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REPORT

OF THE

BOARD OF HEALTH

OF THE

STATE OF NEW JERSEY,

1877.

REPORT OF THE CORRESPONDING SECRETARY.

By the act establishing a State Board of Health for the State of New Jersey, it was made the duty of the board to make report to the Governor, in the month of December, of its investigations and opinions, with such suggestions as it might deem necessary.

The act further specifies, "That the board shall take cognizance of the interests of health and life among the citizens of this State; they shall make sanitary investigations and inquiries in respect to the people, the causes of disease, and especially of epidemics, and the sources of mortality, and the effects of localities, employments, conditions and circumstances on the public health; and they shall gather such information in respect to these matters as they may deem proper for diffusion among the people; they shall also make inquiries and reports in reference to diseases affecting animals and the methods of prevention."

In this, our initial report, it seems proper that we should first make reference to some of the considerations which have led to the formation of this board.

The recognition of a need that the State should conserve the welfare of the citizen for his health and for its protection, as well as in other regards, is no new theory.

The idea seems so far to commend itself for an axiom, as to make it an inherent part of the protection of life to which the principles of common law entitle us. Indeed, it has almost been assumed that the law of self-preservation was so emphatic that no one needed to be guarded or instructed as to his own health, and that a trespass on the health of others was such a palpable infringement of personal rights as almost to work its own limitation. Although it was soon found that what ought to be by nature is not by practice, yet legislation was chiefly confined to the sudden invasion of epidemics, and to a dealing with the results rather than the causes of disease.

A higher step was taken when the demand was made that

those who attempted the alleviation of disease, should be certified as to their competency by those of tested skill in their own department of service.

The next step early taken in our own State was an attempt at the securing of such statistics as to births, marriages and deaths as would give information as to the actual condition of the population.

These records, however, were chiefly valued in their bearing on legal questions, as to descent, intermarriage, and inheritance, and thus were only made indirectly available as indicating the numerical and social status of the population.

The thought seems scarcely to have occurred how informing they might become as to great social, economic and preservative life problems.

Later on in our history we find some recognition of the claims of inoculation, vaccination and quarantine as bearing upon the limitation or prevention of epidemic diseases.

So long as disabilities and diseases causing impairment of physical power or death were regarded as only accidental, providential, or unavoidable, there was no room for any State action except to mitigate resultant burdens.

But as soon as it came to be recognized that very many of the causes of impairment of vigor, of disease and of death, are within the range and the duty of human control, so soon it became the interest of the State to inquire into the bearing of legislative precaution on such facts. This all the more because it is but too evident that modern civilization and improvements have introduced so much that is artificial in living, so many conveniences fraught with peril, that we must meet these new exigencies by increasing vigilance and increasing knowledge and by skillful methods of compensation.

Thus facts have been brought into view which have caused such governments as those of England, Germany and France to devote large attention to these matters.

Statesmen and legislators, in defence of the public weal, have been led to investigate the great questions of population and the prevention of disease as a part of the functions of the State. Inquiries instituted under governmental sanction and control have given such astounding evidences of their importance to civic and national welfare, as to eventuate in systematic public

health services for most of the European kingdoms. To statesmen, to scientists, and to professional men in various departments, it is well known how increasingly and potentially the study and abatement of causes tending to deteriorate the public health have commended themselves to national and local administrations.

While the method of governmental concern over any great public interest is always a matter for practical advisement, the need of the weighty consideration of these great interests is so far conceded abroad as to be no longer questioned.

The present Prime Minister of England only expresses an admitted but not realized truth when he says: "The health of the people is really the foundation upon which all true happiness and all true power of a State depends. The health of the people is the first duty of the statesman."

Gladstone, in an article on the Nineteenth Century, specifies the becoming more largely acquainted with the laws of health "as one of the subjects within the sphere of authority, and of conviction and action founded thereupon."

Pauperism and crime, as well as insanity and reform, have to be studied in the relations of state sanitation and legislation; for the prison-house, the asylum and the reformatory attest how closely they touch the public interest. Great questions of jurisprudence are very frequently before our courts in their sanitary and medical regards, in order to determine their legal aspects. Abroad, it is customary to rank all questions of mental invalidity and of medical jurisprudence, as well as very many questions of social science, within the domain of Public Hygiene.

In America, not less definite and decisive is the recognition of the necessity of some action. The various studies and bearings of sanitary protection have been pursued with considerable zeal. Our National Government, in the army and navy, in the District of Columbia, by its laws for the marine service, in its careful study of methods and returns, and in various ways, is showing its effort to conserve the welfare of the people in protection from avoidable perils so far as they come within the sphere of its legislation. States, in their sovereign capacity, are not less concerned, and already fourteen of them have State Boards of Health, with powers and entrustments in most cases largely in advance of those of our own.

Many of these have been long enough in existence to show excellent results, and have not only increased in public favor but in legislative consideration. Indeed, it is believed by many that the time has arrived when all our States should have Boards of Health, not with plenary authority, but organized so that our legislators can call for expert opinion upon all questions which in a sanitary way concern the welfare of the citizen. Had such been the case in our own State, we could point to many cases in which losses would have been spared to our treasury from well intended but ill advised expenditures on public buildings, and for charities of various grades.

So far as your board knows, the first general sanitary inquiry in this State, made under legislative direction, was that of 1866.

The Legislature of 1865-6 appointed a State Sanitary Commission, consisting of

J. B. Coleman, Trenton,
R. M. Cooper, Camden,
Thomas Ryerson, Newton,
Isaac A. Nichols, Newark,
Ezra M. Hunt, Metuchen.

It was the duty of the commissioners to furnish to the Governor a report as to "the general sanitary condition of the State and as to the prevention of epidemic and contagious diseases; as to the vaccination of the indigent, the condition of the insane in township and county houses, and all such other facts and particulars with such suggestions and advice as will, in their opinion, conduce to future enlightened action for the promotion of the public health."

A reference to that report will show that the commission was diligent in its inquiries and elicited many facts of importance. Its services were recognized in connection with the cholera of that year, and various points brought to light in that report have had a bearing upon popular opinion and individual conviction since.

From the time of the report made in 1866-7, to 1873 there was no investigating legislation in respect to the public health.

It was believed that greater intelligence and conviction was needed as to the dependency of much of ill health, disease and death on preventable causes. As facts in these regards were being accumulated, both in this and in foreign countries, and as

our needs were becoming more apparent, not only to physicians, but to others whose calling and observations led to inquiry in this direction, it was better to abide the time when an improved public opinion or a better appreciation on the part of our governing authorities should favor further investigation; accordingly, it was not until the winter of 1873-4 that the Legislature passed an act for a commission which was to all intents a Board of Health, but whose services were limited to a single year.

This commission consisted of
James R. Mercier, of Jersey City,
Hon. Samuel Lilly, of Lambertville,
Prof. Geo. H. Cook, of New Brunswick,
William Elmer, of Trenton,
Lewis W. Oakley, of Elizabeth,
Ezra M. Hunt, of Metuchen.

This commission instituted extended and systematic inquiry through various portions of our State. It was furnished with abundant evidence that we are not exempt from most unsanitary conditions which obtain in other States, and that we have the same need of thorough attention to methods for protecting the people from the avoidable causes of disease and death. Indeed some of our rural districts were found to be suffering to an exceptional extent with identified and indisputable sources of sickness, while even some of our larger cities revealed a degree of inattention to civic sanitation which did not admit of defence before those at all familiar with recognized and established principles of hygiene.

The report condensed some of the more important information derived from good authorities in divers localities in our State. These showed how fevers, lung diseases, miasmata, were directly traceable to their causes.

Questions as to water supply and sewerage, as to tenement population, arts and trades, as to schools, as to ventilation and heating, as to protection from adulterated and improper foods, as to the health condition of animals, and as to vital statistics, were carefully discussed in the view of accumulated facts.

The report made by the board became the property of the State, and by its circulation both in pamphlet form and through the press, aided much in the dissemination of health-saving knowledge among the people.

As one of the results, a sanitary convention was held in October, 1875, for the purpose of considering the best means for promoting and preserving the health of the towns and cities of the State, and for consultation as to the means to be adopted to prevent the occurrence or spread of disease.

The association has ever since commanded the attention of many of our most prominent citizens, and has perseveringly revealed how much can be done intelligently and effectually to protect our people from very many of those prevalent causes of disease which are an incubus on capital and labor, not less than upon the individual sufferers.

In the winter of 1876-7, your honorable Legislature saw fit to follow the course of many other States, in the appointment of a State Board of Health, to whom should be committed the duty of inquiry and suggestion as to those matters of public interest, which would naturally fall within the scope of their investigation. The Governor had been among those long recognizing the need of some such Health Board, and having given the law his sanction May 22d, 1877, appointed the following persons together with the Secretary of State, and the Attorney-General, who are members *ex-officio*, to constitute said board:

Ezra R. Osborne, C. E., for one year,

Elias J. Marsh, two years,

Laban Dennis, three years,

Prof. Cyrus Brackett, four years,

James M. Ridge, five years,

Theodore R. Varick, six years,

Ezra M. Hunt, seven years,

Hon. H. C. Kelsey, Secretary of State *ex-officio*,

Hon. John P. Stockton, Attorney General, *ex-officio*.

A copy of the law will be found as an appendix to this report.

The board was first called together by Governor Bedle for organization May 22d, 1877, and His Excellency invited to sit with it at its opening meeting.

Ezra M. Hunt was appointed chairman pro tem., and by invitation of the board, addressed it as follows:

Gentlemen:

As we are about to organize into a State Board of Health it may be opportune for me to say something of the antecedents,

which have led to the action of the Legislature, by which this board has been constituted, and of the occasion there is for some such organization in the State.

While there has always been on the part of enlightened nations some attention to matters involving the health of the citizen, as a rule it was anciently confined to alarming epidemics or to those obtrusive nuisances which forced themselves by manifold odors upon public attention. With the progress of medical science, of engineering, of the various physical sciences and of free school education, some of our lawmakers have come to realize that the laws of cause and effect are as definite in the domain of invalidity as they are in the relations which result in good health and normal endurance. When this is manifested in the actual seizures of disease it finds a direct relation to the art of the medical practitioner. But so soon as it becomes apparent that a large ratio of the inflictions of sickness is preventable, so soon there is a domain outside the business relations of a profession which concerns the citizen and the commonwealth.

The geologist feels it not foreign to his work to inquire what telluric conditions affect the physical condition of those who dwell upon the soil. The meteorologist is quite willing to take into consideration the bearings of heat, moisture and all atmospheric conditions upon animal health and life. The Entomologist, knowing that over fifty diseases are owing to parasites and that germs are shown to be somehow connected with many diseases, quite naturally contributes his quota in the study of insect life.

The chemist readily recognizes the relation of his art to the detection of unfriendly substances in food and air and water. The physicist in all his departments knows that manifold facts under his cognizance need his aid and demonstrations to show their practical bearings upon the conditions of physical existence. The architect and engineer readily see how the structures of habitations above ground or the preparation for them and for the removal of household debris require their aid. The physician, as dealing most directly with the human body, of course in the line of his calling, is brought in direct contact with the conditions and circumstances which favor ill health. But if intelligent as to sanitary matters he rapidly recognizes that here is a field in which the workers and the appliances are not exclu-

sively professional, but are such as to command the attention of those of various occupations and are deserving of the study of society at large. We thus meet on common ground, each desiring to bring all that his individual domain may afford. Although thus employing many factors, sanitary science is itself a distinct department. As such, in the University of Edinburg, for instance, it has its place for a degree in science, not as a department of one of the liberal professions but alongside of (a) physical and natural science; (b) engineering; (c) mental philosophy; (d) philology.

In this and many other ways has the science of public health come to be authenticated. Every science has its art. The art of this science is the art of preserving health. It is not difficult at once to see that if there is such an art with a science behind it, it has great bearings upon political economy and is a weighty legislative concern.

There is no need of argument to show that sickness is one of the greatest of all burdens upon national prosperity. That which is the most prevalent discomfort of households and individuals, if preventable, cannot escape the care of the statesman. Indeed the welfare of the State is largely dependent upon the health of its inhabitants. It is not only a comfortable but a material interest. It makes a wide difference to us politically whether the death rate is 16 per thousand as in Massachusetts or 40 per thousand as in some of our cities.

It is a matter of civic import if, under a lax law there are, during a period of fifty years, 35 out of every 1,000 deaths by small pox, while in another country equally exposed, by reason of more stringent preventive acts, there are only 7 to a thousand. 388,340 deaths by scarlet fever in twenty years in England, is an item for political economy to consider, if a large per centage of these is avoidable.

Every death, too, represents very many other cases of sickness and suspended labor, and causes expenditure of labor by others, a large portion of which is not of a profitable kind. Epidemics sometimes make themselves so felt, that besides the home mournings the city is appalled at its business depletion. But more potent than these are the silent forces of lung, bowel and brain affections, which, like the small musketry of batta-

lions, disturb, decimate and despond society more than the occasional cannonade.

Dr. Farr has made a calculation, based on a decade or more of accurate statistics in a district of England, to show the value of healthy men and women and of an average life in a commercial aspect, and so has reckoned the enormous deficit made by preventable sickness.

Apparent as are such facts, so long as methods of prevention were unrecognized or the dependency of disease upon ascertainable and abatable forces only mildly affirmed, the time had not come for the exercise of any general system of limitation or repression on the part of governments. When the plague, or cholera, or yellow fever came, the only activity of government could be in limiting its results by caring for its victims and in aiding the flight of those who could escape. The observation that some such diseases arrived like foreigners led to quarantines, but even these were often so defective as to make a nidus for pest.

