured upon the surface of the soil, and the urine which passed through was collected, measured and its contanined urea estimated. A certain amount of urine (which was equal to that passed by one person in 24 hours) was poured upon the soil at one time. The filtrate from this was collected, measured and its contained urea estimated. This was repeated for a number of days or until the filtrate was found to contain as much urea per 100 c. c., as the urine did before filtration. The results of these experiments are given in the following table :

	Urine poured on Soil.	Urine passed Through.	Total Urea Poured on in Solution	Total Urea in the Filtrate.	Urea per 100 c.c. before Filtration.	Urea per 100 c.c. after Filtration.
			Gramm	Grams	Grams.	Grams.
First day............	1,760 c.c.	938 c.c.	49.28	15.00	3.8	1.6
Second day.	965 c.c.	740 c.c.	25.7	14.06	2.6	1.9
Third day......... ..	860 c.c.	600 c.c.	13.76	9.60	1.6	1.6
	3,585 c.c.	2,278 c.c.	88.13	38.66		

The soil, which had now become saturated with organic matter, was removed from the filter, spread out upon a clean board so as to be exposed to the air, left in this condition 24 hours, and then returned to the filter. Urine was poured upon this soil, and the amount of urea removed by filtration was estimated as before. In this case it was found that the urine, before filtration, contained 1.1 grams of urea per 100 c.c, and after filtration, only 1.6 grams; or the soil which had been saturated with the organic matter was so far purified by exposure to the atmosphere for 24 hours that it now removed one half a gramme of urea from every 2.1 grammes poured upon it in solution.

From these experiments it is very evident that the ordinary gravel, which constitutes so large a proportion of the soil of this State, has but little effect in removing or oxidizing soluble nitrogenous substances from solutions which are allowed to pass through such soils. Furthermore, it became evident that such soil soon becomes saturated, and then no longer has any effect upon the removal or oxidation of these organic substances. The amount of urea necessary to thus saturate one cubic foot of soil was 88.13 grammes, or that contained in 3,505 c.c., of urine. Of course this urine contained a small quantity of other organic substances, so that we will not claim that the following computations are exact; but we will be careful not to overstate them. Suppose that the total solid excretions of an adult are 112 grammes per day (this of course is very low), then the solid excretions from a family of six persons each day would be sufficient, when properly dissolved, to saturate over seven cubic feet of gravel soil. From this it is evident that only a few weeks or months would suffice, with a proper amount of rain fall, to saturate every cubic foot of soil to the depth of five or ten feet in a small yard, in which we often find privy vault, cess-pool and cistern or well in close proximity. Of course if these substances are not destroyed by filtration, they will be carried with the water which passes through the soil wherever such water may go. If the water gains an entrance to the well it will carry with it the substances in solution. At this rate it would require more than a few feet or even rods of intervening soil to prevent the contamination of the water of wells or leaky cisterns from privy vaults, which often are not cleaned once a year, or from cesspools or cemeteries.

But there is another consideration that must be mentioned in this connection. The gravel by itself forms one of the poorest of filters, because the particles are not all of the same size and shape, consequently the interspaces are also of unequal size, and the liquid meeting with less resistence in one direction than in others, soon collects and forms streamlets which may convey the polluted water in quantity toward, or even into the source of the water used for household purposes.

This brings us to a consideration of the second question proposed to be investigated by experimental investigation, *i. e.*, Do different soils differ in their capability of removing organic matter from solution? The gravel having been already tried we did not make any further experiments with it; but we next experimented with sand and loam in the same manner as we had done with the gravel. The comparative results only will be of interest. While urine (3,585 c.c.) containing 88.13 grammes of urea saturated one cubic foot of gravel, urine (4,000 c.c.) containing 89 grammes of urea did not saturate one cubic foot of loam, but, after this amount of urine had been used, the loam still removed four-tenths of a gramme of urea from each 100 c.c. of urine. The sand was also better than the gravel but was not as good as the loam, for 88 grammes of urea in 4,000 c.c. of urine did not saturate the sand, which still removed two-tenths of a gramme of urea from each 100 c.c. of urine. Thus of the three—gravel, sand and loam—the loam is the most active, and the gravel least active in the removal of organic matter from solution.

The explanation of this may be conceived to be as follows: First, the inequality in size and variety in the shape of the pieces of gravel (as has already been referred to) allows the formation of streamlets, and the solution thus passes through the gravel more rapidly than through either the sand or loam. This is the physical defect in the gravel as an agent for the removal of the organic matter. A second cause is the greater porosity of the loam. As was shown by the renewed activity of the gravel after it had been exposed to the atmosphere for 24 hours, oxygen is the agent which acts chemically in the destruction of organic matter, or, rather, in its conversion into inorganic matter. Now the more concentrated the oxygen the more energetically will it act. As is well known, the atmosphere in the minute pores of the soil is condensed.

Oxygen has been justly termed the scavenger of creation and the free access of this gas is necessary in order to render the excretions of animals harmless. This good work is begun in the living body; for the hæmoglobuline of the red blood corpuscles carries oxygen to all the tissues, and by the action of this oxygen, poisons introduced from without and poisons generated within the organism are rendered inert and fitted for excretion.

Animals are formed by the agency of plants out of the constituents of earth and air. "Whatever in our bodies is inorganic originated in the soil; whatever in our bodies is organic originated in the atmosphere. Whatever in our bodies is inorganic will return to the soil; whatever in our bodies is organic will return to the atmosphere. The carbon of the carbonic acid of the air becomes the carbon of the cellulose, starch, gums, resins, etc., of plants; it becomes the carbon of our blood and muscle; and from our bodies it is returned to the air. Thus the changes of matter form an endless chain whose first link is also its last." (Gorup-Besanez.) Now the agent which converts the organic tissues of the animal into inorganic substances is oxygen; and this is the proper agent to use in rendering animal excretions harmless. This is the reason why the dry earth closet, with a pipe to conduct the gases into a chimney, is the best method (at least for the rural districts and small cities and villages) of disposing of fæcal matter. The dry earth takes up the oxygen, which is then condensed in the pores and acts with double energy. Instead of burying these substances down in the earth where but a limited supply of oxygen can reach them, it is far better to allow the free access of the atmosphere. Burial simply aids in the preservation of organic substances, and, as we have seen, they may be carried under the ground into our wells and thus poison us. Instead of simply burying these noxious substances and then thinking ourselves secure from them, it would be far better to render them inert and even useful, as may be done.

As to the location of cemeteries in the vicinity of wells, we think that our experiments show that the decomposing matter from one body would be sufficient to pass a long distance, especially through gravel soil, before it would be completely destroyed. We honor the dead as highly as others do, but it is not right that the dead should be allowed to murder the living.

THE THERMAL AUTOMATIC SYSTEM OF VENTILATION.

In the January and February numbers of this journal we discussed the subject of simultaneous warming and ventilation. An analysis of the difficulties involved, and the resources at hand was attempted, and the conviction expressed that the problem would be satisfactorily solved at no distant day.

We submit the following outline sketch of a plan or * device intended to accomplish the end so much desired, viz. : a comfortable temperature and pure air at the same time in our northern homes.

A warm floor is the central thought of this device, at least so far as the temperature is concerned. With a warm floor many of the difficulties encountered in all the attempts hitherto made disappear as if by magic. A warm floor means warm feet, happy children and general comfort. We propose then to warm the floor, and to do this we provide for sending the warm air from the furnace, *under* the floor on its passage to the living room. We first construct two air tight rooms in the basement or cellar—rooms air tight when the doors and windows are shut—except as they are opened by air ducts as hereinafter described. We also construct an air vault or chamber under the floor, or if you please, within a double floor, for the reception of warm air.

