

# STATE AND PREVENTIVE MEDICINE IN MASSACHUSETTS.

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## MR. PRESIDENT AND FELLOWS

OF THE MASSACHUSETTS MEDICAL SOCIETY :

THE Commonwealth of Massachusetts has bestowed little attention upon matters relating to the practice of medicine, so far at least as the care of disease is concerned.

This Society was organized for the purpose, among other objects, of making "a just discrimination between such as are duly educated and properly qualified for the duties of their profession, and those who ignorantly and wickedly administer medicine." It has therefore encouraged every movement for the improvement of medical education, and has jealously guarded for this purpose that provision of its by-laws which forbids the adoption by its Fellows of any exclusive and, in the light of human progress, necessarily restricted system in the teaching or practice of medicine.

It remains then for the public to decide whether

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NOTE.—At an Adjourned Meeting of the Mass. Medical Society, held Oct. 3, 1860, it was

*Resolved*, "That the Massachusetts Medical Society hereby declares that it does not consider itself as having endorsed or censured the opinions in former published Annual Discourses, nor will it hold itself responsible for any opinions or sentiments advanced in any future similar discourses."

*Resolved*, "That the Committee on Publication be directed to print a statement to that effect at the commencement of each Annual Discourse which may hereafter be published."

it is for the best interests of the community or not that the right to practise upon human life should be placed in the hands of those having a definitely ascertained knowledge of the human body and its workings.

From motives of self-interest merely our profession has no concern in the question so great as that which any other portion of the community may have. It might fairly enough be assumed that we are benefited by the increase in the injuries of the human body which it is our business to heal. But our profession has never taken that position. We have been interested in the efforts to secure some measure of protection for the ignorant and innocent against the conscienceless greed of the charlatan and quack. We have at times asked for legislation to accomplish this purpose, because we know, as no other part of the community knows, all the facts in the case. In the future as in the past the adroit advocate will employ his well-paid skill to prove that with us it is a matter of self-interest.

In answer to this it seems, however, sufficient to reply that nearly all civilized countries have devised some way of ascertaining and making known the qualifications of those who assume the responsibility of treating the diseases of man; and of giving a measurable security to the ignorant and helpless that he who publicly advertises himself as a doctor has a sufficient knowledge of the structure and functions of the human body in health and disease. It is moreover of the greatest

interest to all, that he who undertakes the treatment of disease should know enough to be able to discriminate between the diseases which begin and end with the sick person, and those which are communicable from one to another.

The peculiar importance of the second class lies in the fact that here are found those diseases which we have been most successful in limiting and preventing.

The Legislature has decided that no person shall in this State practise dentistry without a certificate from a board of registration, recording the fact that the applicant either was engaged in the practice of dentistry at the time the act was passed, or had undergone an examination as to his knowledge and skill in dentistry and dental surgery satisfactory to the board. Possibly it may sometimes seem expedient that the same protection should be given to the body as a whole which is here bestowed upon a part.

Several States in the Union have passed laws for the regulation of the practice of medicine; in a majority of these the laws are not enforced. In a few States, where the laws have had the benefit of the enthusiastic labors of intelligent and active administrators, good has been accomplished by driving out of the State those whom Sir Thomas Brown has designated as "Quacksalvers and Charlatans, whose impostures are full of cruelty and worse than any other, deluding not only unto pecuniary defraudations, but the irreparable deceit of death."

But it is unfortunately true that in the State of Illinois, which has been the leader in this movement, and where also much has been accomplished at the same time in improving the character of medical education, not only in that but in neighboring States,—there has developed in its legislative bodies an opposition to the Registration Board, of so virulent sort that the leaders of this opposition are quite willing apparently to sacrifice their whole system of State preventive medicine for the sake of asserting the inalienable right of the people to be deceived, if they so elect; and this too in a State where the work of the State Board of Health has been of very high character.

While Massachusetts has not yet been willing to adopt any decided regulations of medical practice, she has however dealt quite differently in the relations ordinarily designated as State Medicine. What these now are and should become, will be my topic for the short time during which I can claim your attention.

The State undertakes the care of disease only as a part of the public provision made for the poor, or for a class of the disabled more unfortunate than the poor, the insane. In both instances the care is exercised by humane men and women, educated in schools especially designed for instruction in medicine, by thorough courses of study in anatomy, physiology and pathology, with observation of disease and its treatment in the wards of well-appointed hospitals.

The State then as a whole does not believe that

its dependent classes should be turned over to the care of charlatans and quacks, nor are they dosed with proprietary medicines. The same care is also given to the provision of a proper medical service for the militia.

In exceptional cases, in times of the extended prevalence of epidemic diseases, this State has authorized one of its departments to undertake, if need be, the care of those sick with infectious diseases.

But a far more important exercise of the authority of the State is found in the methods employed for the medical examination of the causes of death, for the registration of vital statistics, and for the prevention of disease. Since the year 1877, the coroner's jury has ceased to exist in this State; and in all cases of suspicious death, the probable cause has been ascertained by educated and competent observers selected from our profession. For three years the results of the examinations made by these officers have been published, and present a body of statistics of great value, which indicate very distinctly in some cases the direction to be followed by legislation.

The law regulating the sale of poisons enacted in 1888, was intended to control the sale of these substances, which the experience gained through the returns of the Medical Examiners had shown to be too easily obtainable; the increase in the number of suicides from poisoning being the undoubted result of the unrestricted sale of the arsenical preparations for the destruction of insect

pests, and the consequent easy way of obtaining this familiar poison.

It would be wise to add to the functions of these officers the duty of certifying to the causes of all sudden deaths, even when there is no suggestion of violence, and to the deaths occurring without the attendance of an educated physician.

Even if it be desirable that there should be no interference with the liberty which it is assumed that every person in Massachusetts should have in selecting his own physician, there are, it seems to me, very grave reasons of public policy which should require, at the hands of a duly educated physician or disinterested officer of the State, an intelligible statement of the cause of every death. A very hasty inspection of the causes of death returned upon death-certificates in any city or town in this State, will reveal absurdities and contradictions which may cover crimes, and are, at least, the evidence of the grossest ignorance of the structure and functions of the human body in health and in disease.

When registration of vital statistics was introduced into this State in the year 1842, closely following upon and probably suggested by the English registration law of 1837, a foundation was laid for sanitary legislation.

Notwithstanding the slow progress of our registration towards scientifically accurate methods, it has contributed very much to the honorable position early taken and maintained by this State, in the cause of preventive medicine. Registration

is recognized the world over by responsible authorities as the only sure basis of sanitary legislation. Almost without exception the evidence drawn from these public and impartial records has been sufficient to convince any legislative committee charged with the consideration of public health measures. This evidence must naturally be susceptible of clear demonstration; and we shall all probably admit that in medicine, as in the other natural sciences, our anticipations of results, however useful, however indispensable they may be to the practitioner of medicine, however strong the individual's belief as to their certainty may be, still they have not that general acceptance among physicians even, which should precede legislation.

The present discussion as to the communicability of tuberculosis may be used in illustration. Many here undoubtedly believe that the experimental work inaugurated by Koch has shown that many of the conditions surrounding those suffering from this disease, may be controlled, and should be controlled in the interests of the public health. Does it at the same time occur to any one that legislation is desirable in advance of the convictions of the great body of the medical profession,—or that there would be much chance of obtaining the wished-for legal regulation if this general consent of opinion did not exist?

The registration of deaths at least should be regulated and carried out under some competent medical supervision. However valuable the re-

sults may be which have been obtained from the present painstaking tabulation of names and figures on one hand, and faithful editing on the other, the resulting benefit falls far short of what might be effected with competent medical oversight from the beginning to the end of the work.

In the year 1849 a commission was appointed under the authority of this Commonwealth to make a sanitary survey of the State, "with a statement of such facts and suggestions as they may think proper to illustrate the subject." The commission thus constituted prepared a report which justly ranks with the best sanitary reports of that day. They introduce their statement with the following words:—

"We believe that the conditions of perfect health, either public or personal, are seldom or never attained, though attainable;—that the average length of human life may be very much extended, and its physical power greatly augmented;—that in every year, within this Commonwealth, thousands of lives are lost which might have been saved;—that tens of thousands of cases of sickness occur which might have been prevented;—that a vast amount of unnecessarily impaired health and physical debility exists among those not actually confined by sickness;—that these preventable evils require an enormous expenditure and loss of money, and impose upon the people unnumbered and immeasurable calamities, pecuniary, social, physical, mental and moral, which might be avoided;—that means exist, within our reach, for their mitigation or removal;—and that measures for prevention will effect infinitely more than remedies for the cure of disease."