But amid the modern studies of disease which have been aided by physical science and directed by new methods of classified observation, series of facts have been elicited, which show that man is an animal with laws of development and preservation as definite as those which obtain in any other sphere of nature. While there are limitations to existence within certain defined limits, there are laws of preservation, of protection, and of deliverance from many maladies. These are not casual but precise. Nay, more, the contagions themselves admit of limitation, and the duration and validity of a life is, by the ordering of a kind Providence, very directly in the keeping of the individual and of society as organized in the State.

I need only very briefly to allude to a few of these by way of illustration:

Small pox, once the scourge of nations, and still, by reason of manifold neglects, resident in every State, is so preventable that under a stringent law Ireland had in one year but three deaths therefrom.

Typhoid fever is so directly the result of a specific poison, that we have come to know very many of the conditions of its incubation, and proper surface and underground sanitation will largely abate it.

The various bowel diseases which, especially in our own country, destroys so many thousands of infant population, have very ascertainable relations to bad dwellings, bad water, bad drainage and interference with proper temperature and ventilation.

A large class of seizures, such as diphtheria, scarlet fever, measles, etc., are recognized as dependent for their virulency upon avoidable local conditions, which can be largely remedied.

Miasmatic diseases, which in this and other States are a great tax upon labor, have much to do with undrained lands and injudicious exposures, and so have many causes within the reach of hygiene.

Consumption and other lung affections have in late years been shown to have much to do with soil moisture and with atmospheric conditions, which can be guarded against easier than the actual disease can be cured.

Besides all these, there are constitutional and hereditary diseases the means of limiting or eradicating which are within the reach of preventive art, so that malformation, insanity, etc., come within the perview of interruption.

We refer to these as but a few examples of the large area to which sanitation relates.

Even independent of these, one department of health and life has long been recognized as worthy of registry by the State. As the design of a census is not merely to flatter a pride of progress, but to acquaint a people with the condition, employments and extent of its population, to inform as to military or defensive ability, and to indicate the direction and conditions of development, it was rightly considered that births, marriages and deaths are important items in such information. Accordingly statistics have been secured in their merely numerical bearings.

But the study of all census returns has made rapid advance in the last few years. Prof. Francis A. Walker, as Superintendent of the ninth United States Census, gave special prominence to the importance of such returns, and in common with similar officers in other countries, has shown that in more senses than one they are vital statistics. In cities their value is now so practical that they are used as the direct indications for holding in check the evil communication of preventable epidemics, while

the facts obtained over large areas of territory are being studied with satisfactory results by registering statisticians.

All these and many like facts make it apparent that the time has come when definite methods can be put in operation for guarding and conserving those interests which touch the citizen in that which is his most vital and inalienable right—protection from the avoidable causes of disease or death.

Moved by such considerations, England has now its Government Board, which extends its sanitary supervision to the whole kingdom. The statistics of the Registrar General are often so definite as to enable the government to put out signals of disease as veritable as those relating to approaching storms. It used to be thought by some that the country at large did not need any legislation in this direction, as diseases found their chief carnival in crowded populations. But the country has its special local impairments as definite as those of the city. The imperfect drainage, the damp cellars and contaminated wells of the one quite parallel the sewers, basements and befouled waters of the other. The study of the causes of disease can often be more technically made in sparse populations than amid crowded localities. So true is this that Sir Wm. Jenner, of London, in a recent discussion of the views of Murchison, as to the origin of typhoid fever, has said (1875) the only way of settling the question is "to thoroughly scrutinize every isolated case that occurs in out of the way country places."

In fact the diseases of the city often arise from the country, and vice versa. The severe outbreak of typhoid fever in Leeds, 1873; that at Marylebone, London, and the one in Glasgow, arrived from dairy farms several miles in the country, and water and other contaminations do not always occur at the place of outflow and delivery. Again, it is only by studies over large areas that we can estimate coincidences and account for differences and so arrive at the laws of disease-productivity. Facts in one locality or in one class of population are often misleading, while comparisons and contrasts are most informing. Indeed, among sanitarians, the question of the necessity of territorial observation is no longer discussed.

Satisfactory observations in these regards can not be accomplished without the aid of law. The spontaneity of the individual does not lead him to guard against the ascertained sources

of ill health. Even if circumspect and informed himself, he can not apply the facts to the case of his neighbor. Yet in no other line is the mistake or carelessness of the neighbor so apt to tell upon the adjacent household. Many of the evils are of that nature that they attach to no one vicinage, but are such as relate to an entire street or water course, or section, or to some great highway of conveyance, and must have legal regulation. Much, too, of the value of law in these regards is that it is informatory and educational, far more than it needs to be compulsory. The reports of the English Health Board for the last twenty years have by the diffusion of intelligence done far more for the benefit of public health than have any penal enforcements to which they have given rise.

Large and telling facts have been elucidated, and the press has been engaged until sanitary papers are as common in the London Times as the reports of educational or literary associations. One is even surprised at the intelligent lay discussions found in numerous journals as to local and general health interests. The necessity of law thus comes to be recognized so that what otherwise might be regarded as a trespass upon private rights is welcomed as an offshoot of that olive branch of protection which extends peace from pain and deliverance from death, and so gives to the citizen ease instead of disease.

Law, to say the least, is bland and beneficent and conservative when, in such a noble work, it is no more aggressive than that under which this board is organized. It has asked no attribution of power and seeks no jurisdiction such as that which often needs to be conferred on local boards. Its sphere is to collect and present each year the best ascertained evidence there is as to preventable causes of disease, as to the effects of localities, employment, conditions and circumstances on the public health, and to diffuse it in such practical form among the people as shall add to popular information in these regards.

It will be necessary for us to inform ourselves as to any local causes of disease or as to the course and circumstances attending any epidemics that may invade our State, and by correspondence and observation to seek to assure ourselves of the connection of any existing or abatable evils with such sickness or mortality as may occur. In this we will, no doubt, at times need to invoke the aid of local authorities, and especially the aid of those

who, as medical practitioners, are most observent of the state of public health.

Our experience has been that some of our most reliable physicians, as well as various laymen, such as teachers, druggists, chemists, engineers, et cetera, are responsive to such requests. We think we shall not fail in the securement of a valuable amount of reliable facts and careful opinions.

It will also be well for us to look carefully at all existing laws bearing on public health and after all those defects in legislation which might be supplied without infringement on any individual rights and to the advantage of all. As such suggestions would come before the legislative and executive branches of our State, they would have only that force of advocacy to which clear facts and open arguments might entitle them, and are in no danger of being prematurely enforced.

It will naturally be our aim to seek the aid and co-operation of all local boards, not so much expecting to enlighten them as that they, in the common interests of sanitary knowledge, shall acquaint us with all local facts bearing on health interests, and so enable us, by the collection and presentation of the records of various localities, to render available to our citizens at large the information which cannot be equally serviceable in any other way. A misapprehension of the design of such boards led to a clause in this bill which was intended to restrain its jurisdiction over cities or local boards of health. It is already understood by most of the city boards that no jurisdiction is aimed at or provided, and that, in order to an intelligent presentation of the interests of the other districts, a knowledge of local and aggregated population is needed. We doubt not, with the urbanity of citizens and the devotion of local sanitarians, they will unite with us in conserving interests so far removed from partisanship and so vital to the people of the State at large. It is chiefly by the co-operation of local authorities and of those whose professions and fields of observation direct their attention to health matters, that we are to hope to render most effective co-operation for the physical welfare of the people.

Very many subjects will readily suggest themselves to the members of our board, and it will require much thought so to outline and conduct our work, both of investigation and of imparting information, as to lead the people and our rulers to in-

telligent conviction of what is needed, and to such action as shall be spontaneous and acceptable.

For several years many of our most thoughtful citizens have realized that there was call for a more extended presentation of the interests of public health. Our relations as the great highway to, and as the suburbs of, large cities makes us especially exposed to epidemics, without the protection which great cities are apt to provide. Nuisances expelled outside of city limits are sometimes thrust upon us, which have, in many cases, led to serious results. Our able State Geologist and others have set forth the evils caused by drowned lands, and the advantages to be had in some parts by improved water supply. Statistical defects have been to some degree recognized, and cities like Newark and Paterson have perfected methods of their own.

Our board commences its labors at a most opportune time. In our own country and abroad for the last two years there has been an unusual awakening to the interests of public hygiene, and to the necessity of the fostering care of the State therefor.

There is a large accumulation of facts and of principles to govern us in our work, and a literature rich in illustration and evidence of the practicability of sanitary administration.

I may thus, while declining to be other than your temporary chairman, be permitted to express the congratulations of each one to the other that it is our privilege to labor together in a field in which there is more of usefulness than of reward and more of labor than of honor.

The best acknowledgment we can make to the honorable Legislature which has passed this law, and to his Excellency the Governor, who has honored us by associating us in this work with members of his staff, is to faithfully detect and expose the evils which burden the public health, and impart such information as shall guard against avoidable invalidity. So in our sphere, by contributing to the welfare of our fellow citizens, we may seek to honor God in serving mankind. With these remarks, I beg to announce that the board is organized sufficiently to proceed to business.

The board was then permanently organized by the appointment of Elias J. Marsh, M. D., as President; Ezra M. Hunt, M.

D., as Corresponding Secretary, and E. A. Osborne, C. E., as Recording Clerk.

The board proceeded to a consideration of those subjects which most urgently seemed to call for their attention.

As only about six months would elapse before the first report is required to be rendered, it was thought best to study and outline the work to be done, rather than enter at once upon an extended series of investigations.

The following subjects were chosen and committees appointed to make thereupon preliminary reports:

On registry of Births, Marriages and Deaths—Messrs. Kelsey, Marsh and Bodine.

On the duty the State owes to children as to their protection from impairment of health in the Home, at the School and in the Workshop—Messrs. Hunt, Dennis and Brackett.

A brief summary of directions to families as to the more common domiciliary influences and surroundings productive of disease, and the means of detecting, neutralizing or preventing the same—Messrs. Ridge, Osborne, Taylor and Marcy.

A brief statement of endemics or epidemics that have occurred since 1870 in the State, and their causes, so far as ascertained—Messrs. Varick, Culver and Gauntt.

A brief paper of information which shall point out such localities in the State, as from their topographical and geological position and condition, stand in special need of sanitary improvement—Prof. George H. Cook.

A statement of the climatology at various points in our State for five years past, and of diseases apparently dependent thereupon—Messrs. Brackett, Osborne and Dennis.

The diseases of animals, although not placed in charge of a committee, were directed to be inquired into by various members, and the Corresponding Secretary directed to collect information as to any epidemics that had occurred within the last five years, as preparative to further investigations.

The secretary was also directed to secure a codification of all laws bearing upon or relating to State hygiene, which are to be found on our statute book, and to furnish a list of the same to facilitate reference. The papers which have been prepared by these several committees, will be found to be a valuable part of this report.

Many other matters of sanitary interest have come before the board at its various meetings, but it is not thought necessary to report to your excellency, details, except so far as they relate to the present outlining or execution of work.

VITAL STATISTICS

The first subject to which your attention is invited is that presented in the paper on vital statistics.

It has not been considered by the committee necessary to reason in detail the necessity which exists for a careful registry and return of the births, marriages and deaths in every State and city. Our State was among the first to settle that question by a definite effort in that direction. The improvements made in the methods of studying and tabulating such records, the greater knowledge of the course and causes of disease, the results attained from the systems already adopted in many countries, the necessities of such tables for the study of the laws of population and of life insurance, and the ability which has been shown to limit epidemics, to prolong life, to prevent outbreaks of contagions, and even to abate crime, by the study of these vital tables, has undeniably attested their indispensable importance. As they indicate the rise and ebb of population, the laws which govern it, and the best legislative methods of conserving the interests of the citizen, these results are sought by the political economist, not less than by those who seek to know the science and the art of preserving life. All arguments which obtain for the procurement of any census returns, apply with more force to these than to any other, because they embody more of the objects of a census than any other class of statistics. Our error as a State has not been in entire neglect, but in a failure to change and improve the law, and to bring it in accord with more modern and perfected systems of return. Our present law is not only that of 30 years ago, but even that is mostly a copy of the original law of the eighteenth century. Since then such has been the increase of knowledge as to the interest and significance of statistics, that present methods have become impracticable and misleading.

The chairman of the committee herewith presents his report and advisement as to desirable changes. The New Jersey State

Sanitary Association has also had two papers before it, in which the subject has been well examined, and other facts adduced to which reference may be had. The State Board of Health is carefully considering the whole subject, and will necessarily recommend some change in the present inoperative law.

The report on the duty which the States owes to children in families, schools and workshops, will this year deal only with the home and the school, reserving the relations of the State to children in factories for another year. This report recognizes the child as, to no small degree, the ward of the State; since from five to eighteen years, he is taken under the charge of the State for education. It is all important as a great public and social interest, that we should avail ourselves of such information as to methods and surroundings as will fully carry out the object of free school training. This report seeks to present some of the various evils to which the child is exposed, in order that the attention of parents and citizens may be directed thereto for their abatement. Some of the more important means by which improvements are to be effected are stated. Also some of the readier tests are given by which unsanitary conditions of air, water, heat, etc., may be detected. The whole subject is one of such vital interest to the growing population of the State, that it will commend itself to your careful thought and inquiry.