We provide warm air ducts with registers, as hereafter more closely described. These with a suitable furnace and a good smoke flue complete the apparatus needed. One of the rooms above mentioned is known as the pure air room, and the other as the foul air room. They are separated by an air tight partition. The body of the furnace (and almost any ordinary furnace may be used,) stands within the pure air room, while its mouth opens into the foul air room. Each of these rooms is provided with a door and a window, and is 6 x 7 x 8 feet square, larger or smaller according to the size of the building, and the furnace needed. They are made of brick and well plastered. The chamber under the floor is constructed as follows : Upon the joists a close floor is laid. Upon the floor strips are nailed down, and so arranged as to serve the double purpose of supporting another floor to be laid upon them, and also of distribut-

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* This device is the joint invention of the editor of this journal, (*Herald of Health*), and his brother, Rev. G. W. Gray, D.D.

ing the warm air to all parts of the chamber before it is admitted to the living room. Free communication is now opened through air ducts leading from the interior of the pure air room (containing the body of the furnace) near the ceiling to this chamber through an opening in the lower floor. To allow the air to pass out of this chamber (in the floor) and up into the living room, registers are opened along the *innermost* walls through which the air is admitted from the chamber. By this time the floor is warm and the house full of warm air. But to keep it pure it must be withdrawn and re-supplied. How? In constructing the air chamber in the floor as above described, the strips are so arranged as to leave an air-tight duct along the *outermost* wall of the house in the edge of the air chamber, and which in fact is a separate part of the chamber. This duct, (or these as the case may be,) extends and leads back to the foul air room (in the basement, into which the furnace door or mouth opens) in the most direct way, and discharges into it, and near the bottom or below the mouth of the furnace. Registers are now opened through the floor into this foul air duct. The air, after being admitted as above described, and passing in circling currents across the room, is withdrawn through these registers and this foul air duct to the mouth of the furnace, with which it is in open com, munication. It will now be noted that the ventilating air current sets in from without through a duct of proper dimensions, and enters the pure air room beneath the furnace. It passes about the furnace- is warmed and fills this room, which now becomes a warm air reser· voir, to be drawn upon for supplies. From this room its only escape is through the ducts provided into the chamber under (or in) the floor, and onward into the living room. This living room being in open communication with the mouth of the furnace, and the draft and smoke flue, the air will be withdrawn from it through the foul air ducts, the furnace and smoke flue, and so pass into the open air. Since the combustion of the furnace must feed upon the air drawn from the apartments occupied, all other means of supply having been excluded, the constant withdrawal of the foul air is secured.

The foul air registers are placed along the outermost walls of apart-ment occupied, in order that the draft passing out may catch up and bear away at least a part of the cold air which is always steal-ing into the house through crevices, and running down to the floor.

The foul air ducts connect with the foul air room by the most direct way, and deliver the air into it, that it may be subjected to the strong draft of the furnace, which secures the necessary movement and change of the air in the living room. The foul air ducts deliver their contents within and near the bottom of the foul air room to prevent the possibility of any reversion of the current.

An opening is made in the smoke flue, and provided with a register, through which so much of the air as may not be needed for combustion purposes may be drawn off with the current.

In the pure air room provision is easily made for restoring the necessary humidity to the air, after it has been heated, and before it is sent forward to be used in the rooms above. When several rooms are to be heated at the same time, the several foul air registers of contiguous rooms open into a common foul air duct to secure equilibrium of temperature and warm air in all the rooms. This arrangement practically reduces them all to one room. By this arrangement we secure the advantages arising from a *warm floor*, and they are many and great. According to prevailing methods it is impossible to avoid cold eddies, and a lake of cold air on the floor. The old sanitary injunction to "keep the feet warm and the head cool" is reversed. The cold air descending to the floor, and the warm rising, the *feet* are kept cold, and the *head* warm. If young children could crawl upon the ceiling, and people stand on their heads, it would do. By warming the floor this whole difficulty disappears. In this arrangement we utilize the direct draft of the furnace, as the best avoidable means of exhausting the foul air.

The crowning difficulty with all systems of ventilation that we know anything about is found in the fact that the exhaust draft is *too weak* to effect a sufficiently frequent change of the air. The expedient of sending the exhaust flue up along side the smoke flue, in order that it may be kept warm, and thus increase the draft, was a step in advance, but no draft is so powerful as that occasioned by the *direct heat of the furnace* up the smoke flue. We have succeeded in applying this draft to the exhaustion of the foul air without the possibility of being troubled with the smoke, an advantage which will insure the regular and automatic operation of the apparatus, and any frequency of change and amount of air needed.

Another and the last advantage here claimed for this arrangement is the saving of fuel which it will effect. The loss of heat in ordinary methods of heating is simply enormous, amounting from 75 to 90 per cent. of the heat generated. By sending the heat *under the floor* it is so delayed and expended as to become available in much larger proportion than it can be when it is sent directly into the room. A cold floor is a suitable place for the lodgment of the cold air which is always forcing its way into the house. Neither the floor nor the stratum of air nearest to it can be warmed by turning a stream of warm air into the room, for it instantly flies away to the top and escapes, if it is possible, as most of it usually does. Having passed above the feet, which are always most in need, it is practically lost. A warm floor constantly antagonizes the cold air which finds its way into the room. The heat is expended in warming the coldest air, and precisely that which is giving most trouble, and hence much less fuel will suffice, which as all will admit is a consumation devoutly to be wished.—*Herald of Health.*

ON CONTAGION.

BY MR. JOHN SIMON—*in British Medical Journal.*

The social conditions through which, in our own country at the present time, the more fatal infectious diseases are enabled to acquire epidemic diffusion are chiefly such as the following :—that persons first sick in families and districts, instead of being isolated from the healthy and treated with special regard to their powers of spreading infection, are often left to take their chance in all such respects ; so that, especially in poor neighborhoods, where houses are often in several holdings, and where always there is much intermingling of population, a first case, if not at once removed to a special establishment, will almost of necessity give occasion to many other cases to follow ;—that persons with infectious disease, especially in cases of slight or incipient attack, and of incomplete recovery, mingle freely with others in work places and amusement places of common resort, and, if children, especially in day-schools, and that such persons travel freely with other persons from place to place in public conveyances ;—that often on occasions when boarding-schools have infections disease getting the ascendant in them, the schools are broken up for the time, and scholars, incubating or perhaps beginning to show infection, are sent away to their respective, perhaps distant, homes;—that keepers of lodging-houses often receive lodgers into rooms and beds which have recently been occupied by persons with infectious disease and have not been disinfected;—that persons in various branches of business relating to dress (male and female) and to furniture, if they happen to have infectious disease, such as scarlatina or small-pox, on their premises, probably often spread infection to their customers by previous carelessness as to the articles which they send home to them, and that laundries further illustrate this sort of danger by carelessness in regard to infected things which they receive to wash;—that purveyors of certain sorts of food, if they happen to have infectious disease on their premises, by carelessness spread infection to their customers;—that streams and wells with sewage and other filth escaping into them are most dangerous means of infection, especially as regards enteric fever and cholera, and that great purveyors of public water supplies, so far as they use insufficient precautions to insure the freedom of their water from such risks of infectious pollution, represent in this respect an enormous public danger;—that ill-conditioned sewers and house drains, and cesspools receiving infectious matters, greatly contribute to disseminate contagia, and often by leakage into wells. Of the dangers here enumerated, there is perhaps none against which the law of England does not purport in some degree to provide. At present, however, they all are, to an immense extent, left in uncontrolled operation; partly because the law is inadequate and partly because local administrators of the law often give little care to the matter; but chiefly because that strong national opinion which controls both law and administration cannot really be effective until the time when right knowledge of the subject shall be generally distributed among the people, and when the masses whom epidemics effect shall appreciate their own great interest in preventing them.