The three commissioners who made this report



were Lemuel Shattuck, Nathaniel P. Banks and Jehiel Abbott. No one of them was a physician; and I have therefore quoted their statement of the province of preventive medicine in order that our profession might be relieved of the public suggestion of making an exaggerated claim for the importance of sanitary science. It cannot be necessary, however, to say more about the claims of public medicine in presence of a body which has itself so unselfishly participated in the work of the prevention of disease, and which has so consistently encouraged those of its members who are more exclusively engaged in this field.

The public statutes contain an amount of legislation which seems to afford ample protection to human life from attacks on any or every side. Boards of health, State and local, appear to be possessed of all the powers to interfere at every period of human life, from birth to death, and even beyond the grave, or at least into it, which it is safe to trust to fallible mortal hands. Not to enumerate the general functions of the State Board, to which allusion will be made later, it may be here said that to the local authorities have been assigned the following powers and obligations:—

The preparation and enforcement of such regulations as they may deem necessary for the health of the people, with reference to house-drainage and sewer connections where sewers exist. They shall make such regulations as seem necessary for the public health respecting nuisances, sources

of filth and causes of sickness within the town, or on board of vessels within the harbor of seaport towns, and respecting articles capable of containing or conveying infection which may be brought into or carried out of the town, and may establish quarantines; and shall provide hospitals for the sick in times of epidemic diseases dangerous to the public health. They shall make inspections of nuisances and causes of sickness, and may destroy, prevent, or remove them as the case may require. They may order the occupants of dwelling houses, which are unfit for human habitation, from any cause, to put them in proper condition as to cleanliness, or to quit them, as seems best. They may make compulsory examination of premises when the public health seems to them to require it. Lands injurious to health by reason of stagnant water are declared to be nuisances to be abated by board of health. Householders and physicians knowing that sick people, for whom they are respectively responsible, are infected with small-pox, diphtheria, scarlet-fever, or any other disease dangerous to the public health, are obliged to immediately notify the board of health of the facts.

These authorities shall also assign places for the carrying on of noxious and offensive trades, or may prohibit them.

The State has also enacted a system of compulsory vaccination and revaccination; has prohibited the sale of unwholesome food and of adulterated food and drugs. It has regulated

the hours during which women and children may labor, and has compelled shop-keepers and manufacturers to make provisions for the protection of the health of those employed by them.

It has recognized the enormous injury to human life caused by the intemperate use of alcoholic drinks; has attempted to regulate such use by appropriate legislation; and has directed that in the teaching of hygiene and physiology in the public schools special instruction shall be given as to the effects of alcoholic drinks, stimulants and narcotics, on the human system. It has provided for the control of contagious diseases among the domestic animals. There might be added to this list many laws which have an influence more or less direct upon health by protecting the body from injury. But this rapid and probably incomplete survey of the State's endeavors to protect life and prevent disease will apparently show that there has been no hesitation in granting extreme powers to the sanitary authorities, and sufficient to meet any emergency.

Yet we know that two at least of the conditions which most seriously threaten life are not controlled as they should be,—a public and private disregard of sanitary cleanliness in the first place; and in the next, the unnecessary and reckless spreading of the communicable diseases, either by ignorance, or through a criminal disregard of the rights of our neighbors. In these directions the laws certainly have promised help.

We find that statutes which ought to be plain

and appear to be so are, in reality, confused and vague. Those who seek protection for society as a whole, are much less importunate than those whose selfish interests are involved; and the latter class is quite sure to be ably represented, and, too efficiently for the public good, by trained advocates. There is also an unfortunate lack of direct communication between the general and local health authorities, which delays action in cases of emergency and prevents the coöperation which is, on all accounts, desirable.

Underlying all other reasons for failure to reach the highest measure of success, is the absence of the strong influence of public opinion which controls both law and administration, and which cannot be effective till a better knowledge of sanitary matters be more generally diffused, and the people who suffer shall at last realize the interest they have in the prevention of disease. If the population of this State, as a whole, had shown a tithe of the interest, and the energetic determination to diminish the agencies injurious to human health, that our farmers have shown in procuring efficient legislation for the protection of some of the domestic animals, we should not now complain, as we do, of the unnecessary spread of many of the communicable diseases.

During the past year, there has been a very general discussion throughout the country in the various medical societies as to the nature of diphtheria, and the best means for curing or preventing it. The practical deduction from all the facts thus

far presented regarding the disease seems to be, that its cause or causes are not to be sought in any of the conditions peculiar to urban life. A recent report of the Board of Health of Boston for the year 1888 stated, that 1117 houses in which cases of this disease occurred were carefully examined; 521 houses were found to be in good sanitary condition, and 596 in defective sanitary condition. So that something more than defects in the plumbing of the house must be looked to for a sufficient explanation of the origin of the disease. The most serious epidemics relatively have occurred in this country, as in Europe, among sparsely settled districts.

At present comparative pathology seems to offer the most promising field for careful study, and it may be that some little known disease of the domestic animals is the starting point of a malady which has, during the last year, in a number of localities, proved fatal to a third part of all those attacked by it. It is useless to claim that we have gained much in our resources for the cure of this disease;—but its very evident communicability does enable us to use sanitary regulations, which would undoubtedly limit the spread of the infection, if they could be constantly applied:—these are, prompt notification of cases, isolation and disinfection. For the carrying out of all these measures we have apparently all the authority which laws of the Commonwealth can give; and yet the result is too evident to all.

No city, even, has yet provided for the use of

its health authorities the means of effectual isolation of more than one of the communicable diseases;—a few only have a system of compulsory notification in actual use, or a scheme of disinfection that has any real value.

In obedience to the will of the people, legislative bodies have made laws, but they have in very few cases created an adequate machinery for the execution of these laws;—in fact it is not easy to see how many of our statutes can be enforced by the bodies actually charged with the supervision of the public health in our smaller towns. In the majority of these the board entrusted with sanitary powers is the board of selectmen, a body representing efficiently in most affairs the capacity of the town for self-government; and that means in Massachusetts, at least, good government. But with scarcely an exception, these boards are unacquainted with the vast and somewhat indefinite powers given them by law for protecting the public health, and so, honestly conscious of their ignorance of sanitary work, they do nothing; and in their incompetence, they are perhaps wise in doing nothing. But they have unfortunately also neglected the provision of law which would amply repair their failure,—the authority given to them to appoint a competent officer of health. The prevention of disease in these communities, an interest of the public, is therefore in the hands of a body of men whose livelihood depends upon their ability to cure the disease for the prevention of which their services are rarely retained.

This apparent neglect of the towns rests, I am sure, very largely on the confidence reposed in the public spirit of the local physicians;—it is remembered that they always have done all in their power to protect their neighbors, and this, too, without the intervention of laws which seem to impair the just powers of the selectmen.

There are, however, many serious objections to this service so rendered. In the first place, it is necessarily of secondary interest to the doctor, whose time may be wholly occupied in the hand to hand struggle with death in the case of some one person who for the time being must be of more consequence to him than all others. In the next place, he may be required in the exercise of his judgment as to the influence of some manufacture or trade upon the health of the town, of the neighbors, or of the workmen, to be placed in opposition to the influential members of the small community upon whose good will his earnings may depend.

Under such conditions it is no reproach to him if he declines a service which does not belong to him, and for which he receives no compensation.

Lastly: the special field which has been opened in late years to the sanitary officer is so extensive, that the whole time of the thoroughly educated physician will be required for its cultivation. The inability of the small towns to properly pay such qualified officials might be overcome by the formation of districts, and bringing several towns under one sanitary head.