The report as to the "More common domiciliary influences and surroundings productive of disease," does not attempt to consider all household conditions hazardous to health, but in this, the first report, fastens attention on the evils of defective ventilation and impure water supply, as introductory to a fuller consideration of methods of improvement and of other sources of ill-health which are very apt to occur in household administration, and especially in the close vicinage of cities. It deals with subjects of practical interest to all that dwell in ceiled houses, and thus addresses itself to the consideration of every citizen.

The report on endemic and epidemic diseases in this State since May, 1869, is a summary of all the best information that can be obtained upon the subject. In the absence of any State Board of Health, or of any reliable system of vital statistics, the only dependence has necessarily been upon the reports of medical societies. These are of great value so far as they go, but a

in all purely medical reports more attention is given to the detail of symptoms, to the ways in which separate organs are affected, and to the methods of treatment, than to causes and the methods of prevention. It was, however, thought best by the board to collect all information possible as to endemics and epidemics for the last septennary period. This is introductory to that more strictly sanitary study of causes, of surroundings, of the laws of infection and contagion, which is so important in order to ascertain the most feasible methods of prevention or limitation. The details here given have, therefore, interest for future comparisons, and as points of departure for systematic sanitary analysis. It will be found in the report that soil moisture or imperfect drainage is well recognized as causing fevers and other diseases of an intermittent or miasmatic type. The malignant malarial fever localized in a certain suburb of Trenton in 1871, is instructive as showing how a miasmatic influence may be so intensified as to produce a type of the fever almost as pernicious as the yellow fever of the tropics.

The decline of intermittent and remittent fevers in Camden and its vicinity, as the result of effectual drainage, has been so marked as to corroborate manifold experiences of the same kind in other States.

The report discusses the sanitary effect of salt marshes, and the subject is one needing further inquiry. It will be seen that this report does not deal with developmental diseases, or those dependent on imperfect nutrition, but chiefly with zymotic diseases. These usually depend upon outside contagions rendered active by unhealthy surroundings, and by the susceptibility of the persons affected, both of which we believe can be greatly modified. It will be noticed that the chief endemics or communicable diseases confined to some one locality have been typhus fever in 1870 in Jersey City, and one each of cerebro-spinal meningitis, puerperal fever and erysipelas. Typhoid fever while endemic mostly, has at times almost seemed an epidemic.

Epidemics of measles, mumps, whooping cough and influenza have from time to time occurred. But the three prominent pestilences in the State for the period since 1870 have been diphtheria, small-pox and scarlet fever. Diphtheria has been epidemic in at least twelve counties of the State in a single year (1876), and has at other times prevailed more or less in various

localities. It is as much under the control of preventive and sanitary as it is of purely medicinal treatment.

Small-pox, in the same period, has numbered as many as one thousand cases in a single year in one city. Most of our larger cities on lines of public travel have had it prevalent or epidemic at various times. In Camden it preceded the fearful scourge of Philadelphia in 1872. A mortality of 37 per cent. among those not vaccinated is stated. It is a disease often met with in country localities, as well as in larger cities. A distinguished writer, who is not a theologian, has said that the perversity of mankind in neglecting vaccination, which is so sure a protection against fatal attack, is the most available argument in proof of original sin. Now that vaccination directly from the calf can always be secured, the old excuse of the possibility of catching skin diseases from other people's children, which has been greatly magnified, has to be laid aside. Our State is so much a highway of travel that it is greatly important that all proper means be used to secure the vaccination of adults when the epidemic prevails. The contrast between such cities as Providence on the one hand, and Philadelphia on the other, shows what a difference in the prevalence of the disease can be made by an efficient system of vaccination. It seems to us, it is one of the rights of the citizen to be protected from such exposure. When, as in our State, the child has the gratuity of the free school, it is scarcely a question but that his vaccination should have been attended to before he is placed in a position by which he may unnecessarily become the conveyer of a disease which jeopardizes the rights of all the rest of the school.

Scarlet fever, which is so often epidemic in different parts of the State, is greatly influenced as to its spread and malignity by hygienic conditions, and is, therefore, very much under the control of sanitary jurisdiction.

In reference to this and all other diseases known as zymotic, the bearings of the pollution of air, of water and of habitations and of personal cleanliness thereupon is so definite that our highest authorities agree in calling them filth diseases; not that they may not occur amid good sanitary conditions, but if so, it is because they have been warmed and nurtured into virulence amid favoring circumstances. Even where these diseases occur, we greatly modify them by well applied hygiene. It is

maintained, too, by some of us that in the case of persons exposed to these contagions, much is to be done by their preventive treatment in advance of the time for the manifestation of any symptoms.

The paper on miasmatic diseases in Hudson county clearly presents the atmospheric and telluric influences in the county, which seem to favor the prevalence of intermittent and remittent fevers and to give to other diseases a miasmatic type. While all of us may not attribute the result so entirely to the extreme moisture, yet this is no doubt one of the factors in the causation of miasmatic disease. The views presented will aid in the study of that large class of disease which has its origin outside of the body, and which therefore is to be searched for with eagerness, either that it may be abated or that exposure thereto may be avoided.

The board also requested from Prof. Geo. H. Cook, the State Geologist, a brief statement as to any extended localities in which geological structure or surface conformation gives rise to imperfect drainage, or to any other circumstances which might jeopardize the health of the individual.

The study of the earth's surface, both as to its topography and its geological structure, is telling us much as to the conditions which favor heat or cold, moisture or dryness or sudden changes that may take place both in telluric and atmospheric conditions. Great water basins dependent upon impervious rock below the surface, while the crust of covering soil seems high and dry, sometimes account for intermittents in localities apparently free from miasmatic causes. Minerals in the water or the soil and the character of vegetation have much to do with normal or abnormal decomposition and decay. Water supply for drinking purposes is greatly involved in questions as to clayey, gravelly or humus soil. So, very many other questions as to health, require a knowledge of the earth's structure. The study in this State is all the more inviting because faithful and able service has so well defined its geological structure, and because the great geologic formations are so distinct. Perhaps in no State of our Union is there such encouragement to the study of population as affected by location. The triassic or red sandstone formation occupies nearly the whole of 9 or 10 counties. The cretaceous formation, including the green sand marl beds,

has its long and narrow belt adjoining, giving character to consecutive parts of eight counties more. The tertiary or more recent formations of Southern New Jersey cover six counties and parts of four others. Thus, in all but a small portion of the State, geologic structure can be studied in its bearings on air and water, moisture, disease, et cetera, without the complications which occur from frequent overlappings and intersections. The azoic and paleozoic or primitive formations, including the iron ore and limestone districts, in the northwest portion of the State, intermingle, but the other three formations already noted "are so entirely distinct from one another that they can easily be drawn in separate maps." Our geology, our locality, our minglings of city and country, our distinct sea and mountain districts and all as related to disease and climatology, so invite attention and investigation, that an eminent American sanitarian recently said to us that he considered New Jersey as the best locality in our Union in which to study those sanitary problems which most concern the civic welfare of the American people.

This year as preliminary we have only asked such indication of localities especially needing attention as have been brought to notice in the course of former surveys. We commend this paper to the notice of all interested in questions of drainage and public health, as indicating an important State interest.

Akin to this will be found a report upon the climatology of a part of the State for the last five years, as will be needed for reference when we come to secure future records, and to associate them with reliable statistics as to the progress of disease, and the ratio it holds to heat, moisture and to telluric and atmospheric conditions.

In this report it was not found feasible to make such comparisons, as so few even of our cities have attempted mortuary tables, and as other essential factors are absent, so that the data are insufficient in details and in extent of observation.

It had been the intention of the board to have furnished a careful statement of the diseases of animals for the last five years in this State, in order to show those to which experience had indicated us as most exposed, and for the purpose of pointing out methods of isolation, precaution or prevention. As there have been only sporadic cases of such diseases, as no one seems to have tabulated with accuracy the number of cases, and as the exact

diagnosis of the disease is seldom verified by skilled veterinarians, it was found that such information would have in it little if any practical instruction. It is our hope to secure, from the very few educated veterinarians and from the leading stock proprietors in our State, such facts as shall hereafter enable us to give intelligent notice of this branch of health interest. It is well for our citizens to know that the diseases of animals and their modes of prevention are being carefully studied in all European countries and in our own, as a part of sanitary science, and that veterinary practice is securing to itself exactness of diagnosis and of treatment quite in keeping with the progress of medical knowledge. Animals in our own country suffer greatly from a kind of promiscuous prescribing, little better than guess work, and diseases are spread or fostered which might easily be limited. It is important that the people generally should recognize the health of animals as essential to the productive energies of the State, and to the food material of its inhabitants, and also that many of the laws as to food, ventilation, isolation from contagion, and cleanliness are applicable to them as well as to the higher animal, for whose comfort and sustenance they are provided.

CORRESPONDENCE OF THE BOARD.

The board has initiated correspondence with boards of other States, and is availing itself of the best information it can obtain, as to the more pressing and vital interests of sanitary improvement. It has also been invited to some foreign correspondence, and has answered inquiries presented to it from abroad in reference to the great interests of public sanitation.

In our own State the board, by a circular issued in June last, placed itself in correspondence with persons in various parts of the State, who were believed to be best informed as to local impairments and needs, relating to health. A special circular was also addressed to city boards, so that we might obtain from them such information as would aid in our general work. It appeared that some of our cities had no organized boards of health, and in others they were acknowledged to be inoperative by reason of lack of interest, of information or of defined authority. From most of the cities which have boards of health, we received

kind and co-operative response. The board has not yet entered upon a plan of systematic and tabulated inquiry as to diseases and their causes, as the work preparatory to this is more important just now, and needs to be well conceived in order, in due season, to be well executed.

The labors of the commission of 1874 and the two reports of the New Jersey Sanitary Association accessible to us, together with some reports and other documents of State and county medical societies have enabled us to form such estimate of the work to be accomplished as to make it unnecessary to repeat such preliminary work until local boards are more fully organized, or sources of error which now jeopardize responses to inquiries and inaccuracies which admit of remedy are more carefully guarded.

Soon after the first meeting of our board we were addressed in reference to a nuisance, which had arisen in one of the villages of the State from the accumulation of large quantities of milk in vats. A factory for the condensing of milk had been established, and after running for some time and accumulating a large amount of unused material, the business failed. About 5,000 gallons of milk were left on hand at a season of the year in which it soon underwent fermentive and putrefactive change. The proprietors secured a number of hogs in order to dispose of the material. This, while gradually diminishing the quantity, did not abate the nuisance. The stirring and mixing of the mass, in order for its disposal, really increased the evil. The corresponding secretary, after apprising himself as to the facts, presented the merits of the case to the chief proprietor, who seemed not to have realized the unsanitary character of the nuisance. Although this did not lead to as speedy relief as could be desired, it hastened the efforts to remove the offense. By appointment of the board, a committee then visited the place and gathered from the nearest physician and others such facts as were relevant. The evidence afforded to the committee, not only of the reality of the nuisance as afflictive to the senses, but also as detrimental to health, was convincing. One lady had suffered a serious illness which had necessitated her removal, and which was certified by an intelligent physician as caused by the spoiled milk and the pens. Others in the neighborhood had suffered from consequent diarrhœa and from that feeling of dis-

comfort which often occurs from impure air charged with organic matters, even when there is no pestilential outbreak. We think the citizens of that town are to be congratulated that serious consequences were so limited. Said one of the proprietors to us, "I never could have believed that milk curd could smell worse than carrion." This filthy mass, decomposing under a summer sun and filled with maggots of various proportions, found its way into hogs, which were killed in September and sold for pork of doubtful salubrity. The proprietors had no evil intent, but by a want of apprehension of the risks to health, and from anxiety to save further monetary loss, they jeopardized the interests of others. It was an illustration of that class of cases liable to occur anywhere, in which some local authority should have power to adjudge a nuisance and to cause its abatement, if so immediately prejudicial to public health as to require summary attention. Such a case as this cannot be met by the usual grand jury presentation, as there is no sitting during the summer solstice, when such exposures and when epidemics are most likely to occur. Authority for the summary abatement of threatening sources of disease in cases of actual and present peril admits of safeguards, and is not more likely to invade personal rights than any other kind of authority conferred in the interests of the common rights of society. It is often the misfortune of defective sanitary legislation that even epidemics are permitted to get headway, when a right exercise of conferred authority at the right time would have limited the contagion. The last outbreak of yellow fever at Memphis was a signal instance. In our own State we once saw a thickly populated village subjected to cholera contagion, and the township authorities appealed to in vain, not because of want of interest, but of want of jurisdiction. We have reason to believe in that case a serious outbreak was only prevented by the courage of a physician who, in his own name, took possession of soiled garments and beds and burned them.

It has generally been the misfortune of liberal governments that they leave legislation to deal with accumulated and direful results, rather than with the abatement of causes. Thus the severity of the law which afflicts or punishes, supersedes the blandness of the law which prevents. This milk nuisance to which we have alluded, occurring in a retired and unexposed village, is an illustration of how easily or how undesignedly an

evil may spring up in localities least anticipated, which can be met by proper and well defined statutory limitations, and also of how much need there is of the diffusion of such intelligence as will lead to the entire prevention or speedy abatement of such nuisances.

WATER SUPPLY.

The Board of Health has been appealed to in the case of the interruption of a water course in Warren county, by which, it is alleged, the water of a town is deteriorated and sickness results. We have not as yet been able fully to investigate the facts, but have placed them in the hands of a competent engineer for inquiry. If it is found that there is real peril to health, we shall hope to be able to persuade those concerned to furnish such means of restoration as may be indicated.