Whenever that time shall come, probably the public good will be seen to require, with regard to every serious infectious disease which is apt to become epidemic, that the principles which ought to be accepted in a really practical sense, and to be embodied in effective law, are somewhat as follows: (1) that every case of such disease is a public danger, against which the public, as represented by its local sanitary authorities, is entitled to be warned by proper information;

(2) that every man who in his own person, or in that of any one under his charge, is the subject of such disease, or is in control of such circumstances relating to it, is, in common duty towards his neighbors, bound to take every care which he can against the spreading of the infection ; that, so far as he would not of his own accord do his duty, his neighbors ought to have ample and ready means of compelling him ; and that he should be responsible for giving to the local sanitary authority proper notification of his case, in order that the authority may, as far as needful, satisfy itself as to the sufficiency of his precautions ; (3) that so far as he may from ignorance not understand the scope of his precautionary duties, or may from poverty or other circumstances be unable to fulfil them, the common interest is to give him liberally out of the common stock such guidance and such effectual help as may be wanting ; (4) that so far as he is voluntarily in default of his duty, he should not only be punished by penalty as for an act of nuisance, but should be liable to pay pecuniary damages for whatever harm he occasions to others ; (5) that the various commercial undertakings which in certain contingencies may be specially instrumental in the spreading of infection—water companies, dairies, laundries, boarding-schools, lodging-houses, inns, etc., should respectfully be subject to special rule and visitation in regard of the special dangers which they may occasion ; and that the persons in authority in them should be held to strict account for whatever injury may be caused through neglect of rule ; (6) that every local sanitary authority should always have at command, for the use of its district, such hospital accomation for the sick, such means for their conveyance, such mortuary, such disinfection establishment, and generally such planned arrangements and skilled service as may, in case of need, suffice for all probable requirements of the district.

HOW TO KILL BACTERIA.

In a lecture given before the Berlin Medical Society, December 3, 1879, Dr. Wernich (who, as our readers may remember, was formerly a medical professor in Japan) offered some interesting remarks, *Ueber Bacterientödtung*, or, as we have translated it above, on how to kill bacteria, and that as in the lowest of these organisms the only vital function which we can recognise as performed by them is that of unlimited multiplication under appropriate conditions, their reproductive capacity must be taken as the test of their vitality. A fallacy, however, comes in here which complicates the problem—if the cultivating fluid is not rightly chosen the bacteria fail to multiply. With care, however, this difficulty may be avoided, and after a sufficient preparatory training Dr. Wernich believes that by a modified form of Kleb's "*fractionirte Cultur,*" which he terms the bacterioscopic methed, the distinction between living and dead bacteria may be made with certainty. The principle is simple. If, after rigorous exclusion of all possible causes of impurity from without,a drop of the bacterial fluid to be tested causes cloudiness in an appropriate cultivating medium, which cloudiness the microscope proves to depend on the presence of multitudes of bacteria, and if this experiment can be repeated over and over again by cultivating the new bacteria in fresh media, the first bacteria were living; if no cloudiness occurs under these conditions, they were dead. We should state here that Dr. Wernich's experiments on this subject were partly made in professor Cohn's laboratory at Breslau, the special organism investigated being the *Micrococcus prodigiosus*, or blood mould of the ancients. The research is given in detail *Virchow's Archiv*, Band 78.

Assuming, then, that we can distinguish between dead and living bacteria by the reproductive capability of the latter, how can we kill bacteria and prevent their reproducing their kind? According to Wernich, the bacteria of putrfeaction are killed by a temperature of 130° to 150° Cent. even in three to five minutes. The *Micrococcus prodigiosus* is rendered absolutely sterile at a temperature of only 75° to 80° Cent. But some organisms, for example the *Bacillus subtilis* of hay infusion, exhibit enormous resistence even to the protracted action of heat (Cohn), and, at any rate in the case of the hay bacillus, it is the spores which still retain their vitality even after long boiling. The presence or absence of spores will therefore to a great extent determine whether a given species of micrococcus or bacterium resists destruction by heat, chemical agents, etc., or not.

It is well known that certain substances—sugar, dialysable albuminates, and the elements potassium, phosphorous, magnesium, and sulphur—are necessary to the multiplication of bacteria, but Dr. Wernich mentions another less known fact, namely, that if any one of these substances be absent from the nutritive fluid, the bacterial spores, instead of multiplylng, pass into a state of rest (*Dauerzustand*) in which they may remain indefinitely. Dryness has the same effect, and, according to Koch, the spores of the *Bacillus anthracis* or bacillus of malignant pustule can remain in the dry state for years, be moistened and dried again without loss of reproductive power. Hence, if in any locality these spores have once developed, the chances of the disappearance of the disease there are very small. On the other hand, excess of moisture destroys bacteria with great certainty. The developement of *Bacillus anthracis* is checked by distilled water, and, as our readers may remember, Professor Virchow, in his lecture on the Plague (*Medical Times a d Gazette*, vol. i. 1879, page 286), inclined to the belief that the report was true that "plague germs" lose their infective power by immersion in water.

The effect of light on micrococci is absolutely *nil*; they get on equally well with or without it. On the other hand, it is said that at the positive pole of a moderately strong galvanic current they always die, while at the negative pole they develop to a slight extent. It would take up too much space to enumerate all the gases, acids, salts, and organic substances which are reputed to destroy bacteria outside the body. That they do so *if brought into intimate contact* with them is scarcely doubtful; the important point is to find poisons which will kill bacteria within the human organism without injuring the latter. It is questionable whether at present we possess any such. Dr. Wernich puts the question: Why do bacteria not live for ever?—why, with an apparent sufficiency of nutritive material, do they die? Why do infectious diseases like small-pox and scarlet fever, which are probably due to organisms, last only a certain time? The answer seems to be, that "it is the *products of the tissue change of the living bacteria* which causes the ultimate destruction." About four years ago Salkowski found that bacteria would not propagate in some three-year-old ascitic fluid which had gone through all the stages of putrefaction. Since then this has been explained by the discovery of carbolic acid by Baumann, of skatol (*Medical Times and Gazette*, 1879, vol. i. page 154) by Brieger, of hydrocinnamic acid and phenylacetic acid by E. and H. Salkowski as products of putrefective processes, *i. e.*, of bacterial tissue change.

These bodies, as well as indol, which also developes under these conditions, are intense bacterial poisons; and while skatol is the strongest of them all, carbolic acid is the weakest. Wernich has found that 1 part indol per 1000 of fluid prevents putrefaction, whereas 5 parts carbolic acid per 1000 are required; 0·4 skatol per 1000 prevents the propagation of bacteria, but carbolic acid must be 5 per 1000 strong; lastly, 0·5 skatol per 1000 *kills* bacteria, while we must allow a 1 per 50 solution of carbolic acid to remain long in contact with them to produce the same effect. Yet Dr. Wernich does not think carbolic acid will lose its position as an antiseptic in consequence. Its solubility and cheapness will prevent that: some of the other substances just named take 2000 parts of water to dissolve them.