For the present, however, the service of public protection is essentially unpaid, and dependent upon the voluntary services of our profession. But if the medical men of this State are substantially agreed upon the necessity of a better provision for the protection of the public health, and are willing to use the influence that properly belongs to them, the means of protection will surely be contrived. It is a matter then of much importance that we should examine the present position of the medical profession with reference to the prevention of disease, and more especially the scientific foundations of the many claims of the sanitarian.

From the writings of Hippocrates, down through the many changes of medical opinion to the present generation, are to be gathered expressions which might be used by the most advanced investigators of the present hour in stating the conditions and prospects of preventive medicine. The Father of Medicine built firm the foundations when he declared that a proper investigation of medicine should include a study of the effects of airs, waters and places, together with a knowledge of the kind and quantity of food;—and that from these elements was to be made a diagnosis of the disease and a plan for its cure.

It is only in our own time, however, that the hygiene of the fathers has become a scientific fact, or, more correctly speaking, a collection of scientific alliances,—like a vigorous tree thrusting its roots far out into every near field that contains



appropriate food. It has questions to ask in many departments of knowledge, and insists upon finding out how the human body, under the everchanging physical and even moral relations of life, can best be protected from its multitudinous foes; for the aim of hygiene is the increase as well as the protection of health.

We are met at the very outset by the question, How much can really be done to improve the health of the community and prevent disease? It is never out of place to refer to the benefits of vaccination, and the immense influence it has had on the world. This discovery was the legitimate triumph of observation and experiment. But the condition of mental unrest, and the scepticism which our modern life appears to mistake for the scientific spirit, have led to the reöpening of the question,—with the public it should be said,—as to the value of Jenner's discovery. Some of the doubts are expressed by the writer of an article in the *Encyclopædia Britannica*; but the fantastic views here expressed represent nothing that we know as fact or are willing to accept as theory. He regards small-pox as “an infectious disease arising out of a common physiological or constitutional eruption on the teat of milch cows, and acquiring its special character by the persistent irritation to which it is subjected at the hands of the milker.” Erysipelas, jaundice, vaccinal ulcers and vaccinal syphilis, are included by him among the natural and necessary consequences of cow-pox,—not as results of foreign contamination of

the lymph. He also believes that small-pox is destined to die out uninfluenced by vaccination.

The experience of this State is that in the year 1886 there was no death from small-pox; in the following and last registration year, there were three deaths from this disease, and this in a community constantly exposed to the introduction of the disease from abroad.

Moreover, a certain number of years of immunity from the prevalence of small-pox inevitably leads to the neglect of vaccination and consequent accumulation of susceptible persons. That the disease itself has essentially changed in its terrible severity is not evident.

In the German Empire during the year 1886, the death-rate from small-pox per (1,000,000) million living was 3.5; in cities of the Austrian Empire it was sixty-five (65) times greater; in Hungarian cities it was four hundred and eighty-six (486) times greater. Of the 155 deaths from small-pox in Germany, 45 occurred in the interior of the Empire, where the community is better protected by vaccination; and 110 in the border lands and sea coast towns, where exposure to the influences of countries not so well guarded is more direct.

A recent experience in the English city of Sheffield is also instructive. Here prevailed in 1887-8 an epidemic of small-pox, so severe that 22 persons of every 1000 living had the disease, and 2 out of every 1000 died. The sanitary condition of the population appeared to have little

influence. The death-rate among children was smaller than in any previous epidemic of small-pox, this being due to the increased prevalence of vaccination. The numerical statement of the saving of life in consequence of vaccination cannot be accurately made, but we do know that if the vaccinated children in this English city had been attacked at the same rate as the unvaccinated, they would have numbered 7000 in place of the 353 actually counted, and 3000 deaths instead of the 6 which were recorded.

It is however asserted that the protection from small-pox is secured by vaccination only at the expense of many diseases incident to the transfer of organic matter from one being to another. In Sheffield the annual vaccinations of children in the three last years have averaged 9000, and no death-certificate mentions vaccination as a cause of death.

It is undoubtedly possible that through a carelessness nothing less than criminal, one contagious disease at least may be inoculated with the vaccinal lymph into a previously healthy person. The use of animal lymph has been recommended as a protection against this danger, and by reason of many evident practical advantages.

Though statistics upon this subject in Massachusetts are wanting, it is probable that lymph from the calf is the matter generally used.

The German authorities have met the question of the possible danger of transmitting any disease from the calf to the human being by certain wise

regulations, in accordance with which competent veterinarians determine the health of the animal used, and no lymph is distributed until a post-mortem examination of the calf has shown it to be free from disease.

It has long seemed to me just that the State in making vaccination compulsory should also give its citizens the fullest assurance that they shall not be exposed to the dangers of matter infected with other diseases. While it may not be desirable to interfere with the private establishments already engaged in the business of cultivating and selling vaccine lymph,—a business which it is but fair to say appears to have been faithfully and intelligently carried on,—still there should be some oversight by competent veterinarians at least. At some of the Public Institutions arrangements could easily be made to provide at least all the material required for vaccinations undertaken at the public expense.

When it is considered that every vaccination involves the introduction of animal matter rarely in a fresh state, and possibly contaminated in many ways, into the system of the patient, the wonder is not that some one out of many thousands should suffer, but rather that thousands escape without serious inconvenience and carry with them almost absolute immunity from this hideous pestilence.

It may be remembered that in Jenner's life-time the idea arose that vaccination might be a means of controlling other diseases besides small-pox.

In answer to a communication upon this subject Jenner replied:—

“I never was so sanguine in my hopes of seeing the plague extinguished by vaccine inoculation as some of my friends were. . . . I will just drop a hint ; the vaccine disease, in my opinion, is not a prevention of the small-pox, but the small-pox itself; that is, the horrible form under which it appears in its contagious state is (as I conceive), a malignant variety. Now if it should ever be discovered that the plague is a variety of some milder disease, generated in a way that may even elude our researches, and the source should be discovered whence it sprang, this may be applied to a great and grand purpose.

“The phenomena of the cow-pox open many paths for special action, every one of which I hope may be explored.”

Fifty years passed away before Pasteur and Koch took up the suggestion and began the exhaustive investigations of the protective inoculations by means of cultivations which have been so treated as to represent those milder forms of disease anticipated by Jenner. One man, alone and unaided, began this work, which best illustrates the preventive powers of medicine; he met with abuse and ridicule from many of his profession even. For his followers in this field of experiment and inquiry, costly laboratories have been provided by prudent and wise governments in some countries, by grateful fellow-citizens and admirers in another.

The laws upon the statute book have been already noticed,—some of these, and in fact the larger portion and those which more nearly touch

the comfort and safety of the individual, are executed by local health authorities. There are, however, many important questions which concern the interests of several communities, or are of such character that they cannot be properly controlled by local organizations. These questions have in this State been referred to the State Board of Health. This board has also advisory functions, and is authorized "to undertake investigations into the causes of disease and the effects of localities, employments, conditions, and circumstances, on the public health;" to investigate and advise upon the best means of assuring the purity of water-supplies, and of the disposal of refuse matters and sewage.

With the history of that organization you are familiar; its efficiency and influence will always be dependent, to a large extent, upon the favor which the medical profession may bestow upon it. The Board of Health, in its proper sphere, has always received from this Society encouragement and assistance.

So far as the investigations into the causes of diseases in the interests of preventive medicine are concerned, there are two methods of inquiry. One is of a statistical nature, and rests upon an accurate recording of all the incidents in the history of the disease under consideration,—that is to say, a registration of vital statistics. In the second place, we have the experimental methods. Of these, what may be called the popular experiments are performed for our instruction by water

boards in the case of polluted water-supplies, and by milk dealers in certain epidemics of communicable diseases,—unwittingly in both cases. Now these experiments are always unsatisfactory, from the want of a sufficient knowledge of all the attendant conditions;—nor have we satisfactory warning of the time when the experiment is to be made, and can only attempt to acquaint ourselves with causes after the effects have become evident. The other experimental method is that of the laboratory, where in the examples above taken,—a polluted water-supply and an infected milk,—the direct experiment is made upon some appropriate animal by introducing within its body a certain quantity of the suspected material and carefully noting the results.