The whole subject of the water courses of our State, both as relates to their availability for the furnishing of pure water, or as open sewers or carriers of the pollution of cities, is one well worthy of the careful attention of our citizens. Our cities and our densest population is distributed along water courses, under modifications arising from the proximity of New York and Philadelphia. Tide water and great tracts of salt marshes in the north, and the sand deposits of the south, introduce other correlative factors. The questions of water supply and sewage and river contaminations must be studied in view of the great present and prospective massing of populations on the red sandstone and cretaceous tract and adjacent to great alluvial deposits. Some of these problems, as is well known along the course of the Passaic, have become complicated already. Others can be much more readily and economically solved by being comprehended now, before greater obstructions and increasing disabilities embarrass the solution. It is our hope in another year to discuss more fully the whole subject of water supply, both as it relates to cities and to country districts. We thus allude to it here because we would have our citizens on the alert beforehand in inquiry as to the vital range and critical significance of its wise consideration.

ODOR FACTORIES.

Our attention has also been drawn to the proximity of offensive factories, slaughter houses and dumpings, and collections of filth to which a portion of our State, by its position, is much exposed. At one point from 12,000 to 18,000 hogs are often killed weekly, and besides large quantities of offal are brought from another point to this, for rendering. Factories for dealing with refuse material send abroad their noxious ordors over the wide plains between the Passaic river and Jersey City, and it cannot be denied that the air in summer, and sometimes in winter, is so charged with organic matters as to render it intensely offensive. The refuse of cities is in some cases so gathered upon the outskirts, as to cause present nuisance, which will be rendered permanent and scarcely less hazardous when it comes to furnish the building ground for future dwelling houses.

On some accounts it is not necessary to discuss the question whether bad odors are necessarily harmful. In other countries, law has already decided that smells which inflict discomfort upon society at large, and odorless smoke when poured in such volumes into direct contact with populations as to be afflictive, if it can be remedied, must be on the general principle that whatever unnecessarily and intrusively interferes with the public comfort of large masses, may become a subject for legal enactment. Gladstone has specified poor water, foul air and smoke, as the three prominent nuisances of cities.

It would seem, as thousands are necessarily brought each day within the tainted and offensive air of many of these establishments, that at least the greatest effort should be made to prevent these sickening smells. An eloquent lawyer of our own State recently, in glowing language, described to us the personal infliction to him and to very many whose complaints he had heard, and his sense of mortification that the multitudes passing to and fro through our State, should be subjected to such annoyance. A prominent railroad official who has for long years studied the effect of scenery, of bridges and tunnels, of foul air, and of various conditions and circumstances of travel on the choice of routes, and the comfort and satisfaction of passengers, avers that these matters much concern the inclination of people to tarry in a State, as well as the interest of a company as carriers. In these

instances, the usual argument that those who object should not move to the vicinity, cannot apply, for the roads were in possession before the nuisances, and, besides, the fair presumption is that land near cities must be occupied for human habitations as well.

But the chief point for us is to know how far these bad odors are injurious to health, and so to seek their abatement if indicated on this ground.

While it may not be possible to analyze each individual stench, or to assert that each and every unpleasant odor is harmful to health, yet the general fact remains undisputed that all gases of decay are contaminations of pure air and were not intended for breathing purposes. They give rise to general malaise or to deterioration of vital force. Depression of vigor occurs to some, others have only disbursing mental impressions, which make reasonable discomfort, while the weaker or more susceptible suffer from direct disorder of vital functions. It is not necessary to show that many are permanently injured, but if some have vital impairment for a time, if to others they are the exciting cause of sickness, and if occasionally they prove the fertile hatching-place of endemic or epidemic diseases, such occupations should have brought to bear upon them all the safeguards which science and art have devised. The sudden outbreak and excessive mortality of cholera in 1866, at one of our poudrette factories, was only an illustration of what sanitary observers well know, viz: that filth, although not always the originator of disease, and not always explicable as to the laws of its fertilizing agency, is, nevertheless, as great a promoter of existing disease as are certain artificial manures when applied to various crops, the seeds of which they have no power to originate; nevertheless, they impart rankness, and in some cases seem so to introduce new orders and species, as to imitate or initiate what is equivalent to original production. Facts, too, as to the courses of disease in localities which have been built on organic ground material, now prove to us that such material is unfit for the location of house structures for many years.

We do not claim that factories, or other smell or smoke nuisances, should be prohibited, or that they should be suspended from work by any too summary legislation. But we do claim that public opinion should be respected in condemnation

of these unmistakable nuisances, that their proprietors and others should come to appreciate that they are hazardous to the rights of health by reason of their gases of decay, and that the most scrupulous efforts should be made to prevent offense or danger.

The member of our board who visited the slaughter houses on the Hackensack was in every way treated with courtesy and a desire shown to secure cleanliness and to prevent foul odors. But there was not evidence that the best methods were in use for dealing with decompositions or for deodorizing the immense volumes of smoke which pour their decay-laden gases into the nostrils of so many persons who cannot recognize that thus the breath of life is inbreathed.

The great mistake generally is that effort is made to burn up and to carry off by fire and smoke some gases of decay which are not inflammable and which must be passed through water or submitted to some process of chemical absorption. This often adds to the expense, but not to a forbidding extent. Whether from a want of knowledge or from an unwillingness to incur expense, we do know that all these offensive establishments should be compelled to adopt such measures as shall abate these nuisances. The various experiences as to gas and factory and smoke nuisances, which have occurred from sanitary legislation abroad, and abundant instances afforded by the State and city reports of our own country, furnish abundant and guiding facts and literature upon this subject. On the basis of these we can now only affirm that these odors can either be entirely removed or very largely mitigated, if only it is required that the best devices for their prevention be in use. The presence of some of them in our midst is to be accounted for by the following extract from the report of the Board of Health of New York City: "In addition to the various kinds of business connected with the slaughtering of animals which, if carelessly or improperly conducted, are liable to be complained of, the attention of the board has been called to other manufacturing pursuits located in the crowded parts of the city as being detrimental to the public health. Among these may be mentioned, all factories emitting large quantities of smoke, which enters the neighboring tenements and is injurious to the weak and invalid, if not to those in health, and which deprives the inmates of fresh air and

compels them to keep their doors and windows constantly closed. As it is a fact well established in older cities that this nuisance can be abated at small expense, the board has adopted an ordinance that, from and after the first of June, 1870, every furnace employed in the working of engines by steam, or in any mill, factory, printing house, dye factory, gas house, etc., * * shall be so constructed as to consume or burn smoke arising therefrom, unless a permit to the contrary be obtained from this department." The deodorization of non-combustible gases deleterious to health admits generally of successful accomplishment. In both cases much depends, not only on the scientific methods and apparatus used, but upon the intelligent oversight of skilled and faithful workmen.

FOOT TRAVEL ON RAILROADS.

The evils arising from the use of our railroads as foot paths, has invited our attention. At the instance of a member of our board, our most prominent railroad company has kept for the last two years a record of all accidents happening on their lines. What was recognized by experience is now demonstrated by numbers. Very many of the accidents by which lives are sacrificed arise from the use of the railroad track by tramps in their wanderings from place to place, or by others for convenience in passing to different streets. Life is thus jeopardized, the unpleasantness of mangling accidents is forced upon the public eye, and sometimes other liabilities of accident are involved to passengers. We believe that it should be made a punishable offence to walk thus on railroad tracks, or at least in the case of those roads running more than a specified number of trains each day.

CLIMATOLOGY.

The board is about instituting a uniform system of meteorological observations, in order the more closely to study the bearings of climate upon health. At present the most valuable records are those of the Hon. Wm. A. Whitehead, of Newark, and he has kindly furnished to the board valuable statistics for the last five years, which are herewith presented.

To facilitate easy reference to former health legislation, a brief

codification of laws not repealed will be found at the close of this report.

Other subjects have come up for discussion before the board, to which in this initial report it is not necessary to allude. No one who surveys the range of sanitary science and its appliances but that recognizes the breadth of the field to be studied, and the variety of objects with which it teems.

It is gratifying to know that already many of our most intelligent and progressive citizens are alive to the imminent interests which are involved in these great health questions, and of their bearing on questions of social progress. Beside the labors and writings of members of the State Board, we may be said to have a valuable and increasing literature upon these subjects. There are papers and addresses by Prof. Geo. H. Cook, of New Brunswick; Prof. N. R. Leeds, of Hoboken; Prof. H. R. Cornwall, of Princeton; Superintendent Piérce, of New Brunswick; Dr. J. W. Pinkham, of Montclair; Dr. J. L. Bodine, of Trenton; Dr. H. A. Hopper, of Hackensack; Ashbel Welch, of Lambertville; L. B. Ward, of Jersey City; Col. R. S. Swords, of Newark; Rev. F. R. Brace, of Blackwoodtown; Hon. Wm. A. Whitehead, of Newark, and others, on the subjects of water supply, sewers, purity of air, influences of soil and climate, the causes of insanity, the hygiene of schools, and other matters which promise careful future study and show an intelligent apprehension of the vital concern which the whole science of sanitation involves.

It may be well for us to say, in conclusion, that the board enters upon its work with definite views as to its sphere of inquiry and of actual service.

First of all, it behooves it to become the repository of the best information to be obtained from all available sources both as to the condition of public health and as how far these come under the jurisdiction of State or local authorities. Next to its value as diffusing information among the people, it may be of great service for expert evidence as to questions of health interest which unavoidably come before the State authorities, and upon which they have need to ask for responsible and sustained information.

In some of the States, State Boards have been used with great advantage as references in cases where local board administration was resisted. A State Board has opportunities of acquainting itself with the domain of law, the limits of authority, the desirable equipoise of public and private rights, with impairments

and jeopardies to health from special causes, such as cannot be secured by any one local authority, and may often be of great advisory service. Besides, the great value of local sanitary administration is greatly constricted, unless, by a massing and comparison of the experience of localities, the whole is made available through some central bureau for public service.

With the exception of some legislation so long felt as needed in reference to vital statistics, the board has little to suggest as to legislative enactment. Some general law is ere long desirable, empowering local boards in townships as well as in cities, but this can await until there shall have been wise forethought and advice. It is our desire always to secure public sentiment, or to be able clearly to command representative authority before asking legislation. Even then our only sphere is that of wise suggestion. Time and study will yet develop how valuable to a State the services of such a board may become.

While for the present half year we have been engaged on preliminary work, we shall hope in due time to draw particular attention to existing defects and to remedies, and so to study the avoidable causes and incidents of restricted vitality as to aid in lessening the incubus of disease and death upon the population.

We submit to your Excellency, as a part of this report, the studies, observations and information which the members of the board have been able to secure on matters that intimately concern the public welfare in their sanitary bearings, and as herewith presented in special papers or reports.

ORDER OF PAPERS AND REPORTS.

- I. Registry of births, marriages and deaths.
 - II. The protection of children from impairment of health in the home and the school.
 - III. Some of the more common domiciliary influences and surroundings productive of disease.
 - IV. A paper from the State Geologist as to localities, in which topographical and geological position and condition indicate need for sanitary intervention.
 - V. Endemics and epidemics since 1870.
 - VI. Climatology.
- Codification of Laws, Index, &c.

REPORT ON VITAL STATISTICS.

BY E. J. MARSH, OF PATERSON.

It is unnecessary at this period to enter into an elaborate argument proving the importance of an accurate registry of all births, deaths and marriages, occurring in the State, as the value of such a record has long been recognized by our legislators, and laws have been passed at various times to regulate and carry out such a registration

The chief purposes of this registry are :

1st. To establish a record of the events, as a sure reference in certain cases where the rights and claims to property are concerned.

2nd. To ascertain and illustrate the social condition of the people and the changes it may undergo.

3rd. To ascertain the rate and causes of mortality, a knowledge of which is a necessary basis for a systematic improvement of the sanitary condition of the people. This last purpose will be principally considered in this paper.

In 1798 a law was enacted in this State requiring the clerks of townships to keep the proper books and record therein any marriages, births or deaths which might be reported to them by the persons interested. Such a record from voluntary application would necessarily be very incomplete, and useful in only a few exceptional instances. In 1848 another law was passed intended to remedy these defects, and enlarge the benefits of the registry. This law required all clerks of townships to find out and record all the births, marriages and deaths occurring within their respective districts, and to transmit annually to the Secretary of State a copy of such record. The Secretary of State was then to have the records analyzed and tabulated so as to bring out all the important facts and make a report of them to the Legislature. The duty of collecting the facts was subsequently transferred from the town clerk to the tax assessor, and with this

and a few other unimportant modifications the law continues at the present time. The births, marriages and deaths are collected annually by the tax assessors, copies of the lists made by the town clerks and transmitted to the Secretary of State, under his directions tabulated, and the result published by the Legislature. Thousands of dollars have been spent in carrying out this law, the various fees and expenses having of late years been over 11,000 dollars.

These records having been preserved and published annually for nearly thirty years, it might naturally be supposed that an ample fund of valuable information was at hand either to establish individual facts, or to ascertain our birth and death rates, and the various causes of disease prevailing in the State. In point of fact, however, they have not been and are not now of any use whatever; as references they are worthless and inaccessible; as indications of our present and past social and sanitary conditions utterly misleading and erroneous. The only useful purpose they can serve is to indicate the inefficiency of the present law, and tell us what not to do.