The practical question now suggests itself (Dr. Wernich supposes that it is put to him)—If we had a patient ill of a disease proved to be due to the bacteria of putrefaction (*Fäulnissbacterien*) ought we to give him, say, indol? Dr. Wernich answers, "No; our knowledge of the diffusion and action of it and similar drugs within the body is at present as good as *nil*. We can scarcely conceive that the intimate contact of drug and bacteria necessary, as experiment shows, for the destruction of the latter can occur there." Is there no hope, then, in this direction? Dr. Wernich thinks that we should investigate the conditions of development of those bacteria which can enter and live in our bodies; and, secondly, that at present we should devote our chief attention therapeutically to keeping the bacteria out of the body, rather than attempting to destroy them when they have once entered it. As in surgery so in medicine, exclude the germs if possible; and if skeptics say that there are no germs, we can fall back on the dictum of the great botanist Naegeli (*Die niederen Pilze in ihren Beziehungen zu den Infectionkrankheiten*; Munich, 1877), that the poisons which produce disease cannot be gases or simple chemical bodies, and *must* be some sort of *organized* material.

The above is but a brief abstract of Dr. Wernich's lecture, yet we hope it may be found not altogether wanting in interest or suggestiveness.—*Medical Times and Gazette.*

WHEN a death occurs in Fiji, it has to be registered; and the native scribes not unfrequently fill the blank left for "cause of death" with the words "medicine supplied by the missionaries."

SANITARY SCIENCE—COURSE OF STUDY.

To a young man proposing to enter the field of sanitary science, Dr. J. S. Billings gives the course of needful study as follows (*Sanitary Engineer*, March 1, 1880): (1) He should have a thorough practical knowledge of microscopy and analytical chemistry, and become practically skilful and accurate in analysis of air and water, food and drink. (2) He must study the principles of construction of buildings, both private and public, so far as sanitary questions are concerned. This will involve methods of heating, lighting and ventilation, house plumbing, so far as relates to sinks, traps, etc., and house drainage and sewerage. (3) He should study engineering so far as relates to drainage and sewerage; should be able to make a topographical sketch of a given district, and should have a sufficient knowledge of geology to understand the position of strata and their influence upon sanitation. (4) He should study the mathematics of statistics, and especially the application of vital and sanitary statistics and medical logic. (5) He should study the subject of legislation with regard to the prevention of disease, and should be familiar not only with the laws of his own city and State relating to such matters, but with the methods tried and the results obtained in other States and countries in sanitary legislation. (6) He should study the dangerous trades and occupations which, by the production of dust, of noxious gases and vapours, or by the contamination of water supply, have a tendency to produce disease either among the workmen or among the residents of the neighborhood, in order to know in what the danger consists and how it may be best avoided.

Thus it will be seen the study of sanitary science is far reaching, and, in many respects, different from the study of medicine proper. Doubtless, the study of medicine will ever, as hitherto, prove the best introduction of sanitary science, but it will be only an introduction. From Dr. Billings' outline of study it will be inferred that the sanitary engineer needs to be a man of broad culture and capacity, able to meet many emergencies and qualified to perform duties hitherto delegated to, but not performed by, physicians, engineers, plumbers and householders. To increase the interest in the study of sanitary science, we learn that the Michigan State Board of Health proposes to examine students of the same in its different branches, and to give those sustaining the proper examination an official certificate.

It is hoped that in this way physicians may be induced to so supplement their present knowledge as to specially fit themselves to act as health officers. The first of these examinations will be held next July.

Assuredly we trust that the hopes of the Board may be fully realized, and in the end we doubt not that they will be. But we seriously doubt whether the people are at present so educated as to appreciate the value of the services of a competent sanitary engineer sufficiently to pay an adequate price for services rendered. Still, for the love of science, humanity or official position, there will be some who will enter upon these studies, and so, little by little, progress will be made. If it would, the medical profession could do much to advance the interests of these sanitary studies. It could encourage all householders to have their premises overhauled by an expert, and convince them that a proper compensation to such an expert for such a work would rebound to their pecuniary interest. As the profession of itself is unable to do this work, let it lend a helping hand to all efforts of others to do it. The reaction of such studies upon the profession will be healthful in every way. Principally it will tend to educate the laity to the belief that all diseases come from a violation of natural law, and that all cure of disease comes from an obedience to natural law; that the science of medicine requires for its mastery and practical operation the most learned and skillful minds. Having this special education, the laity will cheerfully patronize the honest and competent doctor and pay him well for service rendered; it will give us proper dissection laws; it will admit us into closer legislative and legal relations to the ruling powers, and it will afford all the help needful to best develop the capabilities of the healing art.

Our personal hope for the elevation of the medical profession, rests solely upon an increased culture of the people in those things needful to practically appreciate the most highly trained medical talent. Hence, we unhesitatingly give our individual influence to any measure that tends towards this result.—*Detroit Lancet.*

DANDY AND BULL.—*Punch* gives an illustration of a spindle-legged dandy, with eye-glass, cigar, etc., meeting a handsome bull. Dandy says to bull, looking closely at him, "Well, you're a splendid fellow, ar'n't you?" Bull replies, "Yes, and so would you have been, if your parents had been selected with as much care as mine were."

DISINFECTION.

Recent experiments made under the direction of the International Cholera Commission have shown that the ordinary methods of disinfection are inefficient, and, in practice, they have often failed to arrest the spread of infectious diseases.

As it is impossible to experiment directly upon the *unknown* low organisms, which are thought to be the means of transporting the various infectious diseases, the effects of chlorine and sulphurous acid were studied upon *known* living organisms; the probabilities being thought to be in favor of the theory that complete disinfection should destroy at least all known forms of life, although it may be true that the tenacity of life of the infective matter of various diseases differs, just as the degree of cold necessary to put a stop to yellow fever is much less than that required to arrest the spread of cholera.

Chlorine and sulphur fumes, in sufficient quantity, were found to be efficient in killing insects, fungi, bacteria and infusoria; the objections to chlorine in houses being that it is more costly; that its use is more difficult, and that it destroys metals, textile fabrics and colors.

The burning of ten grams of sulphur for each cubic meter of air-space, tightly closed, was found *not* to kill bacteria, infusoria, or all insects; twenty grams, however, were proved to be sufficient for that purpose. One volume of water, when saturated at 59° F., absorbs thirty-seven volumes of sulphurous acid—enough to kill all the low organisms found in putrid urine.

The following articles were found uninjured after several hours' exposure to an atmosphere in which twenty grams of sulphur had been burned to every cubic meter of air-space: a clock of steel and brass; rusty and clean nails; gold and silver money; a military epaulet; various colored silk articles; a colored rug; calico; down-pillows; a gilt-framed looking-glass; books; water in an uncorked bottle; flour; meat; salt; bread; apples; cinnamon; vanilla; cigars; wall-paper; oil paintings; varnished articles; gas fixtures; water fixtures; a highly polished razor had a slightly cloudy appearance on its upper side, but that was easily rubbed off. The flour and meat were cooked and eaten, and the cigars were smoked, without any abnormal taste or smell being observed; in the bread not all of the observers noticed a slightly acid taste; the inside portion of the apples was unchanged, the skin was slightly sour; the water, after standing, had an acid reaction, but no decided taste or smell. Litmus paper placed between the leaves of books and under the carpet was turned bright red. Many of the articles exposed had a decided smell of sulphur at first, but that soon disappeared.

The experiments seemed to show that clothing, bedding and other articles may be disinfected without being changed chemically or injured; and it should be added that practically this method has apparently accomplished perfect disinfection, as tested in Berlin.