It is always to be remembered, however, that man and the lower animals are affected oftentimes in different ways by one and the same substance or influence. The bacillus described by Eberth appears to be now generally recognized as constantly present in those suffering from typhoid fever. It has been detected in suspected water-supplies. Experiments on the lower animals have thus far failed to produce satisfactory evidence of its communicability to them. Yet we have now a mass of facts recorded showing beyond question that an organic entity has, in certain cases, found entrance to a water-supply, as in the historic epidemic of Plymouth, in Pennsylvania, where in a community of 8000 souls, 1153 were taken sick with typhoid fever and 114 died, all apparently

clearly traceable to the infection of the village water-supply by the stools of a person ill with typhoid fever; or as in a recent outbreak in Cambridge, in this State, where a quantity of milk collected from some New Hampshire farms, of more than average neatness, had been exposed in some of the processes of its preparation for market to contamination from a well dangerously near the spot in which had been deposited the dejections of a man ill with typhoid fever. This milk carried to a distant city in another State sickness and death. These experiments which have been unconsciously performed for us upon this large scale, have their counterparts probably in the experience of every physician here present.

In a State so densely populated as this it is not possible to find a water-supply sufficient for the needs of our large cities free from the dangers of faecal pollution. We must recognize the imminent peril, and take seasonable precautions to ward it off. A thorough policing of the tributary water shed should be constantly kept up, and a systematic notification to some central authority of cases of disease liable to endanger the water supply would enable that authority to secure at the point of danger the prompt local disinfection that may be necessary. It is also well that we should remember in this connection that of the mere making of laws we have had enough perhaps; an educated sense of sanitary decency well-diffused through all classes in the community will be the most effectual agency for protecting our



cities and towns from the dangers of polluted water-supplies.

As the infective material is undoubtedly present in the discharges from the bowels in typhoid fever, the thorough destruction of the stools should be effected either by chemical action or by heat; or better still, by fire, when some mechanical appliance shall make the kitchen fire available for the purpose without nuisance.

While the evidence of the origin of typhoid fever in fæcal pollution is almost overwhelming, it must be admitted, it seems to me, that the particulate contagion of it may have a life distinct from the human body through considerable periods of time.

During the year 1888 typhoid fever was more prevalent in New England than it had been for a number of years. It broke out at nearly the same time in many widely separated districts; the cases appeared in large numbers during the months of July and August, under circumstances which made it generally impossible to trace them back to pre-existing cases. The experiences of the bacteriological laboratories indicate that the bacillus assumed to be constantly associated with typhoid fever, can be reproduced in various artificial culture media for many generations. What the hand of man can accomplish in the cultivation of these microscopic growths, nature has probably already done in some of her mysterious working places. Our knowledge of the innumerable microphytes is still so limited that we do not seem justified at

present in assuming that this bacillus under consideration is necessarily connected with man and man alone.

The question of the best way of protecting our milk-supplies from several of the communicable diseases, is not only a very pressing one but one very difficult to answer. Milk offers a soil of favorable character for the growth of many micro-organisms ; a water polluted with specific bacteria, even when used in the limited way customary in cleansing the ordinary receptacles of milk, is still capable of infecting a relatively unlimited quantity of the latter.

There is certainly no substance used so generally for food as milk, which is prepared for the market with so slight regard for scientific purity, not to mention ordinary cleanliness, as is the case with this. The cow herself is often improperly cared for, is milked so long as anything that passes for milk can be obtained ; her diseases are not properly recognized ; she is frequently in a filthy condition, while the milk itself, in the process of milking and storage, is brought into contact with the oftentimes foul skin of the animal and the unwashed hands of the milker, to be finally deposited in an unclean receptacle.

Scarlatina in the cow, the so-called Hendon-disease, which has been carefully examined in all its relations by the medical officers of the English Local Government Board, has been clearly proved to be transmissible to persons using the milk from diseased animals. Quite recently more extended

studies upon this subject by Dr. Klein have confirmed his previous statement that from the blood of persons suffering from scarlatina an organism can be separated which in microscopical and cultural characters corresponds with the strepto-coccus obtained from the sores of particular Hendon cows. This strepto-coccus Mr. Power has conclusively shown to stand in direct relations to an outbreak of milk scarlatina in certain portions of North London at the end of 1885 and beginning of 1886. Dr. Klein's recent experiments with newly-calved cows have shown that this organism, whether derived directly from the human body, or after its passage through the system of the cow, will, when inoculated subcutaneously at the root of the animal's ear, cause on the teats of the cows ulcers like those observed in the cases at Hendon. He finds these ulcers to be amongst the earliest evidences of disease in the animal; that they occur whether the animal is milked by hand or is suckling her calf. The teat-sores come in from 4 to 9 days after the inoculation; then comes a general affection of the whole skin with more or less febrile disturbance, and sometimes disease-processes are observed going on in the lungs. In the disease so induced changes are found after death in various organs, such as would naturally be looked for in an acute specific disease, and so constant in character as to make them indicative of the existence of cow-scarlatina.

He also asserts that the post-mortem appearances found in animals affected by this disease

bear much resemblance in essentials to those found in human subjects dying of scarlatina.

More recently the same department has described another disease of milch cows that had been observed at Edinburgh. The milk from the dairy, where these cows were kept, had distributed a form of febrile sore-throat among its customers. This form of sore-throat was not recognized as peculiar to either scarlatina or diphtheria. A cow suffering from this "Edinburgh disease" was placed under careful observation during life. The post-mortem appearances and the bacteria associated with them were studied; with the result, that the disease was found to be inoculable, and though having certain affinities with the "Hendon disease," still evidently was not identical with it. One of Dr. Klein's conclusions is of a scientific interest beyond the limits of the consideration of this disease. Criticism of Dr. Klein's researches has repeatedly taken shape in asserting the unity of those forms of the chain-forming micro-cocci, which he and others have been at pains to distinguish. At the end of his long investigation he finds himself in a position to enumerate seven sets of characters serving for differentiation between one and another organism of this group;—that is, that he has reached a point where the application of seven tests is wanted before an assertion of the identity of any two strepto-cocci can, even provisionally, be made. All the nine strepto-cocci examined were from the bodies of animals variously diseased. Some of the distinguishing characters

were obtained by the microscope, others by cultivation in suitable media, and all apart from evidence that is obtainable by inoculation of animals and from pathological changes resulting therefrom.

The foot and mouth disease,—a contagious eruptive fever of cloven-footed animals,—is also communicable to man in various ways, chiefly through the use of uncooked milk. It came to this country with imported stock in 1870. Children are most exposed to the disease, both on account of the relatively large quantity of milk used by them as well as from their smaller powers of resistance to disturbing influences.

Since Koch in 1882 discovered the bacillus of tuberculosis, and demonstrated the identity of tubercle in man and animals, there has arisen this most important question; under what conditions may milk become the vehicle for the transfer of the bacillus and the disease from the cow to man? At the congress for the study of tuberculosis, lately held in Paris, it was among other resolutions voted, “that the sale of milk from tuberculous cows should be absolutely prohibited.” The full significance of this vote will be realized when it is added that in France tuberculosis is officially held to be one of the communicable diseases. Where there is tuberculous disease of the udder, it is of course agreed that the milk should not be used. But it is not true that tubercle not affecting the udder has been generally regarded as a sufficient reason for prohibiting the use of the

milk. Certain observers of repute claimed positive results from the intra-peritoneal injection in Guinea pigs of the milk of tuberculous cows without local disease of the udder.

The evidence from other sources is already sufficient to cause serious apprehension of danger to man from the use of milk from tuberculous animals ; of course the inference is also inevitable that tuberculous mothers cannot safely suckle their own infants.

The Massachusetts Society for the Promotion of Agriculture, with a large and enlightened sense of the general importance of this question, has employed a competent physician and distinguished bacteriologist to conduct an investigation of this most important subject, and has placed at his disposal stock and suitable buildings, together with the coöperation of a skilled veterinarian. We may therefore confidently look forward to substantial additions to our knowledge of this, the most fatal disease in Massachusetts.