These assertions and charges may be considered too sweeping, and proof of them may be asked. If so it is easily given by looking into the practical results of the registry. Here it is found that: 1st. They are inaccessible as individual records for the reason that the names are not indexed but recorded solely in the order in which they have been taken by the assessor. Hence to find the evidence of the birth, marriage or death of any one person, search must be made through the entire register perhaps of some thousand names. 2nd. They are incomplete, not slightly so, or with a few omissions, but a very large proportion is left out. This is only in accordance with other experience. The vital statistics of the country were collected after a similar plan for the last United States census, and the superintendent of that census estimates a deficiency of over forty per cent. in the number of deaths reported. This is accounted for partly by the carelessness of the assessors or census takers, partly by forgetfulness on the part of the persons questioned and by various other reasons. Our State reports may be a little fuller, but still are very incomplete. Sometimes the assessor makes no return at all. In the Secretary of State's report for 1875 it is stated that from 32 townships no reports of deaths had been received.

Where reports have been received, sometimes more than half the cases have been omitted. An examination of any of the annual reports will show these deficiencies, but a few examples will suffice. They will be drawn from the registration of 1875, for the reason that a State census of inhabitants was taken in that same year, and the mortality rate can easily be calculated. For the whole State the mortality rate was 13.6 per 1,000, a figure so small as to throw suspicions on the correctness of the returns. In the State of Massachusetts the rate was 19 in 1,000.

A comparison between some different counties and towns will show remarkable differences. In the northern part of the State, Passaic county, with a population of 53,775, has a mortality of 1,221, or a rate of 22 deaths in every thousand inhabitants; Sussex and Bergen counties are immediately adjoining. The former has a population of 24,010 and a mortality of 231, or 10 in 1,000; the latter a population of 35,516 and a mortality of 330, or 9 in 1,000. These two latter counties show a mortality rate so small that the returns may be determined to be certainly incorrect, and this to such an extent as to render them worthless for sanitary investigations.

These instances are by no means exceptional, and the same state of affairs is found in many other counties. Monmouth reports a mortality of 6, Somerset 7, Warren 8, Hudson 9, Mercer 10, in 1,000 inhabitants. The only counties returning even a possibly correct mortality are Passaic, with a rate of 23; Essex, 22; Union, 28; Cape May, 16, and here undoubtedly many deaths have been omitted. These deficiencies are found in all parts of the State, both in rural districts and in large cities. In fact, the greatest difference appears in the case of cities, in some of which there is the merest approach to accuracy, and in others the most complete departure from it. Hoboken, with a population of 24,706, has a mortality of 728, or 29 in 1,000, while Jersey City, with a population of 104,227, returns only 774 deaths, or 7 in 1,000; or in other words, Hoboken is represented to have almost exactly as many deaths as Jersey City, which has four times the number of inhabitants. Elizabeth and Trenton have each about 25,000 inhabitants, and while the former is reported to have 746 deaths, the latter has 235, or not one-third as many.

These examples will suffice to show how incomplete and unreliable the returns are as matters of record, and how utterly

valueless and misleading for the investigation or illustration of the sanitary condition of any given district.

If, then, there is such difficulty in obtaining a mere enumeration of the number of deaths (facts which require no special intelligence or education to ascertain), it might be reasonably expected that a record of the particulars of each case would be still more full of errors, as this calls for more attention, exact memory, and even special knowledge. Among other particulars, the law requires a record of the age and cause of death. The age is generally known at the time of death, but after the lapse of a few months the exact number is forgotten and an approximate age is fixed. Thus assessors and census collectors find that the round numbers give more cases than those immediately adjoining—20, 30, 40, 50, &c., show many more than 19 and 21, 29 and 31, &c. In many cases the age is not reported at all. The greatest difficulty, however, occurs in fixing the cause of death. This is a purely medical matter, and can only be determined with accuracy by the physician. The parents frequently do not know or remember the statement of the physician, and utterly erroneous returns are made, and every death is referred to some well known malady; all wasting diseases become consumption, all sudden deaths heart disease, and all infantile deaths cholera infantum or convulsions. In over eleven per cent. the cause of death was not reported. Such returns are necessarily utterly unreliable and valueless to the sanitary statistician. No one can study the cause and course of disease from such "fictitious data."

After these imperfect returns have been collected by the assessor, they are copied by the township clerk and the copies sent to the Secretary of State. They are here tabulated, according to the directions of the law, in various ways. The forms used, having been long since adopted, are followed in stereotype fashion. This work is purely clerical, or a mere calculation of figures. There can be no analysis, comment or explanation of the meaning of the figures, because there is no sanitary expert superintending the work. Hence results a yearly report of incorrect returns, obtained at considerable expense, compiled and printed for the supposed benefit of the public, but consigned by that public to a well-merited neglect. Perhaps it would be no exaggeration to say that not in a single instance have these statistics been of the slightest value to any citizen except those who have

received fees for collecting them. To the State they are valueless, unless as a stepping stone to a better system.

METHODS OF IMPROVEMENT.

From this examination of the imperfections of the present system of registration, it will be an agreeable change to turn to the consideration of the best methods of improving and perfecting the registry.

The first principle to be established is that each event is to be recorded near the time of its occurrence, and on the information of some person personally cognizant and competent to give the necessary information. The experience of this and other States has shown it to be impossible to obtain correct reports, if taken by an annual census. The births are best reported by the parent, or the physician in attendance; the marriages by the clergyman or magistrate officiating, and the deaths by the attending physician, who alone is competent to state the cause of death with any precision. Another principle is that all these returns should be ultimately dealt with by the same officials. This may not seem to be absolutely essential, but the three records have for so many years been associated as to have established a kind of law by custom.

After stating these two principles the subject can best be considered in detail, by examining the facts to be recorded, the method of collecting them and their subsequent use and preservation, for deaths, births and marriages separately.

1ST—FACTS TO BE OBTAINED AND REPORTED.

Births.—Little change is required from the present law. There should be a statement of the names of the parents, date and residence, with some witness for the purpose of identification; also, for social inquiries, the birth-place and occupation of parents, and perhaps a few other similar items.

Deaths.—In addition to the requirements for births for purposes of record, it is also especially necessary to give the cause of death, and also, perhaps, the duration of the sickness. The cause of death should in all cases be certified by the attending physician, or by the coroner if there is no physician. This is

absolutely essential. No statement of the disease at second or third hand should be permitted. Perhaps in cities a few additional statements should be required, as, for instance, for tenement houses and other points of local sanitary importance.

Marriages.—Here there should be the usual requirements of name, age, residence, date, nativity, with the names of witnesses.

2D—METHOD OF COLLECTING OR REPORTING THESE FACTS.

Births.—The difficulty of obtaining a complete registry of these is far more embarrassing than of deaths and marriages. The method of making an annual census has been found unavailable. Attending physicians might be made responsible, but in very many cases there is no physician present.

Parents might be required to report births, but, on trial, this has been found ineffectual. A rigid law, with penalties attached, or a liberal compensation for returns, would no doubt aid in securing completeness. At present some of our cities have stringent laws and are seeking accuracy. In townships, if the collection is left to assessors, they should be subject to penalty in case of neglected or incomplete returns. Outside of cities, if the duty could be made to devolve on the Clerks of School Districts in connection with their census of children within school age, the smaller area and its coincidence with the other duty might secure greater accuracy. The most feasible methods are still under the careful consideration of our board.

Deaths.—There should be much less difficulty in obtaining a complete return of deaths. The event of death is, in a certain sense, a most public one, or at least the final disposal of the remains is public, and is a fit subject for legislation. This is advisable, on the grounds of decency, health, and the prevention or detection of crime. In many of our cities there are efficient municipal laws on the subject. No burial of a corpse is allowed without the permit from the proper officer, and such permit can only be granted on the certificate of the attending physician or coroner. These certificates are made to cover all the points required for registry. An extension of this law to all parts of the State would give a complete registry. The only apparent objection would be that in rural districts it might, on account of distance or otherwise, be troublesome to find the officer appointed

to give the burial permit, but the law could provide for such a contingency. In cities this officer is usually the city clerk, unless there is a special officer designated as registrar of vital statistics. In villages and country districts it might be the assessor, or if the township were of great extent and the population scattered, or in the absence of the assessor, or in other emergency, a justice of the peace might be authorized to give a special permit. City clerks or registrars should keep a list of all practicing physicians.

Marriages.—There should be no difficulty at all in obtaining a proper registry of marriages. Marriage being a civil rite, regulated by law, by authorized persons, clergymen and magistrates, these persons can be directed to make the necessary returns to the proper officer.

3D—USE AND PRESERVATION.

The first statement or certificates of the events being obtained and in the hands of the city or township officer, their proper use for sanitary, social and statistical inquiries, and their permanent preservation as records for future reference must be considered. As permanent records their proper place would be the county clerk's office, with other similar papers. For other purposes, they should be examined, tabulated and analyzed at stated times, by competent persons for the State at large.

At such periods as a general law might specify, all these returns, or a certified copy thereof, could be sent to the Secretary of State, that expert examination might be had of all the returns from every part of the State, so that a State Report could be prepared thereupon. The original certificates, if these had been sent, could then be alphabetically arranged and returned to the office of the county clerk of each county, or to the keeper of permanent city records, for permanent future reference. This would avoid the double expense which now occurs in many of our cities by reason of both State and municipal collection of returns.

The amount of compensation would not need increase unless a duplicate was required, and even then the full expense would be much less than that which now accrues in each township by reason of one unnecessary copying, and in many cities by reason of a double collection of statistics, which, practically, however,

is often double only as to remuneration. The change would at once elevate this class of vital statistics into the field of approximate accuracy, and enable us to study many health and life problems by the light of tabulated, significant and reliable records.

REPORT ON THE HOME AND THE SCHOOL IN THEIR RELATIONS TO HEALTH.

BY EZRA M. HUNT.

I. The Home.—It cannot but be admitted that the most fundamental of all the relations of the citizen is that which concerns the Home. The domestic condition of a people is one of the weightiest concerns of the statesman. That is a wise administration which does the utmost that is practicable to secure to each person a residence where the best conditions of physical, intellectual, industrial and moral development are secured. Felt embarrassments, already meeting us in dealing with our population *en masse*, are teaching that somehow we must reach more effectually the starting point of influence. If the foundations be destroyed, what can the nation do? The studies of social science and the examination of social facts and results, are constantly illustrating how intimate are the blendings of home influence with all that constitutes the personality of the citizen and the welfare of the State as involved therein. In a republic, where the relation of each man is that of a citizen-voter, as well as that of a subject and co-laborer, the importance of the elements at work in providing material is essentially magnified. It would seem sufficient simply to announce the principle that the ability and usefulness of the citizen—his ability to govern and be governed—is more involved in his home rearing and home surroundings than in any other one question of outward situation and circumstance.

But when we pass to note facts in evidence, the modifications resulting from parentage, early training, home life, both youthful and adult, and the sanitary associations of domestic conditions, are still more significant and abiding.

The laws of physical inheritance and the modification of these laws by home surroundings and influence, are not less definite

than those of moral and intellectual force. Take up, for instance, the tenth report of the State Board of Charities of New York as relating to the causes of pauperism, and see how the results grow out from social and domestic conditions. Study any great circumstance as to the social *status* of a people, and you will more and more come to realize how much in individual and congregated instances is a legitimate result of present or former home life.

Nor is this as purely a question of intellectual and moral training as some seem to suppose. We cannot unwrap a man, woman or child from the folds of personal bodily environment.

The body, its growth, its care, its culture, and all those influences which have to do with its preservation in health, are no inconsiderable concerns in their bearing upon the common welfare. While we cannot agree with those who would resolve all mental and moral into material acts, and consider imperfect judgments and sinful deeds the result of disease, yet it must be admitted that abnormal physical conditions and bad household situations and unsanitary surroundings are large elements in mental and moral degradation. Even the demand for unnatural stimulus is often, in part, the result of depression arising from bad air and imperfect food. Alderman Waterlow, of London, and others, have shown by positive example how the poorer classes can be elevated in character by providing them comfortable homes.

The question of the health of a family is largely determined by the homes in which its members have been or are now being kept. These, too, determine whether they are to belong to the sustaining or depending class of society; whether as producers or consumers they occupy, or will come to occupy, a place in the commonwealth. This is one of the criteria of their value as citizens. If there is any one fact which sanitary science and investigation have made manifest in the last decade, it is that health and disease are far more within the reach of prevention, modification and control than was once estimated.

The power to improve bad physical organizations and to prevent new invalidity by hygienic influences is much greater than even physicians formerly supposed. Infantile diarrhoea and other bowel affections, once attributed to unavoidable accidents or considered the inevitable penalty for living to a second sum-

mer, are now unmistakably traced to intense heat, to imperfect feeding or care, and to a very few other classifiable and mostly avoidable causes. Of the 21,204 deaths in 1874 in England from this cause, 18,024 were under five years of age. When, as in such cities as New York and Washington, we look after causes, we are not slow to identify a very large proportion as associated with evils directly connected with home life. We need not compare the enormous mortality with the small per centage of country districts, but comparing different cities, or parts of the same city, can easily show where and why disease is domiciled. Indeed, the graphic statist can beforehand draw his lines of greater and less intensity and predict the diarrhoeal wave.

Developmental diseases, or those having their manifestation during the period of youth, are definite both as to their causes and as to their limitation or prevention by good home management.

Contagious diseases, of which scarlet fever and diphtheria are especially formidable with the child, and typhoid (enteric) fever and small pox among the grown, are not only dependent upon specific contagions, but the question of their malignancy, if not of their occurrence, is largely influenced by the condition of the premises into or upon which they alight.

Not less measles, whooping cough, croup and erysipelas are counted among those zymotic diseases largely controlled by immediate surroundings and dwelling houses.