If we may judge from these results, effective disinfection, by burning sulphur, requires eighteen ounces to each space of one thousand cubic feet. The sulphur should be broken in small pieces, burned over a vessel of water or sand, so as to avoid danger from fire, and, if the room is large, it should be put in separate vessels in different places. The room should be tightly closed for six hours, and then aired; it is better that the room should be warm than cold. Of course, efficiently disinfected air is, during the process of disinfection, irrespirable. Most articles may be disinfected in this way, if hung up loosely in the fumigated chamber, although it would be an additional safeguard to expose anything thick, like a bed-mattress, to prolonged heat at a temperature of about 240° F.; and, indeed, heat must, with our present knowledge, be considered the best disinfectant. With this end in view, local boards of health are advised to procure furnaces and laundries, as is commonly done in other countries, to be used for the sole purpose of disinfecting articles which have been exposed to the infectious diseases, as recommended in the Ninth Annual Report of the State Board of Health, and described by Dr. A. H. Johnson, in an exhaustive paper on Scarlet Fever (pp. 255 *et seq.*), in that report. Of course, a much simpler disinfecting furnace than that described will answer every purpose. For ordinary use, in disinfecting *houses*, the sulphur process is the best.

A solution of chloride of zinc (one part of Burnett's Disinfecting Fluid to two hundred of water), very quickly kill bacteria *which have been placed in it*, and arrests putrefaction. Caustic lime serves equally as well (1 to 100), but leaves a sediment not always easy to remove. Carbolic acid in sufficient strength to be effective (1 to 100) is more expensive and of disagreeable odor.

It is needless to add that "disinfectants" used in sufficient quantities to destroy bad smells do not necessarily kill microscopic living organisms; and it is not supposed that they directly influence the so-called "germs" of the infectious diseases, unless concentrated to the extent which has been mentioned.

Finally, fresh, pure air acts as one of the best "disinfectants" by enormously diluting the infectious matter, and, under certain conditions, including time, must render it inert to all effect, even if not quickly destroying it, as many thinks is the case.—*Circular from Mass. State Board of Health.*

NICOTINE IN HER SMACK.—I wonder how any woman who has ever kissed a clean man can go through the pretense of ever kissing a tobacco-chewer. Did you ever see one suffer the penalty? This is how she does it: There is a preliminary shudder, and then she sets her teeth hard, holds her breath, and makes a little pigeon dip at the foul lips of the grinning beast, and then, pale with horror, flies to the kitchen, where, if you follow her, you will find her disinfecting with soap and water. Many of the blessed little hypocrites pretend that they like the smell of a cigar, but even hypocrisy is powerless to force from a woman the confession of a fondness for hanging like the bee on a flower to a tobacco-worm's lips.—*Mrs. Garrison.*

COURAGE is a wonderful agent in throwing off disease. A walk of five miles would cure many an occupant of the lounge. Will-power will surpass pill-power in nine cases out of ten, if not in every one. To hold a bottle of smelling salts in the hand on account of a head-ache may be just the thing, at times, but to fling a pound of fruit cake out into the alley, and then walk a furlong as a reward for not eating the compound, is nearly always a much better thing.—*Sanitarian.*

LEAKS IN GAS PIPES.—To deteet leaks in gas pipes, apply soap suds to the suspected leaky joint. The formation of bubbles will show an escape. This is safer than trying the joint with a lighted match. If the leak occur in the branch of a bracket or chandeler, it is repaired by soldering with plumber's fine solder; if it be a very small one, heat the piece first, with a spirit lamp, and fill the aperture with cement.—*Sanitarian.*

CONCLUSIVE.—Lodger.—"I detect rather a disagreeable smell in the house, Mrs. Jones. Are you sure the drains——" Landlady.—"Oh, it can't be the drains, sir, whatever. There are none, sir!!"—*Punch.*

Annotations.

MEASLES NOT A TRIVIAL DISEASE.

Since January 1, 1880, says "the *Proceedings*," there have been 1,864 cases of measles reported to the Brooklyn Health Department; this is probably less than half the number which has actually occurred. During the same time there have been 73 deaths from the same disease, while during the entire year 1879, measles caused but 40 deaths; should the present rate of mortality continue throughout the year, the record will show 240 deaths from measles for the twelve months of 1880. While measles has thus far caused 82 deaths, there have been but 65 deaths from scarlet fever. In New York last year, measles caused 244 deaths.

It is a common impression that measles is a trivial disease which every child must have at some period of its life; that the younger he is the more mild the attack, and therefore the sooner he has it the better.

This is the popular opinion, and some physicians hold the same views. From practical local observation and careful investigation of the subject, together with the experience of Brooklyn physicians obtained from their answers to a series of questions sent them by the Board of Health, we believe, says Dr. J. H. Hammond, Sanitary Superintendent, Brooklyn, that the general impressions referred to are entirely erroneous, and if permitted to go uncontradicted, liable to do great harm and injury, even to the degree of sacrificing life.

ACTION OF THE BOARD OF HEALTH.

Measles being so prevalent in Brooklyn, and its mortality so great, the Board of Health has included this disease in the same category with scarlet fever and diphtheria, and requires the following action:

1. Reports to be made to the Health office by physicians, of all cases coming under their care.

2. The exclusion of the sick and of others residing in the same house, from the schools of the city, both public and private, until a permit for their return is obtained from the Board of Health.

3. These permits to be given when the patient is no longer in condition to spread the disease, and when the rooms, clothing, and other infected materials have been properly fumigated.

4. The fumigation prescribed by the Board of Health is by the burning, for five hours, of sulphur, one pound to each thousand cubic feet of space to be fumigated, the apartment being tightly closed.

5. Certificates of physicians that these requirements have been fulfilled will be sufficient evidence, and on their presentation to a sanitary inspector or at the office of the Board of Health, the school permit will be at once issued.

THE NATIONAL BOARD OF HEALTH—At the recent meeting of the American Public Health Association, Dr. Fulsom said he had been directed by the Advisory Committee to offer the following preamble and resolutions:

Whereas, the National Board of Health has, in accordance with the law which created it, requested the advice of the American Public Health Association regarding the form of a permanent national health organization of the United States, including its relations to quarantine, both maritime and inland, and,

Whereas, the opinions of the Advisory Council of the Association, upon the subject of health legislation, collected and presented to this body through Dr. J. M. Toner, Chairman of the council, have been duly considered; therefore,

Resolved, That, in the opinion of the American Public Health Association, the present National Board of Health has been of such vast service to the country that it is not expedient to make any essential change in its organization, and that any minor improvement in details should be left to the Board itself.

2. That the investigations which have been commenced by the Board are approved and should be continued, and that similar investigations should be undertaken by it into the consideration and prevention of other diseases as well as yellow fever.

3. That Congress should appropriate sufficient funds to enable the Board to employ the best talent and apparatus in such scientific and practical inquiries.—The sum of $500,000 (half a million), had been granted by Congress.

THE FOLLOWING TESTIMONIAL of a certain patent medicine speaks for itself: "Dear Sir,—Two months ago my wife could scarcely speak; she has taken two bottles of your 'Life Renewer,' and now she can't speak at all. Please send me two more bottles at 1s. 1½d.; and very cheap it is at the money. I wouldn't be without it for the world."

Vital Statistics.

POPULATION STATISTICS OF FRANCE AND GERMANY

Some interest attaches to the population statistics of two large countries like France and Germany, and the returns which have recently been published show results which are not without importance. In France the attention of statisticians has of late been directed to the steady and serious decrease in the population, as evinced by the gradual decrease in the birth-rate. In 1878 the number of births was 937,211. The two causes accounting for the decreases are the fewer number of marriages and, what is far more important, the decline in the number of children resulting from these marriages. In fact, the proportion of children to each marriage is dwindling more and more all over the country, except in Brittany, and in some of the departments in the centre and the south. In the class composed of petty tradesmen, or the well-to-do peasants, there is seldom more than one child per marriage, and M. Baudrillart has stated that in one of the rural communes in Picardy he ascertained the number of children among the best-off of the peasants to be thirty-seven for thirty five families. To a certain extent the decrease in population is kept in check by the decrease in the mortality, which numbered 839,036 in 1878, or 2·26 per cent., whereas in 1864-68 it was 2·34. But the question nevertheless remains as to what will be the ultimate destiny of France if the decline of population still continues unchecked. In Germany, on the other hand, the estimated population of the Empire at the end of 1878 was calculated in round numbers at 44,211,000; the number of births during that year was 1,785,080, and the deaths 1,228,707, giving an excess of births over deaths of 556,473, or an annual increase of population amounting to more than 1·25 per cent. For every 1000 of the population 15·4 were married, 40·4 were born, and 27·8 died, so that the births were more numerous than the deaths by 12·6 per 1000.