The number of cattle in New England suffering from tuberculosis is undoubtedly very large. From the reports of the veterinary surgeons attached to some of the large public slaughter-houses in Germany, it appears that more than ten per cent. of the cows brought to these places are tuberculous. There are no equally valuable statistics, to my knowledge, on this side of the Atlantic ; but an intelligent non-medical observer, connected with one of the largest slaughter-houses in New England, believes, as the result of his own obser-

vation, that the proportion of animals so diseased and brought to our slaughter-houses probably exceeds the rate above given. It is also stated that Western cattle are not found to be tuberculous in the same relative numbers.

In the course of the legislative hearings which preceded the enactment of the present wise and quite effective statutes to prevent the sale of adulterated milk, it was held by the opponents of that legislation that the standard of pure milk sought to be established—thirteen per cent. of milk solids—was unjust, because many apparently healthy cows never yielded a milk which reached that standard of solid parts per hundred. There is but little question as to the truth of this statement. Cows of certain breeds give a very large quantity of watery milk which does not reach the legal standard, while cows of other breeds give a milk which exceeds the legal requirement. This idea, that whatever issues from the udder of the cow is authoritatively stamped as milk of unquestionable purity, lies at the foundation of many of our difficulties in securing a healthful milk.

The use of cows of certain breeds, which produce milk of low grade, is not essentially different from the unnatural feeding, which has the result of increasing quantity at the cost of quality, and amounts to the commercial fraud of watering the milk inside the cow; and does have a definite injurious effect upon bottle-fed infants, by depriving them of a portion of the nourishment which should be contained in a definitely measured

quantity of milk. The udder is, moreover, an organ of excretion as well as secretion, and the experience of the human mother is probably repeated in the animal, which is so often called upon to provide for the human infant ; the milk, by reason of some quality beyond the reach of chemistry, does not agree with the stomach of the child.

The milk that reaches the consumer in the cities is, almost invariably, a mixed product. Possibly more good than harm results from this. In the majority of cases injurious qualities in any one milk would be so diluted by the addition of many times that quantity of normal milk as to give a mixture better than the single objectionable specimen. If the injurious quality, however, should be found to reside in an organic body capable of development in a suitable medium, we should have gained little by increasing its opportunities for growth. Well-considered legislative action has made it a punishable offence for a man to sell milk which falls below a certain standard. It seems to be an unnecessary concession to allow the cow to produce for the market the article which her owner is forbidden to sell as standard milk.

The importance of this subject must be my excuse for dwelling so long upon this detail of public health work. It must be plain to you that many of the dangers to which allusion has been made can only be dealt with by the authority of the State. Much of the information requisite for a



decision, in special cases of injury to health, can only be obtained through an agency which acts in all portions of the Commonwealth.

Excessive infant mortality is one of the saddest social facts of the present day. With all the improvements that have been brought about in public and personal hygiene, it is far above the rate which can be secured and does exist in other parts of the world. Our experience shows that a large part of this is the result of improper feeding. It is probably not true that female vanity has triumphed over the maternal instinct so far as to cause that marked deficiency in the capacity of the human mother which has promoted the cow to her vacant post of honor.

There is no reason given by chemistry, however, why the milk of the cow should not be all-sufficient for the human infant. Milk, very evidently, is only occasionally treated with the care which it deserves and requires. If human milk were prepared in the same slovenly fashion, and given to the infant from the same dirty apparatus, I do not believe that the results would be essentially better.

The nursing-bottle, as we ordinarily find it in use, is a culture apparatus for the micro-organisms in general, which can only be harmless from the fact of the antagonisms of the bacteria. The chemical products of decomposing animal matter also present are positively dangerous.

Dr. Böckh presented to the Sixth International Congress of Hygiene at Vienna, in 1887, some

facts in relation to infant mortality in Berlin which are very instructive. A table of deaths of infants before the end of the first year of life shows that the mortality of those fed on cow's and goat's milk was three times, and of those fed upon artificial substitutes for milk five times, that of infants nursed at the breast.

Very successful attempts by private organizations have been made, in different parts of the world, to secure satisfactory conditions of cleanliness in the preparation and distribution of milk ; and these attempts would gain much in number and effect if the members of our profession would help on the movement by directing attention to the dangers attending habits on the part of the milk-producers, which have, perhaps, been thoughtlessly adopted and retained.

It is not overlooked that many other external conditions have a great influence upon the mortality of infants. I have only attempted to deal with one influence, which can, without great difficulty, be controlled.

Examinations of the public water-supplies, and consideration of the best means for securing their purity, have received much attention in this State. It has been well said that no other article universally used by man is so little examined, changed, or freed from injurious qualities, as water. No other article of food or drink is exposed to so many contaminations.

It would be a waste of time, in this presence, to insist upon the possibility of the origin of disease in infected water-supplies.

In a vague way this fact has been recognized in all ages. We learn from Thucydides that the Athenians attributed the plague at Athens, during the Peloponnesian war, to the fact that the enemy had poisoned the wells at the Piræus, the place where the disease first broke out, and whence it invaded the city. During the middle ages the connection between the use of certain drinking-waters and the outbreak of disease was so close that the suspicion almost immediately arose that some poison had been mixed with the water-supply. As the Jews were the people in the community who possessed much information as to drugs and poisons, and were sometimes wealthy, they were at once accused of poisoning the wells; and suffered somewhat as respectable members of our profession do now in trumped-up malpractice suits. In the last outbreak of cholera in southern Europe, the doctors were charged by the mob with the same offence, and in several instances nearly lost their lives in consequence of popular violence.

Dioscorides recognized the difficulty of ascertaining all the important qualities of water, and wisely says that he can make no general statement about it, so much depends on its many and varied relations to places. How permanent and how general these injurious conditions may become is shown by the prevalence of certain diseases in cities of notoriously polluted water-supplies, and by the disappearance of these diseases when this single condition is removed by the substitution of pure water.

There are many municipalities, the world over, where every new comer acquires his citizenship at the expense of an intestinal catarrh or a typhoid fever ; it is a matter of secondary importance whether this happens through a direct infection, or because disturbances are set up which open the way for the entrance of the specific poison. Typhoid fever is now more a disease of country towns than of cities, in all cases where the cities have unpolluted water-supplies. Before the general introduction of good public supplies, the reverse was true ; and still is in certain cities where the water-supply is not sufficiently protected from fecal contamination. The universal experience of mankind has taught this lesson ; some of the most permanent monuments of the old world are proofs of it.

The stranger who stands in wonder beneath the Pont du Gard to-day scarcely realizes that the great Roman, who built it to meet a sanitary need of the camp and town of Nemausus, constructed his mighty aqueduct with such costly permanence, that the flourishing modern city of Nismes shrinks from the mere burden of restoring it.

How infected the soil of a great city may become is shown by the frequent outbreak of diseases that stand in close relation to soil pollution ; and by the immediate appearance in more southern latitudes of pernicious fevers whenever the soil is disturbed during the warmer seasons of the year. The quantity of human excrement alone which is buried in the vicinity of the dwelling

houses of the older parts of our cities is enormous, even upon the smallest estimate of the amount per capita which is buried in the soil yearly.

This is sooner or later washed, in whole or in part, into the subsoil waters ; possibly to reappear upon the surface before it has lost its dangerous qualities ; and even though the quantity of impurity taken into the system at any one time be small, it must be remembered that the dose is often repeated.

The deep soil waters are themselves generally free from micro-organisms ; in whatever way we contrive to bring them to the surface something in animal or vegetable life is added to them. Absolutely pure water does not exist in or upon the surface of the earth ; nor is it at all certain that it would be better adapted to our uses if it did exist, for there has not been anywhere a continued use of chemically pure artificial waters, by a sufficiently large number of human beings, to enable us to decide the question of the influence of the organisms always present in natural surface waters.

When chemistry had reached a degree of delicacy that could discriminate between minute quantities of the dissolved substances of organic life, it was at once supposed that means had been found to enable us to form correct judgments as to the healthfulness of any given specimen of water.

The improvement of the microscope in the last generation made it possible to conveniently study the grosser microscopic organisms. The great

improvement in this instrument in quite recent years, together with Koch's method of plate culture of micro-organisms, has carried the analysis of water chemically, microscopically, and biologically to refinements which puzzle seriously our capacity to make available to sanitary science the investigations of the laboratory. Exact and repeated analyses of the drinking-waters have hitherto been rarely made ; usually they are procured under the pressure of some suspicious circumstance in the history of the water-supply, or in the hope of discovering an explanation for some unexplained outbreak of disease.