Consumption and other lung diseases making up so formidable a number of invalids, and tabulating so many thousands of death each year, are more controllable in their preventive and early limitation than in subsequent treatment. Damp houses, undrained premises, inadequate food, imperfect clothing and ignorance of those laws by which temperature is controllable, add many a victim from those who might be saved.

It is not our purpose to furnish any exhaustive list of the avoidable diseases which are often engendered by imperfect home management, but merely to draw attention to the fact now so fully recognized that these are within the province and duty of home prevention. Besides it is not to be overlooked that many who inherit imperfect constitutions, and yet who do not succumb to disease, might be greatly improved by proper rearing, and that many of naturally good health are so placed under

untoward circumstances as greatly to impair their vitality. Such may not find an early place in the records of mortality, but by their imperfect existence their power of labor is impaired, their happiness curtailed, and others, it may be, through them, inherit an imperfect organization. The State is crippled by the home-errors of its citizens to an extent that is a matter of legislative concern. Governments seem too often constrained to provide for the results of imperfect lives, when much of the necessity might have been avoided by legitimate attention to the causes. While we are spending our millions on asylums, penitentiaries and pauperism, and suffering nationally because the consuming are gaining upon the producing classes, it well behooves us to consider whether we could not somewhat turn the stream at the fountain, and so influence American home life as to lift from it some of the burdens of ill health, sickness and death, and more fully insure in the families which make up the State the bodily conditions so indispensable to profitable labor, to thrift and to usefulness.

If not a very intellectual, it is nevertheless a very matter-of-fact view, that in every home human animals are being cared for. The adults are animals upon whose proper air, food, and surroundings not only their comfort but their life-force depends, and each child is an animal in process of growth under conditions which will very much determine what the future available power shall be. Spencer has said, "The first requisite to success in life is to be a good animal." The body is the machinery which is to be operated, and in so far as it is incapable of responding to the demands made upon it by its other resident or rather interwoven forces, in so far it is defective machinery, which is not fully equal to the service legitimately to be expected of it. So far as this is avoidable it is a burden which ought not to be imposed. So far as close rooms, irregular heating, mouldy dampness, impure water, bad sewers or outhouses, unfit food, accumulated filth or other preventible things are making sickness or causing the lowering of health standard, so far it is highly desirable to secure abatement. The limitation or removal of all such inflictions is as much for the interest of the State in its corporate capacity, as for the household in its family welfare.

There are two methods by which the State is to operate in this direction.

The first is by a proper diffusion of information and direction upon such matters among the people. It is well recognized that the government has an educational relation to children, not as a mere gratuity, but under the law of self-preservation, for without a fair degree of intelligence Republics are only ephemeral possibilities. But there is information for adults as well as for children, bearing so directly on civic welfare, that it cannot safely be dispensed with to the extent in which it is purely protective and does not involve burdensome outlay. In the homes where adult and young life are most affected by surrounding influences and where the health of all is dependent upon domestic arrangements, we cannot afford to leave the people in ignorance of the guiding laws of life. They must be informed as to the more comprehensive axioms of physical welfare and be warned against those insidious and frequent evils which are apt to be underestimated or overlooked, and which so often entail invalidity.

It is for this reason that so many European governments have instituted health authorities, whose duty it is to study those great questions which have to do with the social and domestic life of the people, and have enforced those methods which improve domiciliary indwelling. Our American methods being more at first to convince rather than compel, various States have established Boards of Health, whose duty is to point out those evils which are most distinctly certified, to present the methods of dealing with them, and by an annual report acquaint the people with their dangers and their relief. It is thus that we may hope to elevate and educate the families of the State into a degree of intelligence in such sanitary matters as most intensely concern the common welfare. These are interests that require for their elucidation and presentation the expert study of the scientist, the physician and the engineer, and yet when duly examined are capable of being recognized as of saving value by the people at large.

With all that may be said about the dilatory carelessness of householders to avail themselves of proper appliances for health, it is nevertheless true that unsanitary conditions are not so apt to prevail among those who are informed.

Many a man who now has his well too near the outbuilding, his house drains and cess-pools badly situated and managed, or

the necessary off-fallings of domestic life illy disposed of, would have made more suitable provision at the start had he known the dangers of contamination and the intimate relation of these untoward circumstances to diminish vigor.

With forcible facts before him, or the assurances of those who are fully informed, he is more likely to make indicated changes and to prevent the repetition of his error by those about to construct for themselves.

The need of pure water, its liabilities to contamination, the simplest tests of its purity, the necessities of good air and the means of securing it, the laws for regulating heat and moisture, the bearing of ground and house drainage on health, the laws as to foods and drinks, the evils of uncleanness, and manifold other subjects, of which these are passing illustrations, if fairly presented to households are capable of comprehension by very many who have never thought much about them before. By the enforcement of clear principles and supporting evidence they educate on points in which individual comfort is concerned, and so have the chance of appreciation and application independent of the enforcements of law. Even where there is still neglect, they make that public opinion which the more readily accepts the enforcements of law in those cases where the corporate or local authorities deem its intervention necessary. The welfare of the State is so inherently involved in household health that it may well put forth some effort to conserve it.

It is partly in this view, too, that sanitary inspection has accomplished so much for those cities in which it has been most thoroughly carried out. All outside and general sanitary circumspection has been found inadequate in dense populations until it has been extended to a care for individual houses. There must be dealing with the root of the evil. It is the testimony of very many of these inspectors, as we have reason to know by careful examination of numerous reports, that they have often been of as much service by awakening the attention of the inmates to evils from which they were suffering, as by any direct insistence upon the application of legal requirements. While this may not be needed in less aggregated populations, yet in many larger villages and towns much benefit might be secured in this way.

• In every school district of our free school State a member of the

Board of Trustees visits, or should visit, each house, for the purpose of enrolling the children who may be entitled to the benefits of the school fund. If the duty is not delegated, he is generally a person interested in the welfare of his neighborhood, and of the homes which each day send a part thereof to that next most prominent home, the public school. We believe it would be entirely possible to have such an one inquire also into the sanitary condition of domicils, and endeavor to guard the population there from those unhealthy influences which prevent so many of our scholars from growing up into all that stalwart fullness of health which is needed for the varied avocations of life.

There will, no doubt, still be a large class who from ignorance, from carelessness, from indifference or other causes will not respond to any methods of information, and for whom it may be necessary to invoke the enforcements of law in those cases where private rights or the public good are too gravely imperilled.

The crowded tenement house, the unkempt premises and those mentally or morally degraded will no doubt ever need the traction and scavenging of law. This will neither be difficult nor oppressive when those competent to discern come to appreciate how much one and all are involved in the protection of each home from such preventable sources of contamination as are within the range of ordinary ownership or tenancy.

It is because these interests of healthy home-life are so imminent and vital to the State, and because it is desirable, as far as possible, to substitute the intelligent appreciation of the household and the citizen for the rigorous enactments of compulsory legislation, that we desire so much the diffusion of knowledge as to the intimate relation between imperfect life-force and abatable causes of invalidity in the homes of our people.

The second method is by the direct exercise of legal authority. While it is our American boast that every man's home is his castle, yet we are not to carry liberty into license and make the independency of the individual a tyranny to society. If my fellow citizen runs stenchy slops into my street gutter, or keeps his premises in such a condition as that positive disease is engendered thereby, he is the oppressor and must be restrained. We would surround his personal rights with all due precautionary

protection. We must have the evidence clear. But, nevertheless, the right of dealing with such cases must be recognized and duly exercised. While we believe most in instruction, in persuasion and in that inspection which is at first informatory rather than compulsory, we believe the State has great occasion to inform itself as to the requisites of household health and the sphere of legal enactment in preventing concealed or open nuisances, such as are perilous to life or inimical to vigorous vitality. We would thus have it recognized that the condition of each home has a direct bearing upon that public health and public comfort which are so important to the welfare of the State.

The proper diffusion of intelligence, such inspection as is informing, instructive and precautionary, and if need be, such laws as compel the abatement of pronounced and unmistakable nuisances, are the safe guards to the health of the citizen and to a degree the inalienable rights which municipal or State law should secure to their respective constituencies.

II. THE SCHOOL IN ITS RELATIONS TO HEALTH.

For the child there is another home beside that which he finds under the family roof. By the laws of our State, from the age of five to eighteen, he is recognized as having his appropriate place in the school-room. He is here to spend no small portion of his waking hours, under circumstances and conditions most vital in their bearing on all that relates to his future life. It is a home constructed for him by the State itself, in the common interest of the child and of the commonwealth. By law he is made the ward of the government. It behooves it well to consider the terms of the guardianship and the charge involved. He is here to be fashioned as to his body and as to his health, no less than as to his mind. It is a deep, broad and high concern of society whether the boys and girls who, at the age of five, crowd to the school house door and are seated in the school room for a period reaching over ten or twelve years, are there to find those aids to physical health to which they are entitled by nature and which involve so much as to the effectiveness of their future citizenship.

May we not apply as an axiom the idea of Simon, in another connection, and say, That whatever work the State assembles its

children to do shall, as far as depends upon it, at its cost, be divested of all needless unwholesome circumstances.

It is not a mere charity, but for the public welfare, that the free school seeks to offer to the masses such education as can be received amid the best conditions for health. Fitness for the labor of life is the ultimate result sought. It is not for special intellectual eminence that New Jersey opens wide the door of ingress to the free school. It is for usefulness. Far more than is generally felt this means such education as will make the person effective in his or her occupation. It is that it may fit the pupils for entrance upon their life-work which, with the most of them, means manual labor. It is to give that training which will make them *force-full*, not only as to skill and intelligence, but as to bodily endurance, too. Labor is to be the working capital, and that preparation which does not recognize this is fearfully incomplete. They are to be *operatives*, and they are to operate their bodies in skillful handiwork, not less than the student does in more isolated brain work. The school-child body is not a mere outside wrapper for the mind, to be taken off when the mind is polished aright, but is itself the very instrument. Indeed, in a sense the mind is secondary, the body primary. The body is fitting to be worked by the mind, just as much as the mind is being trained to regulate the body.

The casket is not to be broken and thrown away so soon as the jewel becomes brilliant. It is the casket that is to be handled and made strong for the inevitable stress and strain to which it is to be subjected.

It is at a time, too, when over tension, or cramping restraint, or unfavorable conditions in anywise, will tell for permanent evil more than at any other period of life. The fact that "children are young and can stand a great deal," is over-stated. In a weighty sense, because they are young they are far more susceptible to deranging influences, and the symmetry of coming life is more easily marred.

The young lives, as Simon puts it, are finer tests of foul air than are the elder and perhaps acclimatized population. Many an influence resisted by older lives, if exerted during the formative periods tells for permanent impairment of a normal vitality.

Besides being the period of general impressibility, physically

as well as mentally, school life includes the two crises of second dentition and puberty.

There are not only the physiological processes of organs to be performed, such as circulation, inspiration, secretion, etc., but growth is going on meanwhile, and, besides, there is the special awakening of new activities at these periods. The nervous system is aroused into its highest ardor, and all susceptibilities are increased. Wrong management not only affects organs, but development. Two vital processes occurrent at the same time are more easily deranged than either could be alone. Still more dissonance is possible when we consider that the derangement of either breaks links in a long and exquisitely wrought chain of harmony, and so disorders generally.

Experience is constantly informing sanitarians how frequently the disabilities of physical life have their foundation in school circumstances. Thus the child, instead of having himself developed into capacity for life work, is so educated that one department of himself is trammelled and often terminated by the other. One leading design of common school education should therefore be to make the body effective, and so to culture the mind and soul as that they shall administrate the body wisely to this end.

Yet in the attempt to impart capacity we organize incapacity; for nothing turns into incapacity so fast as ill health.

Jarvis and other eminent statisticians have made careful computations to show how many days and years sickness abstracts from the effective force of individuals, and so from the capital of the State.

If the same examination is conducted as to the shortening of the labor period by too early exhaustion or its embarrassment by partial invalidity, it is found that the aggregate force and the aggregate years of working life are being abbreviated.

A degree of this may be traced not only to the "tyranny of a bad organization," but to the equally destructive tyranny of school-day experiences, which has made sad havoc with many a hardy scion or failed to enable those less favored to grow into a vigorous manhood. For not only should the school-room and the school secure the requisite condition for vigorous health, but both, by regulation and instruction, should indoctrinate the pupils into the conception of the necessity of health, its depen-

dence upon right management, and should guard them against those evils to which they are most naturally exposed during the period of their growth.

So far from accomplishing these positive and educational results, how patent is it that at the present day the average school-room and the usual process of education greatly imperil the health of the pupils.

Turning in manifold directions, we have only to compare the actual conditions which obtain, with the well-understood requisitions of a healthful vitality,

AIR CONDITIONS.

Take, for instance, the two leading necessities of good air and regulated temperature.

Boston schools are nearest a model of any in this country. Yet in an examination of forty, made in 1871, "the average proportion of carbonic acid found was 1,393 parts in a million, or nearly four times the normal amount existing in the outer air. (See Mass. State Board of Health Report, 1871, page 405.)

Dr. Endermann, in a series of examination of schools, in New York city, in 1872, found the proportion of carbonic acid varying from 1,400 to 2,700 parts per million.

Of forty-six school-rooms examined by Prof. Kedzie, in Michigan, but four gave less than 1,200 parts of carbonic acid per million; twelve from 1,200 to 2,000; nineteen from 2,000 to 3,000, and one from 4,300 to 4,900 parts per million.

Last year the city government of Cincinnati authorized Prof. I. B. Hough "to make such surveys of the school buildings and chemical analyses of the atmosphere therein as should establish clearly and fully their actual sanitary condition."