ENGLISH RATES OF MORTALITY.

At a recent meeting of the Statistical Society, (*Med. Times Gaz.*) Mr. Welton read a paper on "Certain Changes in English Rates of Mortality." In opening this subject he remarked that while the leading facts in relation to the statistics of mortality is the regularity underlying every variation of death-rate, it is well, on the other hand, to examine from time to time the data for long periods, and to consider the stability or changefulness of the phenomena. Tendencies may thus be discovered, which, in a protracted series of years, would bring about unmistakeable results. Mr. Welton based his comparisons on the six quinquennial periods extending from 1846 to 1875. On this basis he found that, according to the death-rates given by the Registrar-General, the mortality of both sexes at ages from five to twenty-five had certainly been reduced; but this abatement had been attended by an aggravation of the mortality at higher ages, putting aside epidemic years, and that such aggravation had been far more considerable among males than among females. Mr. Welton next referred to different sets of tables prepared by him as compared with Dr. Farr's English life table, and he showed that the period of years before the persons who are born are reduced to half their original number was, according to these tables, as follows:—By Dr. Farr's table—males, 44·4; females, 46·4: female expectation greater by two. By experience of 1856-60—males, 46·5; females, 48·9: female expectation greater by 2·4. By experience of 1871.75—males, 45·8; females, 50·9: female expectation greater 5·1. In conclusion he adverted to the causes of the increased mortality among males aged thirty-five to sixty-five, the result arrived at being that this increase had not been largely due to epidemics, to consumption, or to diseases of the stomach and liver, but to disorders of the lungs, heart, brain, kidneys, and to cancer.

THE DECEMBER RETURN OF THE REGISTRAR-GENERAL FOR IRELAND.

The return of the Registrar-General in Ireland for the fourth quarter of the year 1879, records the registration during that period of 30,668 births and 24,497 deaths. The births were equal to an annual birth-rate of 22·9 per 1000 of population, as against 34·2 per 1000 registered in England; the deaths represented an annual rate of 18·3 per 1000, as against 21·4 in this country. It is remarked in the return that the birth-rate in Ireland is again under the average of the corresponding quarter of the previous five years to the extent of 1 per 1000 of the estimated population. The death-rate is above the average for the same period, the excess being 1·6 per 1000, and is the highest registered in the fourth quarter of any year since registration of deaths commenced in Ireland the year 1864. As some explanation of this latter fact, it has to be considered that although the weather during the first two months of the quarter was comparatively much more favourable than it had been during the preceding portion of the year, During September it became unuasually severe, and contributed much to increase the mortality amongst the very young and very old. The suffering caused by the extremely bad harvest, and through the depression of trade, is also, no doubt, responsible to some extent for the excessive death-rate of the quarter under notice; but it is stated that during that period none of the registrars return any deaths as attributable to starvation, although some of them admit that want may have led to increased sickness and liability to disease. The deaths from the seven principal zymotic diseases were slightly under the corresponding quarter of 1878, but above the average mortality for the fourth quarter of the three years 1876 to 1878. Scarlet fever has been steadily increasing throughout the whole of last year, and after the three months ending December, was credited with having caused 589 deaths. Measles and whooping-cough were the next most fatal, the former with a mortality of 319 and the latter with 459. Of the 24,497 deaths registered during the quarter, 3968, or 16·2 per cent, occurred in public institutions.

VITAL STATISTICS OF THE PAST YEAR IN GREAT BRITAIN.—Accompanying the return of the Registrar-General for the last quarter of the year 1879, (*Med. Times and Gazette*) will be found a brief summary for the whole of that year. From this we gather that in the United Kingdom 1,144,571 births and 707,379 deaths were registered during the period—equal to rates of 33·5 and 20.7 per 1000 respectively of the population estimated to be living in the middle of the year. The *natural* increase of population, by excess of births over deaths, was 437,192, against 436,360 in 1878. In England and Wales during the past year the birth-rate was equal to 35·1, and the death-rate to 21 per 1000 persons living. The birth-rate was 0·6, and the death-rate 0·8 below the average rate in the ten preceding years. The death-rate in 1879 was also 0·7 below that which prevailed in 1878, but somewhat exceeded the rate in 1877, which was the lowest on record. The annual death-rate in England and Wales averaged 25·4, 22·2, and 22·4 per 1000 respectively during the three decades 1841-50, 1851-60, and 1861-70.

Notwithstanding the marked increase of density of population in urban districts, English mortality may be said to have remained stationary during the thirty years 1841-70. Last year was the ninth of the current decade 1871-80, during which the average annual death-rate in England and Wales has not exceeded 21·9 per 1000. This decline of mortality, which, the summary says, may be accepted as evidence of improving sanitary condition, implies that during the past nine years more than 150 000 persons have survived in England and Wales, whose deaths would have been recorded had the average annual rate of mortality in the previous thirty years been maintained. The deaths from the seven principal zymotic diseases in England and Wales during the year 1879 were 60,157, and were equal to an annual rate of 2·39 per 1000, against 3·44, 3·11, 2·71, and 3·32 in the four preceeding years. Compared with the numbers in 1878, the fatal cases of measles showed a slight increase, whereas those of each of the six other diseases had considerably declined. The decrease of deaths referred to diarrhœa and small-pox was specially marked; the fatal cases of small-pox were, without a single exception, considerably fewer than those returned in any previous year since the establishment of civil registration in 1837.

The death-rate from fever (principally enteric), which was equal to 1·11 per 1000 in 1865, has since declined with but slight fluctuations, and in 1879 did not exceed 0·30. In the past nine years the annual death-rate from fever has averaged but 0·51 per 1000 against 0·91 and 0·88 in the two preceeding decades—a very satisfactory sign of sanitary progress.

VITAL STATISTICS OF BROOKLYN, N.Y., FOR 1879.—The actual mortality in Brooklyn during the year 1879 was 11,569. The total number of births reported was 10,169; of still-births, 889; of marriages, 3,222. Of these three classes the returns are incomplete, whereas the deaths are fully reported. Estimating the population at 564,448, the annual death-rate was 20.49 per 1,000 persons living; while in 1878 the rate was 20.40 per 1,000. This latter may be signalized as the lowest death-rate this city has experienced since our mortality statistics began to be fully registered. Next to that, however, stands the low death-rate of 1879; so that the health of the city, as measured by its roll of deaths, was considerably above the average of recent years. A comparison of the total mortality during certain years, and of the rates proportional to population, may be instituted by means of the following exhibit:

Years.	Deaths by All Causes.	Differences.	Population, (Census or Est.)	Death Rate per 1000.
1879..................	11,569	494+	564,448 E.	20.49
1878..................	11,075	287—	542,739 E.	20.40
1877..................	11,362	972—	521,864 E.	21.77
1876..................	12,334	136—	501,792 E.	24.58
1875..................	12,470		482,493 C.	25.84
Average 10 years......	11,329		455,000 E.	23.78

There were no deaths by small-pox, and no serious epidemic prevailed. Yellow fever occasioned two deaths (both imported cases), but it secured no foothold. Diphtheria caused 689 deaths, an increase as compared with the previous year. Scarlet fever, 344, a falling off as compared with 1878. The number of deaths by certain other of the principal causes was: by whooping-cough, 204; measles, 40; croup, 250; typhoid fever, 59; cholera infantum, 680; all diarrhœal diseases, 1,258; all diarrhœal diseases under five years of 1,076; malarial fevers, 150; erysipelas, 64; intemperance, 67; rheumatism, 67; cancer, 231; marasmus, 353; consumption, 1,665; hydrocephalus and tubercular meningitis, 189; meningitis and acute diseases of brain, 372; apoplexy, 229; convulsions, 241; all diseases of the nervous system, 1,238; diseases affecting the heart, 505; bronchitis, 479; pneumonia, 975; all diseases of the respiratory system, 1,632; Bright's disease, 256; puerperal diseases, 182; old age, 239; infantile asthenia and premature birth, 257; suicide, 37; in public institutions, 637.