In various parts of the world examinations are now going on for the purpose of ascertaining, with all possible accuracy, all the facts in regard to public water-supplies.

Two years have been already spent upon this work in Massachusetts ; and it can now be safely asserted that, when a public water-supply again becomes so disagreeable to the senses of taste and smell that men will not drink it, the changes that have taken place can at least be pointed out.

Possibly the conditions of those changes may be still beyond control ; but we shall at least know in what quarter we are to look for help.

Observation and experiment attach a significance to the presence of certain substances in waters, which would not, at first thought, be considered deleterious. Iron, for instance, has been considered objectionable in water used for domestic purposes, simply because it left stains upon

fabrics which are washed in it, or come in contact with it. But we have now found that the presence of iron in a water makes a medium favorable to the development of certain minute forms of vegetable life which, in sufficient quantity, cause the water to become too offensive for use.

For the State examinations, specimens of the various waters selected for examination are taken every month, in such manner that the external conditions can be preserved throughout the investigation. The chemical analysis includes the determination of the color peculiar to the water, as well as the odors. In as many cases as possible the animal and vegetable forms of life are also studied. In a hundred different waters taken at random from various portions of the State it would probably be impossible to at once select those which the final judgment of the experts, with a knowledge of the chemical constituents of the water for a long period of time, would designate as dangerous on account of pollution. That is to say, the absolute figures of the amounts of ammonias, nitrates and chlorides, may vary quite considerably in different waters; and yet one would not be justified in assuming that the water containing the larger amounts of any of these substances was more unwholesome than the rest, unless an accurate knowledge of the surroundings was possessed. But these figures are of great value in the history of any one water; their variations have especial significance; and it is for this reason that the chemical determinations should be

made with the greatest accuracy possible. It cannot be granted that this great degree of accuracy is unnecessary. It is true that methods of analysis have changed much in comparatively short periods of time, and results which were deemed of great consequence twenty years ago are neglected now. It is occasionally asserted that the days for chemical analysis have passed away, to give place to bacteriological examination, to a counting of the bacteria actually present in a measured quantity of water. For a certain length of time this method has been in fashion, and it appears to be generally true that waters containing the largest numbers of bacteria are the most dangerous. These biological examinations involve the expenditure of much time and the employment of many skilled observers, if anything more than a mere counting of the bacterial colonies be attempted. It is not, therefore, probable that bacteriological examinations will take the place of chemical analysis. On the contrary, we may rather anticipate that biological studies of the organisms contained in water will accurately determine those which may be injurious to health ; and that the chemist will then devise methods for detecting the chemical peculiarities of a water which would be condemned in the laboratory of the biologist. Difficult as this requirement may be, and impracticable as it may at present seem to be, some of the results recently obtained by chemists who have made special studies in the analysis of water indicate possibilities of greater



accuracy than that to which we have thus far attained.

Specimens of surface drinking-waters may contain the ova of some of the parasites of the human body, as well as other forms of animal or vegetable life dangerous to health, but of sufficient size to be detected by the naked eye, or by the lower powers of the microscope. These organisms, however, have not attracted so much attention, or given rise to so much speculation as the bodies which are only visible under the highest powers of the microscope. Among these are to be placed those bodies which are now generally believed to be the causes of certain infectious diseases in man. The presence of these organisms cannot be detected by chemical analysis ; and it is because we have no certain knowledge as to the effect upon them of the mixture with very large bodies of water that no public health authority has ventured to advise the use of a water-supply which has once been polluted with sewage.

This hesitation also exists when we consider water in the form of ice. Examinations actually made, not only in this State but also in the laboratories of other States and countries, have shown that the process of freezing diminishes the quantity of matter in solution in the water frozen ; that this removal of substances foreign to pure water is least upon the exposed upper surface, and in the layer of snow-ice usually noticed in the article as seen in commerce ; that the purification increases in the lower layers, and is greatest in that

portion of the mass which is clearest and contains the fewest air-bubbles. The change effected by freezing may thus amount to almost complete purification in part of the ice formed, and, for the whole mass, even, the reduction in dissolved matters may average ninety per cent. But it is also true that some of the micro-organisms are not destroyed by freezing. This Society is familiar with the history of an epidemic caused by the use of ice proved by chemical analysis to be impure. It should be added that, in this case, which is reported in the seventh report of the State Board of Health, the pond from which the ice was taken was wholly unfit for use as a water-supply, and probably would never have been selected for that purpose. There has always been a popular belief, for which there appears to be some foundation, that contaminated waters become purified by the act of freezing. But what we have really gained by a scientific examination of ice is this, that we now know that some portions of the mass are very much better suited to safe use than others ; and a careful preparation of the article for market will naturally include the removal of the suspicious portions.

There are also, fortunately, in every part of the country bodies of water from which pure ice can be obtained ; until these sources are exhausted we should all agree that the human body, at least, should not be used as an experimental culture medium.

Important additions to our knowledge of the

conditions that should surround the storing of water have also been made ; the arrangements for protecting water from high temperatures and free exposure to light, have had marked results in diminishing the growth of objectionable organisms.

The examination of water to ascertain the presence and number of micro-organisms has also improved the construction of filters, by giving a definite test of the degree to which such bodies are removed ; and we can now find filters constructed upon scientific principles and adapted to the requirements of public water-supplies even. It is also claimed that chemicals can be so added to the water to be filtered that organic substances will be removed by a reaction which frees the water from the organic bodies and produces an easily managed precipitate. There is no reason apparently why this result may not be obtained. But, granting that water may be purified by filtration, by the addition of chemicals, or by boiling, these processes are poor substitutes, on the part of the individual, for a good public water-supply which has the advantages of competent and continuous watching and of all the resources of the State for its protection.

In very close connection with any general treatment of the water-supplies of the State stands the consideration of the disposal of sewage. A few cities and towns can turn their sewage into the ocean or into streams without serious injury to any one. But the streams which can be so used

at the present time are few in number ; and, with the rapid increase of population, will soon cease to be available.

Over how wide an extent of territory the watershed of the supply of a great city may stretch, will be understood when it is stated that the Cochituate, Sudbury, and Mystic supplies of the city of Boston, come from lakes or streams which drain a hundred and twenty-two square miles of territory, forming portions of sixteen cities and towns. In the sparsely settled parts of this area household waste may safely enough be disposed of in or on the soil ; but it is also true that in too many cases it is, in ignorance, so used as to be a danger to the household from which it comes, as well as to the neighbors.

The health of the great city requires water free from pollution ; it must have it, and, it is safe to add, it will have it.

The assertion has occasionally been made, in some public assemblies, that there is some sort of natural right belonging to those dwelling on the banks of a pure stream of water to misuse it and defile it. But this is again a question which it is quite unnecessary to discuss here, if it be true that sewage can in any way be safely treated without placing it in a body of water.

Experiments have been carried on for two seasons at a station at Lawrence, under the control of the State Board of Health and the immediate direction of men who have a complete knowledge of the conditions involved in such work. Various

methods of sewage disposal have been investigated ; three only seem to deserve serious consideration :—chemical treatment ; irrigation upon large areas, but not to such a degree as to imperil crops ; and, lastly, intermittent irrigation upon limited surfaces of properly prepared filter grounds, without expectation of securing crops.

The first method, so far as it has yet been employed, does not remove more than half of the contained impurities, and leaves an effluent which it is not safe to discharge into a stream which is used for domestic purposes. The first cost is large, the maintenance is expensive, and the works are not always free from offensive odors.

Broad irrigation is only practicable where very large areas of cheap land can be obtained, and even in this case the probabilities of a profit from the undertaking are very small.

The method of intermittent downward filtration is that, which, thus far, offers the best hope of success. In this there is no promise held out of an income in the way of crops from the irrigation field. But the attempt is made to purify, as completely as possible, the largest quantity of sewage on the smallest area. How thoroughly these requirements have been met is manifest from a few of the many experiments made with filters of coarse mortar sand five feet in depth. Upon such a filter sewage was applied at the rate of one hundred and twenty thousand gallons over the acre daily ; and after nitrification had begun the ammonias were less than one and a half per cent.

of those of the sewage. Upon increasing the amount filtered to one hundred and eighty thousand gallons for the acre, the ammonias also increased, but for the next four months averaged less than two per cent. of those in the sewage.