We quote as follows from his elaborate report:

"It will be seen by the appended table of analyses, that a number of school-rooms were found to contain considerably more than one-tenth per cent., (the amount stated as tolerable,) and that even in the best ventilated rooms of the newer houses the per cent. is quite materially above the average out-door quantity. It is true that a person can become habituated to the endurance of a vitiated atmosphere, * * * a process

which, though it trains the child to live on impure blood, yet trains it to live a poorer and feebler life."

The report covers over forty different rooms, and draws the conclusion "that in a large majority of cases the ventilation of our school-rooms is injuriously defective."

As to air space, it is generally conceded that from 200 to 300 cubic feet is the smallest allowable for each pupil. Yet in 265 rooms in this great city of schools only 29 afford 300 cubic feet, 166 less than 200 feet per pupil, 22 less than 108.5, 14 less than 100.

There was often found great defect of pure air, of moisture, and various defects in other regards.

In twelve school districts the schools were reported as suffering from the odors arising from neighborhood nuisances. There is no reason to believe that the showing as to ventilation, etc., is beyond that occurring in many of our cities, and in no inconsiderable degree in very many towns, villages and rural districts of this State.

Brooklyn makes no better showing, and the fine architectural schools of Philadelphia are strangely defective as to their ventilation. Such schools have the principle of Babcock's Extinguisher. As it puts out fire by its surcharge of gas so do these effectually obscure the light of intellect.

In villages and towns, while there is more freedom for air, there are lower ceilings and less care is taken to discharge the air at recesses or at the close of the daily session, because janitor service is less perfect. The exposure to draught is greater and teachers as well as scholars come under our care as a result of bad ventilation. It is to be borne in mind too that children by virtue of their growing and "active vitality in proportion to their weight are twice as powerful as adults in deteriorating the air which they breathe." Being seated much of the time at nearly the same level, and that not so favorable as if a higher one, they are more apt to rebreathe the same strata of foul air. Air which has been once breathed has lost about 5 per cent. of oxygen, and had added to it 5 per cent. of carbonic acid. Stoves and furnaces add to this lung supply of carbonic acid.

Besides the amount of carbonic acid is not to be regarded as the full measure of vitiation. Soiled clothing, and exhalation from the skin and lungs, bad breath and the results of imper-

fect food and digestion give to many of our public schools a fearful amount of floating organic matter.

Amid the lower classes many a boy has his clothing saturated with the smell of his untidy home, which for want of sufficient change of garments is not swept away by outer airing. The lungs and the skin throw off watery vapor to the amount of 25 to 40 ounces each 24 hours, and organic impurities of 30 to 40 grains other than the vitiated air of the breath are constantly being voided. In the great open, and with cleanly clothing, these find easy riddance, but not so in the huddled embrace of the desk row. The aggregation of children under such circumstances too often causes them to be distributors of contagion.

Facts as to the potency and putrefactive decomposition of organic matter plainly point us to increasing care as to its constituency and harm in school-room atmospheres. Dickens describes it as a "strange unwholesome smell, like mildewed corduroys, sweet apples wanting air, and rotten books" (David Copperfield, page 33). But even when present in quantities more deleterious than the carbonic acid, it is not always detectable by the senses. The headache and general malaise from which school children often suffer is largely owing to this.

HEATING.

As to Heating, most are well aware that this is apt to be very badly regulated in the school-room. Imperfect attention to furnaces or stoves, made to generate carbonic oxide or other bad gases by extreme heating or shut dampers, give rise to manifold evil results. In fact the entire regulation of heat as to our schools needs the care and study of teachers, school officers and the public generally. The introduction of anthracite coal instead of wood has much complicated the whole question of ventilation and heat, so that our schools suffer greatly from sudden extremes of temperature and from air whose impurity is increased by the heating arrangements. Beside other impurities, ordinary coal gas has usually from five to seven per cent. of carbonic oxide. (See Wood, Public Health Ass'n, vol. III.)

Often the interference with moisture or distance from the dew point is so great that the air passages are irritated, and catarrh, coryza, bronchitis, or more serious lung affections result. This

undue dryness of the air, as shown by Buckheim, constricts also the depth of inspiration, and healthy evaporation is embarrassed. Virchow rightly attributes most of the pulmonary diseases of children to overcrowded rooms, to changes of temperature in passing from hot rooms to the cold stairways or outside, to the dust of the school-room and the impaired respiratory movement induced by prolonged sitting. I once asked Brown-Sequard how it happens that nervous diseases abound more among Americans than with the quick and versatile French. His reply was: "Your miserable hot-houses have much to do with it."

It must be admitted and realized that the evils of defective ventilation and heating find their intensest illustration in the average American school room. There are so many disturbing elements, so many embarrassing complications. The audience is a child audience, in an assembly room where they sit much of the time and stay several hours in succession. The individuals are not re-dressed for the occasion like a church or concert audience, not under charge in small groups as at home, nor to leave in an hour, as in the usual public hall, and are of ages, of clothing, of conditions of health, and of home life so different as to give great variety of susceptibility. They are, too, very differently affected by the mental processes they are attempting.

We must realize the embarrassment and not despair because of its reality. For the coming nation, the young citizen is here at a time when unsanitary conditions will tell upon the household at home, and upon the future of the child always.

The cry of philanthropy and political economy, and of State free school jurisdiction is, that we give concentrated attention and investigation to the subject proportioned to its difficulty and the stern gravity of the interests involved. The wardship we have undertaken must not be discharged at the expense of the health. If health or being itself is imperilled in learning to conjugate the verb "to be," or if a knowledge of the boundaries of Siberia involves pulmonary risks equal to a voyage thither, better have a little less learning and a little more strength.

These are vital questions to a degree that involves not only personal comfort, but the threatenings of race-degeneracy and national decay. The present condition, both as to ventilation and heating, can certainly in very many cases be amended and made to accord with well ascertained methods of improvement.

Besides these prominent interests as to air and heat, there are other infringements having important bearing on public hygiene.

In many districts greater care should be exercised to insure personal cleanliness. That old adage "Cleanliness is akin to Godliness" means all it says. An eminent British sanitarian began his reform by changing the "personal" of his tenants. The wash bowl, the glass and the penny comb in the pocket are valuable when at the command of the pupil. When water is cheap and paper towels are available there is no excuse for soiled face or dirty hands. In the best schools of Holland there is beside the teacher an attendant, who sees to the personal condition of each child upon entering the school each day. This one thing has something to do with Holland thrift as well as Dutch neatness. Children who are not washed all over each week, whose clothing is soiled by the grease and dust and bodily secretion of months are sources of air poisoning that can not be disregarded. Long hair and foul caps are good nestling places for harmful particles. Such persons are not in the best condition for mental work. Facts as to zymotic or other contagious diseases are rapidly showing us how such persons become common carriers of disease, and how epidemics otherwise mild and circumscribed are made malignant and wide-spread. The cloak room, in which the outer garments of children are so often huddled together, instead of being a dark side closet, should be a well-aired room. While we have no disposition to interfere with the rights of dress unduly, yet the right to dirt is not as inalienable as that of life, liberty and the pursuit of happiness.

The increase of eye diseases is marked in our own country as well as in Germany, England and France, where it has attracted large attention. Agnew, Loring, Derby, Williams and other oculists here have fully pointed out the facts coming under their cognizance. Modes of study, the individual position, the direction and the intensity of the light are greatly concerned in this. The usual arrangement of desks compels many of the pupils to face the light or to receive it too fully sidewise.

What is called the architecture of school buildings is far too little directed to proper lighting. Near-sightedness, weakness of eyes and need for artificial helps early in middle life accrue from the school oftener than as a result of any congenital defect. In the frequent black-board exercises of schools we have noticed

how, by reason of their position or that of desks, the pupils before them are not able to adjust their positions at the angle or distance that suits them. Indeed confusion in figuring often arises from constricted distance or undue shading or glare of light. These boards are often on the wall, along the aisles, with but little intervening space, and with unfavorable illumination. The eye is a great organ, for the mechanic and merchant as well as for the student, and we greatly need to have more attention turned to such care of it during school life as shall not enfeeble it for the present, or shorten its time of effective service after the meridian of life.

The evils of defective desks and constrained positions and an inordinate use of one side to the neglect of the other, are points telling much upon form and symmetrical development. Rudolph Virchow asserts that the schools are largely at fault as to modes of seating and posture, and thus accounts for distortions of the spine, and especially that form of curvature known as scoliosis, or lateral curvature. There is much in the present arrangement of desks to disturb that equilibrium of antagonistic muscles on which erectness depends. Hamilton, in his recent complete work on surgery, says, as to treatment, "Boys must be taken from the desk, the counting-room, and from the school-houses, where they are compelled to sit many hours each day upon benches without backs, and girls must be taken from schools where health is always held subordinate to deportment and scholarship."

Females, more especially, are found to suffer from malposition and congestions in the pelvic, even more than in the spinal region. Some three years since Brown Sequard delivered a lecture at Washington, in which he claimed that "there is a connection between development of the brain as regards the mental faculties and the development of the brain as regards leading movements on one side of the body." He avers that in education "an important point should be to make every child, as early as possible, use the two sides of the body equally—to make use of them alternately. Not only the right hand but the right side, in all its parts, is put too much foremost. There is a much greater difference in the power of motion and sensation in the two sides with very many than is supposed. In girls this is especially manifest, as not so much equalized by out-door exer-

cise. Various necessities of posture and constrained sitting in school, foster this tendency. This want of coördination, and the use of one side out of proportion to the other interrupts the duality of nature, and gives rise to muscular disabilities." What is called the "writing position," by Guillaume, inclines to this.

The increase of nervous derangement in all grades, and of varieties of paralysis showing themselves too early in life, should lead us very closely to guard against those strains on the nervous system, which either cause lesion or such impairment of function as manifests itself in spasm, paralysis, chorea or other disordered states.

An article before the American Social Science Association, May, 1875, by Dr. D. F. Lincoln, of Boston, ably treats of "The nervous system as affected by school life."

He speaks especially of dyspepsia, sleeplessness, irritability, headache, chorea, neuralgia, hysteria, spinal weakness and menstrual anomalies and general depression, as directly resultant oftentimes from traceable school errors.

THE MATTER OF SEATING SCHOOLS.

The matter of seating schools, the size and mode of desks and the variations imparted by recitations and other changes, should receive far more attention from a hygienic view than they do.

Not only the locality and the kind of seats, but their adaptation to the size of the pupil is most important. The back of the seat slightly rounded, should fit in just below the shoulder blades, the width of the seat support the leg about half way to the knee, and the feet always very easily reach the floor. With the tendency to sit forward in the seat, a slight inclination backwards is desirable. The edge of the desk should be just opposite the nipple, with a very moderate slant, which really would be better varied by the character of the work to be done upon it.

Dr. Guillaume gives the following as the proper heights for desk, stool and seat back—11 Swiss inches being equal to 13, English measure. Where there is an inclination, as in the usual desk, the edge may be a trifle lower :

HEIGHT OF PUPILS.				HEIGHT OF DESK.	HEIGHT OF SEAT.	HEIGHT OF BACK.	
Feet	Inches	to	Feet				Inches.
3	6	to	3	9	15.8	9.5	11.9
3	9	"	4	2	17.0	10.3	12.9
4	2	"	4	5	18.1	11.2	14.0
4	5	"	4	8	19.2	12.2	15.0
4	8	"	5	1	20.4	13.1	16.1
5	1	"	5	4	21.6	14.1	17.2

The evils arising from lofty buildings and long flights of stairs have attracted the attention of some observers. Children, in our cities especially, are thus often constrained to this somewhat unnatural and unduly fatiguing exercise. It is an especially exhaustive motion, throwing the pelvic and other muscles into unnatural action, and deterring some from exercise in order to avoid repeated ascent. It is said that man is the only animal who will voluntarily climb a stairs. "It is recorded in the memoirs of the incomparable Martinus Scriblerus how, in his eager pursuit of knowledge, he met with an extraordinary misadventure through the ignorance of his assistant, Crambe. Having secured the body of a malefactor, he hired a room for its dissection near the pest fields of St. Giles, at a little distance from Tyburn road. The body was carried by night without much difficulty on Crambe's back, who found it easy, being both young and lusty, to travel along the level road, carrying on his legs the double weight of the malefactor and of his proper self. As soon, however, as he commenced to ascend the staircase, the wonderfully increased exertion (twenty to twenty-five times as great as before) began to tell upon Crambe, and, as the accurate narrator records, upon the corpse also; in consequence of which Crambe dropped his burden in disgust and fright and allowed it to roll down the staircase, while he himself ascended breathless into the upper room, where Martin, scalpel in hand, eagerly awaited the arrival of his expected subject." We cannot vouch for all that happened to Scriblerus or his Crambe, but here, at least, the laws of animal mechanics seem to magnify the reality of the burden, for the work of carrying loads horizontally is easily shown to be about 1-25th part of the work done in lifting the same loads vertically through heights equal to the horizontal distances.

IMPERFECT JANITORSHIP.