By the five principal classes of causes of death, the number of decedents was: I. Zymotic diseases, 3,283; II. Constitutional, 2,574; III. Local, 4,379; IV. Developmental, 1,017; and V. Violence, 316. By seasons, the record was: For the first quarter, 2,832; second, 2,478; third, 3,398; and fourth, 2,861. By sexes: Males, 5,823; females, 5,746. By nativity: born in the United States, 8,341; foreign born, 3,228. Under 1 year of age there were 2,881 deaths; under 5 years of age, 5,201; and at 60 years of age, and upwards, 1,684.

Vital Statistics of New York.—During the year 1879 there were 25.573 births, 8,446 marriages, 2,191 still-births, and 28,342 deaths (14,807 males, 13,535 females, and 442 colored), which took place in this city, reported to the Bureau of Vital Statistics of the Health Department; this shows a decrease of 150 births and 1 still-birth, and an increase of 817 marriages, and 1,334 deaths when compared with the number reported during the year 1878. The annual death-rate of the city to every 1,000 of the population, which was estimated at 1,097,563, in the middle of the year, was 25.82, which bears the following comparison to the preceding ten years, viz. :—1878, 24.93; 1877, 24.50; 1876, 27.62; 1875, 29.47; 1874, 28.94; 1873, 29.68; 1872, 33.76; 1871, 28.26; 1870, 28.84; 1869, 27.13; 1868, 27.25.

The total deaths from diarrhœal diseases (which include cholera infantum, cholera morbus, diarrhœa, dysentery, entero-colitis, diarrhœal enteritis, and gastro enteritis) was 2,965, 1,151 males and 1,414 females; of this number, 2,592 were under 5 years of age; it will therefore be seen that although the total mortality was higher than either of the preceding two years, the deaths of children under 5 years of age from diarrhœal diseases was less than the number that occurred during any of the preceding 10 years. As usual the highest number (1,079), occurred in the month of July.

Phthisis Pulmonalis continues to cause more deaths than any single disease reported, the number of deaths attributed to it being 4,343, (2,280 males and 2,063 females, 4,244 white and 99 colored), which was 123 less than the number reported from it during the previous year.

The deaths of children under 5 years of age were 12,777 (6,879 males and 5,898 females); of this number 205 were colored. The death rate of children under 5 years of age to the 1,000 of the population under that age, according to the N. Y. State Census of 1875, was 99.70. The proportion of deaths of children under 5 years of age to the total deaths was 45.44, which was less than that of any of the preceding 10 years. Contagious or infectious diseases caused 2,601 deaths, small-pox 25 deaths, scarlatina 1,477, diphtheria 671, whooping cough 537, and typhoid fever 78 deaths.

Of suicidal deaths there were 117, 100 males and 17 females; 40 were single, 51 married, and 11 widowed; 50 were natives of Germany, 11 of Ireland, 2 of England, and 29 of the United States.

TOTAL RETURNS OF DEATHS FROM EACH COUNTY IN ONTARIO FOR THE YEAR 1879.

COUNTY.	Total No. of Deaths for the whole year 1879.	Increase over 1878.	Decrease over 1878.	Phthisis.	Scarlet Fever	Pneumonia.	Infantile Debility.	Old Age.	Heart Disease.	Typhoid Fever.	Diphtheria.	Convulsions.	Diarrhœa.
Algoma	52	19	.....	9	.....	4	1	5	.....	.....	.....	1	.....
Brant	342	31	.....	44	5	27	3	30	24	4	12	12	6
Bruce	468	64	.....	59	2	20	7	24	14	8	24	7	3
Carleton	699	.....	13	79	5	23	41	41	19	2	20	7	8
Elgin	295	14	.....	31	.....	16	1	27	8	11	7	4	2
Essex	521	20	.....	59	1	27	4	16	9	11	21	6	11
Frontenac	460	.....	39	61	13	17	3	35	29	4	9	8	5
Grey	442	3	.....	36	5	25	3	29	12	4	21	3	6
Haldimand	205	8	.....	32	.....	17	.....	18	7	7	6	5	3
Halton	212	24	.....	24	2	20	.....	11	6	5	5	3	3
Hastings	584	12	.....	88	61	17	7	40	24	9	21	4	5
Huron	651	17	.....	60	9	29	4	35	29	16	46	9	11
Kent	434	84	.....	34	6	22	3	23	15	6	14	3	5
Lambton	442	56	.....	37	3	39	1	22	13	22	22	11	13
Lanark	248	.....	1	34	2	27	4	26	11	5	8	2	4
Leeds and Grenville	465	.....	34	79	.....	26	5	51	16	5	22	2	5
Lennox and Addington	249	.....	22	44	7	3	.....	26	11	7	.....	3	1
Lincoln	415	.....	3	53	9	26	3	22	16	9	16	7	5
Middlesex	1027	72	.....	114	11	69	6	72	37	13	38	27	16
Muskoka and Parry Sound	96	.....	67	10	.....	3	2	2	5	5	2	3	.....
Norfolk	325	50	.....	46	3	18	7	24	13	7	13	9	6
Northumberland and Durham	596	.....	89	83	1	31	.....	47	29	14	4	6	3
Ontario	499	31	.....	54	.....	30	3	43	20	14	4	9	6

Oxford	418	.....	55	38	3	31	.....	33	19	5	15	9	5
Peel	242	.....	1	21	3	8	.....	27	5	6	12	5	2
Perth	461	79	.....	42	3	22	9	37	16	5	17	14	8
Peterboro'	288	.....	4	30	4	14	8	35	10	1	5	9	1
Prescott and Russell	344	.....	34	31	2	11	16	28	14	6	39	2	6
Prince Edward	216	23	.....	46	.....	5	5	18	5	.....	6	3	6
Renfrew	216	.....	36	25	.....	6	1	14	9	.....	2	7	3
Simcoe	576	13	.....	40	5	28	7	45	22	6	24	21	8
Stormont, Dundas and Gleng'y	552	.....	139	69	2	14	2	43	20	8	26	8	3
Thunder Bay	26	.....	15	.....	2	6	.....	.....	.....	.....	.....	2	.....
Victoria	262	.....	21	26	.....	16	5	26	5	8	2	6	4
Waterloo	494	.....	1	55	1	31	6	43	15	12	18	15	1
Welland	315	.....	1	26	2	26	2	22	13	9	6	4	6
Wellington	609	.....	64	42	7	39	9	50	33	11	26	12	13
Wentworth	1020	105	.....	102	74	61	12	39	40	31	52	31	29
York	1709	.....	229	234	9	116	20	75	87	47	50	56	80
Total	17475			1997	262	970	210	1204	680	343	635	255	302

TOTAL RETURNS FROM THE CITIES—BUT INCLUDED IN THOSE FROM THE COUNTIES, ABOVE.