Another filter of the same kind, which received sewage at the rate of sixty thousand for the acre daily, gave an effluent of nearly constant quality; having one half of one per cent. of the ammonias of the sewage, and showing less organic matter than many of the drinking-waters of the State.

Still another filter of very fine sand, which filtered at the rate of twelve thousand gallons daily for the acre, gave an effluent which, by chemical analysis, contained less organic impurity than the water of Lake Winnipiseogee; at the same time the bacteria of the sewage applied amounted to five hundred and ninety-one thousand in a cubic centimetre; in the same quantity of fluid taken from the effluent there were but two, and these may have come from the air during the taking of the sample.

So far, then, as chemical and bacteriological analysis can give assurance of the possibility of effectually purifying sewage by intermittent filtration through sand or gravel, the result is satisfactory.

This, however, has been attained under conditions which probably would not be possible on a larger scale or under ordinary municipal direction. The final test, also, has not yet been made, that is, the trial to ascertain whether the peculiar

something in a given specimen of water which causes typhoid fever in the person using it will still exist in the effluent though unrecognized in the chemist's laboratory or by the microscope, and will be found to exist there by the crucial test of an experiment upon some animal susceptible of the disease. Even if complete safety has not been reached, very much has been gained by the diminution in the number of harmful agencies. There is scarcely another influence in nature of so great sanitary value, or generally so constant in its operation, as that of dilution and division.

The warfare waged by the phagocytic cells of the human body against intruding foes, so eloquently set forth in recent days, can only be successful when the enemy is divided. The strongest battalions prevail in the marvellously complicated world of the human body, as well as in the comparatively elementary arrangements of the battlefield.<sup>1</sup>

<sup>1</sup> To the same purpose is the fact that a practically thorough disinfection may be obtained in the laundry by simple washing. For the truth of this we have the experience of some of the hospital and public laundries, like that of the Sanitary Department of the city of Glasgow.

The health officer of that city, J. B. Russell, M.D., and there can be no better authority, states that during an experience of ten years there were washed in the establishment referred to over a million articles infected by every variety of known contagion. Everything was done as a careful housewife would do it, but in a place provided for the purpose and with the assistance of certain mechanical appliances. Blankets and woollen articles were not boiled; every other fabric was. The result was complete disinfection; and the test of the success of the work is found in the fact that not a case or suspicion of a case has occurred of interchanged disease,—for instance, the appearance of small-pox or other contagious disease in a house from which clothes had been taken and returned on account of scarlet fever. The only defect in the arrangement was the oc-

The undoubted protection from several infectious diseases which is afforded by free ventilation is an instance more of dilution than of destruction. What the particulate contagion may be which is carried from a person ill with scarlet fever to one susceptible of it cannot easily be imagined ; and yet, during a season of very general prevalence of this disease, almost every person in densely peopled districts must be exposed to some portion of the infectious material. The actual amount of this material which comes in contact with a susceptible subject seems to be of decided influence. It has been proved to the satisfaction of the responsible authorities in England that certain small-pox hospitals, even when most carefully managed, have been a source of infection over a large circle, of which the hospital was the centre ; with an incidence of disease diminishing regularly with increase of distance from the building this influence also stands in direct proportion to the number of sick in the hospital.

Assuming, however, that a person has been fully exposed to a contagious disease and does not contract it. Immunity from the communicable diseases, whether obtained by a previous attack of them or by the lack of that predisposition of which we hear so much now-a-days, is a simple statement of fact, behind which lies an impene-

casional infection of the washerwomen who handled the soiled clothing. But even this difficulty can be reduced to very small proportions, if not wholly removed, by more careful management and previous disinfection by heat.



trable mystery. The word "zymotic," which has been much used in this connection to designate a class of diseases, having "the property of communicating their action, and effecting analogous transformations in other bodies," unfortunately carries with it the suggestion that the phenomena of fermentation are an explanation of the diseases thus designated. It is true, probably, that the accurate study of the process of fermentation, carried on by Pasteur, contributed more than any other single investigation to the remarkable activity of the last few years in the study of the bacteria of many of the infectious diseases. But beyond the constant association in a small number of diseases of certain micro-organisms with some of the organs or tissues of the body, we have not yet penetrated. It was early seen that the micro-organism, simply as a tenant of the human body, had a comparatively limited influence. The purely mechanical invasion of the tissues of the body should not be more injurious in the case of the pathogenic organism than in that of the innocent growth. There remained, then, to be considered the products of the vital processes in these microscopic organisms. Many of these products have been shown to be possessed of the most poisonous qualities, and their study offers one of the most attractive fields for original research.

These instances of the present direction of the work of the State Board of Health have been given because they are the subject upon which the State has directly legislated. The experi-

ments and observations could not easily have been made under any other authority than that of the State, and they touch more nearly than any other general conditions the lives of great numbers of human beings by influences not easily measured or perceived even by the trained observers of our profession.

They are conditions requiring the interference of the State, because in our civilized life the individual is utterly helpless in his vain endeavor to protect himself, even could he identify the source of the injury. There must be coöperation, voluntary if it can be so arranged, but secured by all the power of the State, if need be, against stupid neglect or wicked selfishness.

Incomplete as our knowledge, then, is upon many of these subjects, it must however be evident to all that great progress has been made in the last twenty years in the discovery of many of the essential conditions of disease. We have gained enough to be able to decidedly limit some of the communicable diseases ; with others again we have accomplished but little. As in curative medicine, so also in preventive medicine, it will not do to wait until we have satisfied all the demands of science before we act. We must expect, in the light of a larger and better experience, to discard many things which we have hitherto thought to be essential, and to seek for assistance in the directions where we little expected to find it.

Our knowledge of the pathogenic micro-organ-

isms is closely limited to laboratory experiments with pure cultivations of the various species. This is very certainly not the condition of things in that outside world where diseases are contracted and the sick must be treated. There is not much really known of the simple metamorphic processes effected in plain chemical fluids by bacteria ; and when it comes to the infinite variations caused by their action on the human body, we can at best only describe results.

Man exercises a power over plants that the public health officer would oftentimes be glad to possess over human beings ; and something useful may perhaps be learned from the experiences of agriculture, though we may never be able to exercise the same control that the gardener so freely and profitably makes use of, when he destroys a vicious stock, or breeds out certain imperfections by the careful selection of parents through successive generations.

This art of agriculture, which has so many points of resemblance to our own, teaches us that the liability to certain diseases which is found among animals has its analogies in the vegetable kingdom.

Under certain conditions a plant is more apt to become infected by parasitic diseases ; in its first tender growth, for instance, and when the surface of the plant is wounded. Peculiarities of tissues have also a marked influence ; farmers know that the thin-skinned potatoes offer less resistance to the intrusion of some vegetable parasites than do

the thick-skinned varieties ; but when the entrance is made there appears to be no difference in the consequent changes in either kind.

General and external conditions exercise the greatest influence upon plants, such as temperature and moisture both in the air and in the soil. Close planting is an evil that no interference short of a removal of the condition itself can relieve. Perhaps no more suggestive comparison can be made of this noxious influence, to conditions in our own social life, than that which is at once suggested by the thought of the crowded tenement houses of our cities.

It is a comparison in part only ; for man suffers not alone in health, but, in his almost beastly condition of overcrowding in the worst of these tenements, is robbed of those sentiments which are worth more to the human race than robust bodies even.

As commerce has distributed over the world trees and plants, which, by some inherent peculiarity, are fitted to flourish only in exceptional surroundings ; so possibly in the human race we shall find certain stocks which deteriorate when removed from their native soil, while others may improve.

In the vegetable world, a knowledge of the real nature of the disease gives us the best clue to the discovery of a remedy ; removing the common barberry from the borders of the wheat field protects, to a measurable extent, the grain from a rust which has inflicted at times serious injuries on this crop.