Ottawa	410	.....	46	47	1	13	36	11	10	1	8	5	7
Brantford	142	28	.....	13	2	9	2	7	11	3	4	9	5
Kingston	244	59	.....	30	1	14	2	17	22	5	2	6	4
Belleville	207	14	.....	29	40	7	5	7	9	1	13	1	2
St. Catharines	173	.....	5	28	1	11	2	1	9	5	2	2	3
London	356	12	.....	41	9	27	3	17	12	2	1	14	6
Guelph	121	4	.....	17	3	5	4	4	10	.....	3	4	1
Hamilton	646	52	.....	56	57	37	9	12	23	15	29	24	23
Toronto	1432	.....	34	168	6	85	13	31	54	35	40	35	70

THE DEATHS REGISTERED IN 1879.

On other pages is a table showing the returns of deaths in Ontario for 1879; for which we are indebted to the Registrar-General's Department. A few townships have not yet sent in their returns. There will be a slight increase in the returns of 1879 as compared with 1878. Of the 39 Counties, 19 show an increase in their returns, and 20 show a decrease. Of the 9 cities, however, 6 give an increase and 3 a decrease; giving a total increase from the cities, over 1878, of 84 deaths.

It should be observed that the decrease in the returns of deaths is chiefly from the Counties of York (329) Stormont, Dundas, and Glengary, (united 139) and Northumberland and Durham, (united 89); while Wellington, Muskoka, and Oxford show a considerable falling off. The decrease in many of the Counties is very small; as in four of them it is only one each. The increases are much more uniform.

OF THE CAUSES OF DEATH.

There is considerable improvement in giving the causes of death. During several years a large number had been registered as dying from "old age," many of these at less than 70 years of age. It was a very convenient cause to give. In 1878, 1722 were registered under this head; while last year only 1204 were so registered. In In 1878, 1210 were registered under the head of Infantile debility, a very unsatisfactory cause to give for a death; in 1879, only 210 were thus registered. Convulsions is another unsatisfactory cause to give, and is properly only a symptom of several diseases. In 1878, 454 were so registered; last year, only 255. We have on several occasions in this Journal drawn attention to the objections of this loose method of registering a death. The report of the Registrar-General too has taken strong exceptions to it during the past three years. We are pleased to see the improvement and trust it may continne.

There were in 1879 the usual large number of deaths from consumption, 1992; just two less than in 1878.

Consumption is a preventable disease, and this appalling death-rate which shows probably only about two-thirds of the actual number, for the returns are not complete, might be largely reduced by the proper administration of public health laws, if there were some system in the province for such administration; as there is in our educational system and other less important matters. The education of the public in general health subjects too, would doubtless help much to lower the death-rate from consumption.

In 1879, there were 970 deaths registered as from inflammation of the lungs (pneumonia), against 826 in 1878. From heart disease there was an increase in 1879 of 59 deaths over those of 1878. There were not nearly so many deaths registered as from diphtheria last year; 635 against 986 in 1878. From scarlet-fever, 292 deaths in 1879, and 368 in 1878. From typhoid fever, 343 in 1879, and 379 in 1878.

ON THE REGISTRATION RETURNS IN ONTARIO.

The returns of vital statistics from the cities, towns, and villages in Ontario, show a satisfactory increase and may be regarded as nearly complete as possible. The want of completeness in the returns from the townships, is no doubt largely owing to the distance many of the people are from the division registrar, who frequently lives at one side of the township, or possibly outside of it altogether.

We suggested some time ago that this might be remedied by making each school district in the townships, a division for registration purposes. A death, birth, or marriage could hardly occur in a school district without the teacher soon becoming aware of it, and if he were paid a small fee for each registration, and made liable to a fine for neglect, it would doubtless add much to the completeness of the returns. He could make returns to the present division registrars. During school vacations he could get some one to act for him.

After all it is of the first importance to awaken the people to the importance of these returns, to teach them the value of having them complete. In England much has been done by educating the people in regard to these matters, and by circulating thousands of weekly statistical reports.

BOOK NOTICES.

REPORT OF THE MEDICAL SUPERINTENDENT OF THE ASYLUM FOR THE INSANE, TORONTO, for the year ending 30th September, 1879.

The Superintendent, Dr. Daniel Clarke, has kindly favoured us with a copy of the above report, and we have read it with much pleasure and interest. In addition to the usual statistical matter the report contains considerable which closely concerns the well-being of the general public, and which ought to be very generally read. This relates chiefly to the principal causes of insanity noticed. The report reads :—"In looking over the tables of Asylum Reports from year to year, the thoughtful reader cannot help being alarmingly startled at seeing such a record of large percentages of cases of insanity being attributed to these three causes, viz. :—1. Hereditary Taint. 2. Worry from over-work. 3. Intemperance. The hereditary cause may at a low estimate be placed at 45 *per cent.* of the insane population. It is worth while in a Report of this kind to make inquiry into the radical cause of such a dire calamity as that of insanity. Nothing new can be written about it to medical men, but if the public can be made to pause and consider in the midst of the hot pursuits of every-day life, some good may result from a cursory glance at the subject. What is this hideous ogre which is working such woe in our midst? To say that a disease is hereditary means, in the community, that it is incurable, although such is not absolutely the case."

After noticing hereditary diseases, physical forms and features, and mental traits, the Doctor continues :—"The epileptic, the consumptive, the scrofulous, the syphilitic and the insane marry without knowledge or reflection, and, as a result, fill our hospitals, asylums and prisons with their degenerate progeny, or bequeath them a brood of ailments which makes a fruitful soil for a crop of deteriorated constitutions, which to the unhappy victims of parental folly, makes life not worth living for. The lower animals are carefully assorted and mated because it pays to raise superior herds of domestic production, but no pains is taken to elevate, ennoble, and improve physically, mentally, socially and morally the human race by taking rational steps to eradicate this evil. Morality rightly forbids law to interpose its arm in this matter, because of the freedom of choice which must be allowed to the subject, but here is a plague spot to root out, against which moral suasion might be used with good effect. It would be startling to say how much indiscreet marriages lie at the root of our social vices and national sins. The friends of humanity—more especially parents—might by judicious advice and discreet exposure of consequences following rash selection, do more for their children and generations yet unborn, than were they to endow them with the richest legacies." Yes, parents might, if there were some means of instructing them in regard to such matters; few at present know the consequences of "rash selection," &c. "The redeeming feature is," says the doctor, "that when such unions take place judicious living and intelligent obedience to nature's behest may do much to avert untoward results to themselves and their posterity. The vitiated system always makes gallant efforts to recuperate from its fallen condition, if seconded by intelligent conduct and habit."

It is worthy of notice that, in the Asylum, "During the year only five drams of morphia, four ounces of opium, and three and a half ounces of chloral were administered internally among an average of 765 persons (patients and attendants)."

FOURTH ANNUAL REPORT OF THE STATE BOARD OF HEALTH OF WISCONSIN.

This is a valuable addition to Sanitary Literature, containing 165 large pages, of useful and practical information for the people. It contains practical papers on "Homes for the People;" "Our Public Schools," "Ground air in its relations to health, "The adulteration of foods," and other subjects, together with numerous extracts from special correspondents.

ELECTRICITY IN MEDICINE AND SURGERY, WITH CASES TO ILLUSTRATE, By John J. Caldwell, M.D., Baltimore, Maryland. Practice limited to Diseases of the Nervous System.

Electricity is becoming a therapeutic agent of considerable importance in the treatment of disease, and doubtless ere very long investigation will cause it to be better understood. In this pamphlet of 40 pages, numerous cases are given in order to illustrate the value of the agent.