Investigations into the geographical distribution of diseases have proved that the whole world has suffered from a pestilence which is at home only in the delta of the Ganges ; while in comparative pathology we may establish the fact that some epidemic disease of the human race belongs primarily to a domestic animal, in whose body it can be most satisfactorily dealt with.

This country, but fortunately not our own State in our own time, has suffered severely, and may suffer again in this year even, from a pestilence which is endemic at one or two ports only in the Gulf of Mexico. Yellow fever is a disease which owes most of its terrors to sanitary neglect ; and so long as the port of Havana is allowed to remain in its filthy condition, a permanent culture ground for the disease, so long will our whole Southern seaboard suffer from occasional panic, and what is worse still, from the state of negligent exhaustion that always follows a fit of panic.

If it were possible to control by inspection the admission of yellow fever through the regular channels of commerce, it certainly would not be possible to close the doors by which it may be smuggled in. It is a constant warning, as all epidemics fortunately are, of the need of cleanliness, and the warning has evidently not been everywhere heeded. But it is to be hoped that statesmen may find a proper subject for international consideration in the question whether any country should be allowed to maintain wantonly at our very doors an unnecessary source of harm to our lives and property.

In the comparative pathology of the communicable diseases, no disease has attracted more attention to itself than rabies. The tragic features of the final struggle, the long uncertainty as to the outbreak, and the failure of medicine to cure it, have invested it at all times with features of special interest.

The real protection afforded by the inoculations of Pasteur has been therefore gratefully acknowledged by our profession and by the people ; and is the splendid crown of a life of magnificent service to mankind. But, even in this disease, Prussia, with twenty-eight million inhabitants, by a system which deals with the dog first, and keeps the animal at all times under proper restraint, and in case of disease under care of a veterinary surgeon, has a record of fewer deaths from rabies, through a number of years, than the city of Paris alone from cases originating there.

In Paris, notoriously, whatever laws exist relative to dogs and the necessary control of them are not strictly enforced.

For our public health service, then, we must have, in the first place, a scientific knowledge of the infecting principles of the communicable diseases, in order that we may discover whence they come and how they increase and live. We must be enabled to separate the sick from the well ; each case is a public danger, of which a public officer should be notified. Each patient must be made to understand that it is his duty to protect the community as best he can. If he is ignorant,

instruct him ; if he is negligent, punish him ; and while he is helpless, support him.

The interests of the State, the city, and the individual, in questions of public health, cannot be separated. We often hear this subject spoken of as though the topics of public and private health were essentially distinct. There can be no distinction ; whatever affects injuriously the individual must of necessity produce the same changes in all others in like circumstances. The duty of the citizen is to avoid the doing of those things which may work an injury to his neighbor's health ; and this obligation the State must enforce. But the interference of the State is only desirable when there is a sufficient foundation of actual knowledge, gained either by observation or experiment, upon which can be safely established a body of laws.

These facts and the interpretation of them are properly the work of experts, who are, almost of necessity, members of the medical profession.

It is in the direction of a better preparation of members of the medical profession for this expert work that the State can render essential aid. No public interest is of so great importance as the protection of health, and there is no other public interest for which the State expends so little.

For the practitioner of medicine there is the sure prospect, if possessed of fair intelligence, good education, and industry, that he will obtain an honorable place in the world and a decent maintenance. For him who devotes himself to

the study of preventive medicine there is, at present, no prospect of employment in any place which the State or the city considers as deserving any compensation above that of a purely administrative office, which pre-supposes no unusual or expensive preparation for its proper management. This is an unpleasant contrast with the wiser management of countries where the value of human life is better recognized.

Let me not be understood to include in the positions, for which all adequate compensation is claimed, either our State or local boards of health. These boards have been made up of men, not of our profession alone, but of representatives of all the busy occupations of the world ; they have freely given their services in the past, they are doing so in even greater measure to-day, and will undoubtedly continue to do so in the future.

But unpaid service such as this should not in vain ask for the right to adequately reward the devotion and intelligence of the responsible officers, upon whom must rest the administration of some of the most serious functions of government, which can only be performed by an expert of thorough training ; and though this work were an hundred times more costly than it is, it would still be less than the useless wastes of human life and pecuniary expenditure caused by sanitary neglect.

But it has, I hope, been also made plain that the one force, upon which more than any other future reliance is to be placed, is the better education of the people in sanitary matters. In too



many directions they have hitherto been unable to speak for themselves. Everything that concerns the general health has been regarded as a mystery only to be approached by those who have had some peculiar initiation. But we have certainly now arrived at a stage in our progress where we can designate certain conditions as essential to good health, and sufficiently simple to be the property of all.

Disinfection, the essential qualities of which are now understood better than before, is seen to have no surer foundation than systematic cleanliness down to the minutest details.

The attempt to thoroughly disinfect, by means of chemical agents, any considerable space or any large object is well nigh hopeless. In many instances the attempt to purify by some bad-smelling preparation is positively dangerous, from the false sense of security conferred by the process. Let me not be understood to discourage the attempt to deal with limited quantities and individuals by means of chemical disinfectants ; but in proportion as we try to deal with indefinite things does our work cease to have a definite value.

Thorough washing with soap and water has been shown by experience in the laundries of pest-houses to be fully as efficacious as the most elaborate treatment with chemical disinfectants. For such objects as cannot be washed, heat above two hundred and twelve degrees, exposure to sun and air, beating in open places, have effected the same result. The thorough cleansing of the walls and

exposed surfaces of infected rooms, with a generous supply of fresh air, has apparently answered as well as the most elaborate diffusion of disinfecting gases.

In dealing with the patient, however, there is some excretion from the body or some definite particle which bears the infection, and can be destroyed and must be destroyed if possible. This destruction may be accomplished by chemicals, or by heat, or better still by fire. It is true in this as it is in the practice of ventilation for the removal of foul odors, that it is much easier to conduct away the stench before a large room is polluted by it, than to change all the air in the apartment itself.

Mr. John Simon, many years ago, suggested that the troublesome question of a separate isolation ward in a hospital would be answered if sufficient separate ventilation outwards could be obtained for the bed of each patient, by bringing it into connection with an outward ventilating shaft. In one hospital at least this has been accomplished by making a direct connection between the interior of the bed and the ventilating system of the building; the apparatus is quite simple, as all practicable systems of ventilation should be, and has at least answered the purpose of removing one disagreeable odor without introducing another.

While indicating a few of the directions in which public health authorities have undertaken to provide relief for existing sanitary defects, or

to obviate the injurious influences inseparable from the growth of population, I am conscious that many things have been omitted which are substantial gains to our power of dealing with disease, both from the side of the physician as individual, and from the point of view of the public health authority. But enough have been enumerated to prove that there can be no separation of interests. The individual will surely not needlessly suffer when the community as a whole is so far protected as mortal hand can protect. But there will be the unending struggle, for all that, in which our profession can bring relief to the suffering, hope to the hopeless, and strength to the weak.

During many years it was the pious and gracious custom for the reader of your annual address to briefly commemorate the services of the members of this Society who had died during the year.

The Massachusetts Medical Society now numbers nearly eighteen hundred members. Thirty-nine who were with us a year ago will meet here no more. It is not possible in the few minutes at my disposal to name each one of them.

They lived active, devoted and unselfish lives ; not many of them were known in the great world, and very few of them had acquired more than a modest competence ; but among them were those who had fairly earned the title of "the good physician" by qualities which are recognized and

honored now as they always have been since the time when their possession deified the Father of Medicine.

Some had been more especially known to us and the public for the attention which they had bestowed upon measures for the improvement of the public health ; but no one of them had hesitated to contribute what he could for the protection of all, well knowing that herein lay the best security for the well-being of each part.

The figures of their ages are the measure of their sacrifices ; length of days is more rarely given to him who practises our profession than to any other of the so-called learned occupations of men. But what reward had they, and what shall be ours ? Let our own poet speak :—

“ In life’s uneven road  
Our willing hands have eased our brothers’ load ;  
Pain was our teacher, speaking to the heart,  
Mother of pity, nurse of pitying art ;  
Our lesson learned, we reached the peaceful shore  
Where the pale sufferer asks our aid no more,—  
These gracious words our welcome, our reward,  
Ye served your brothers ; ye have served your Lord.”