The duties which ought to devolve upon a school house attendant or janitor are among those most important and yet most frequently neglected in our public schools. In Germany in all schools of good size the janitor lives in the school building. It needs to be realized that the buildings require to have brought into requisition most of the principles which apply in the proper care of a family dwelling. It is good *housekeeping* that our schools must have if we wish to have them to be places for the keeping of health. No woman at the head of a family would think of putting thirty or more children in one room for each day and leave its sweeping for the close of the week and its general cleansing to a yearly overhauling. Not merely disorder, but dust, dirt, greasiness and unavoidable friction and use must make any such room unhealthy unless its need of this housekeeping attention is recognized. Too often the service of the janitor has in it but little akin to the care of the good house, and consists merely in attention to a general sweeping and clearing up such as conveys the idea of respectable appearance to the average man. But of all other rooms the school room most needs the introspection of diligent attention. Thorough airing of it and the side rooms adjacent is desirable at the close of each school day, soon after the scholars have left. Such sweeping as not only cleanses the aisles, but about the desks must be quite frequent. The dusting looks not merely after the upper surface of the desks and seats, but after the books and whatever things may have got out of place among them. A washing of the desks occasionally is needed to remove the soiling that inevitably occurs. No kind of furniture more frequently needs the renewal of a coat of varnish than that of the school room. In large and crowded schools, when not too cold, an emptying of the air by opening the windows at each recess will be of advantage and the room should be entirely vacated.

Care should be taken to see that the cellar and all unfrequented closets are kept clear from the gathering of any nuisance and these should be included in the daily care.

In smaller schools where no attendant is employed, similar care should be exercised by the aid of the scholars under the direction of the teacher. Indeed, in either case the teacher should

be held responsible to see that proper housekeeping is secured and consider it as a part of his work thus to protect the health of his pupils. A personal sanitary inspection each week, which shall include the basement or cellar, is an important part of his supervision.

The care of the grounds also requires some attention that all causes of nuisance may be avoided. As their pleasantness and the various arrangements for recreation and exercise that can be devised, aid much in relaxation from study and in that diversion which is refreshing, these come into consideration as bearing upon the hygiene of the school as well as upon facilities for exercise. It is often noticeable that girls too frequently spend their recesses in the school room and so not only prevent its refreshment by air, but also fail to secure that benefit which ought to be derived from a brief outdoor enjoyment. The whole subject of the relation of the school grounds and of gymnastic provisions to health is too extensive for discussion here and we only refer to it as to be recognized in its bearing on successful education within.

PRIVY CONVENIENCES.

The privy and the well are the two prominent appendages to every school property which need to be carefully considered and provided for in all schools.

Where, as in some cities, all provision is indoor, there is some advantage in the easy securement of cleanliness, under careful inspection, but all the evils that may arise from foul gases, imperfect traps and ventilation, and imperfect flushing are to be sedulously watched. The water closet is to all intents a public one, in that it receives the excretions of those differing more in health than do members of the same household, and bringing together masses, some of whom are not unlikely to be affected by bad sanitary administration at home. The closet itself should always have secured to it special ventilation, and the janitor daily employ some disinfectant to secure greater cleanliness. For out-door arrangements the number of appliances have kept pace with the practical difficulties involved.

The "school sink," much used in New York city, is thus described: "It consists of a long iron trough or tank, (with water

in it) at one end of which is a draw-cock, giving a good supply of water, and at the other an aperture of exit, secured by a plug or stopper. When it is desired to get rid of the excrementitious mass the plug is removed, the water at the other end turned on and the contents soon swept into the sewer. The plug is then replaced and secured and the sink is again ready for use." (N. Y. 17 City Health Report, 1870.) This is not so easily discarded as contrivances depending on the pupils, and if attended to each day secures against the evils resultant from entire dependence on the traps in the connecting sewer.

The common privy vaults or ash pits, if cemented or so arranged as that buckets beneath would receive the daily contents, are far more easily managed than household privies, for the reason that they are used only a part of the day and on Saturdays are entirely unused. Abundant opportunity is thus afforded for that frequency of change which avoids large accumulation, and avoids also that decomposition which is the chief nuisance of these outbuildings. It is the amount that renders the condition uncleanly and embarrasses its removal. If the janitor each day sees to the condition of the privy inside, this of itself would usually secure neatness, and if the accumulation is removed each week both the ease of disposal and the value of the material commend the method. But, alas, an entirely opposite course is pursued. All this is regarded as vacation work. Too often the early summer finds the school midden already too foul for endurance, and the filthy mass is left for a summer vacation disposal. All this is so totally wrong that the teacher and the trustees must see to it that this prevalent nuisance of annual or semi-annual clearance is summarily abolished. Let a weekly or monthly removal be enforced, and all such embarrassments vanish.

The use of lime, plaster, etc., are always of service to correct any odor, and there is greater reason for absolute cleanliness and less excuse for exceptions to it in the school outhouse, than in those more constantly in service.

WATER SUPPLY.

We have always insisted that as far as possible each school should have its own distinct water supply. If from a city pipe, it should be so introduced as to be easily accessible, and should

have near it a cup and a self-emptying wash bowl, for the use of scholars. It should be supplied to each floor so as to avoid the necessity of frequent stair descent. Care must be taken that the pipes and faucet are such as not to impregnate the water with any hurtful metallic particles.

In case the water supply is from a well or cistern outside, the greatest care must be taken to preserve it from the contamination to which the carelessness or mischief of children may expose it. The covering should be so tight as not to admit anything from the surface, and the ground so raised about it as to throw off any outside drainage. A permanent trough beneath, with a spout to carry off the water, prevents much soiling directly at the well, and is a convenience in the drawing of the water. It is not difficult to have near at hand a self-emptying wash basin, and these aid in securing cleanliness. The purity of the water can only be assured by an occasional examination. If there are special indications of foulness the well must be cleansed or the water submitted to a chemist. Some reference to ready tests will be found at the close of this article.

CONTAGIOUS DISEASES.

As a large class of diseases is especially communicable to children, it would be a natural inference that as they gather each day in masses, or come, it may be, from homes in which some are already sick by contagion, they must become the carriers and diffusers of such diseases. Careful statistics show this so largely to be the case, that school authorities recognize it. Instead of precautions to prevent it, the one sovereign remedy seems to be to disband the school. This is often unwise educationally, and indeed not promotive of general good health. It would be far better, if in case of any prevalent epidemic the trustees immediately inquired into the families under their charge, or informed themselves as to local cases of sickness such as rendered it inexpedient for other members of families to attend school, and cautioned parents not to send those in any degree unwell. A superintendent of schools in one of our counties recently told me that he visited a large school in which several of the pupils had their necks bandaged, and, in two or three instances, poulticed. On inquiry as to the cause he was told that diphtheria

was prevailing. When he heard afterward of its spread he was not in doubt as to the cause. The practical working of the contagious disease acts of Great Britain and Holland show how much can be done to prevent such a catastrophe.

RECESSES.

In the Kindergarten system, accurate observations have been made as to how long children of various ages will bear interested attention without fatigue.

Much of the cry about the evils of long school attendance and the advocacy of half-time schools, arises from an imperfect adjustment of work and play, a lack of variety in position, and a disregard of the rest to be secured by the proper variety and adjustment of studies. A child will be invigorated by mental as well as by muscular work, if only the music of its life has its rests. There is a great American tendency to work continuously for several days or weeks, or even months, and then make up for it all by a Sunday sleep or a summer vacation. The method tells badly on the general health, and even more when its influence extends to our schools. The decided inclination is to crowd all school hours between 9 and 1.

Let the child have a recess every half-hour or hour if only five minutes, a change of study and of posture, and an occasional singing or gymnastic exercise, and he will endure many hours of schooling with ease and benefit. A half day of all work and a half day of all play is often a strain and stress on the system, while an intermingling of the two, according to age and degree of effort, is not harrassing. If children are received into school so early as five years of age—which seems to us of very doubtful expediency—they need great care lest they be exhausted by over-restraint; but even here it is not so much a question of time as of method. To those older, there must be a careful adjustment between study and recreation. The bearing, too, of times of recess upon eating, is not to be overlooked. Children do not endure long fasting well, and if eating hurriedly the tax upon the digestive organs is all the more severe. A quiet meal every four hours is oftener than otherwise the rule for school children. Those who are kept at school until one and then hasten home for a hearty meal often suffer from the fast. Much of the irrita-

bility of children over their tasks the physician can trace to that exhausted vitality which arises from unintermittent exertion, delayed meals, or other unsanitary circumstances. The habits of long fasting or promiscuous eating, which are the legitimate outgrowth of the attempt to finish up the school day rapidly, is largely telling upon the health of our American people.

Such are a few of the more prominent ailments which attach to the modern school-room, and such the chief points that need to attract our attention in its hygienic management.

There are many other matters, such as exercise, mental hygiene, rewards and punishments, and the times and length of study, the best assortment of studies for healthy mental development, etc., which involve the most skillful circumspection of the phenomena of mind, and of those points of contact so frequent and intricate by which mind and body act and react on each other.

On these it is not our present plan to dilate, but only to call attention to their vast importance, their direct bearing on health as well as on mental power, and the necessity that those having the charge of children should rightly estimate the profound and weighty hygienic questions which have so important a bearing on the present progress and future welfare of the child.

It has thus been our object, first of all, to draw attention to the extent of the field of observation, and the immense interests which are concerned in the school period. A great and desirable object is attained if only we can sound to the great public the cry, Attention! There are multitudes who send their children to our public schools in such a routine way that they little think how far their entire life destiny is involved in their experiences there. Even when recognizing that they are to attend for discipline and instruction, there is little thought of the health of the body, which is to be as really moulded and decided there as the progress of the mind. But if only parents pause to think how habits of physical as well as of mental life are there formed, and that the surrounding condition of the child, just as much as the soil and locality of the plant, determine to a great degree its future, it is easy to awaken them to some sense of the interests involved. Good air, right temperature, right light, right posture, cleanliness, right drink, right surroundings, mean far more for the mental as well as bodily con-

dition of the child, than is estimated. Character and future capability for industry, thrift, sustenance are all concerned in the school period, and every citizen should feel it. One of the first remedies, therefore, for evils, is to do just what the State Board of Health is doing here—to draw the attention of the citizen to the reality and pressing necessity of these interests—to the fact that they are largely overlooked, and that to a great degree they admit of correction. The reason for not dwelling upon them more fully or with greater exactness of detail is that investigations on these matters have already been made in various countries and states, which need no new and special experiments in our own State to confirm their accuracy or their applicability to us. The mere statement of the facts ought to be enough to gain the admission from the public mind that a real importance attaches to the subject.

The minds of parents and citizens being thus drawn thereto, with the admission on their part that these interests need attention, the natural question is, What is proposed to be done in order to secure a greater avoidance of existing evils for the future?

DUTIES OF TRUSTEES.

Our first point is that the trustees of our schools need to make these matters a special subject of their own intelligent study and supervision. There is no class of perfunctory officers in our State that more need to magnify their office. They are the appointed guardians, the constituted foster-fathers of a great family of children, committed very largely to their care by the State. Their duty is not merely to learn that there is a school-house, that a teacher has been hired, and that the machine will, on a certain day in September, be put in motion, but to look after the preparative condition of this large child-family as its health wardens. We ask that they hold themselves responsible that the children whom the State, in self-protection as much as in liberality, has assembled for education shall, as far as possible, be divested of all circumstances which will in any wise tend to the least imperilling of physical health. To this end the points which we have noted, and others that experience may suggest, should be subjects of their careful guardianship, and should be attended to as a part of their obligations to the State, and to the district as well, as a token of their heart-interest in the children.

DUTIES OF EDUCATORS.

Next to these, and perhaps practically even more, must we look to the State and county officers of education. They, from their intelligence and information, and personal identification with school-interests on a broader field, may be expected to have good vision over the great field of responsibility opened up before them. The Normal School, the State Superintendent and the various County Superintendents need themselves so to be impressed with the health-interests involved in the education of children, that with the pressing enthusiasm of a far-reaching discernment, they shall push home upon trustees, teachers, all school guardians of youth, the vital necessity of intelligent appreciation of these imminent concerns, and so far as in their power see to it that they are not overlooked or slighted. It is pleasant to know that in our State such offices are generally filled by men who have shown adaptation and capability, and an enthusiastic energy in their work. Although some of them have not yet been able to magnify or enforce these considerations, we believe there is of late a new impression of the critical necessity of new advisement in these regards, which only needs to be deepened by a more thorough study of the subject.

Besides, each individual *teacher* is to be reached. The teacher himself needs a wider view of his own relation to physiology as a study. There are many already that appreciate it as a worthy part of general information, and a branch which may be vindicated for a place in the class-room. But more than this is needed for the teacher who would come to realize the intimate and integral relation of a knowledge of physiology and the laws of health. He needs this not half so much in order that he may teach it, as he needs it in order at all to comprehend his calling. The structure of a man, his physiology and modes of working, and the condition under which the whole being is to be operated in any educational process, are so vital and fundamental that he needs to realize some of this knowledge as an underlying principle in all education. The physical, the intellectual and the moral are so bound together in that composite creature we call a child, that we cannot regulate the developments of children unless we know much of the parts that make up the whole. Some knowledge of each is necessary to the proper management of

any one part. "We cannot," says Maudsley, "understand mind function without embracing in our inquiry all the bodily functions." Mental phenomena have their corporeal conditions, which must be understood physiologically. The real teacher should have studied the entire article with which he has to deal. If his idea of physiology is merely that it is a proper subject for teaching, like botany, he will merely look upon it as an interesting branch of science, and will perhaps teach some of its deductions formally. But it is not until it enters strongly into his conceptions of adequate preparation for dealing with the child at all, that he will come to grasp it with his whole head and his whole heart. A recognition of it as fundamental to all questions of education is needed in order even to give full force to that special department of only one of the parts of physiology known as hygiene.

Thus the teacher will be prepared to estimate the statement when we say that the care of all things that relate to the hygiene of the child or his sanitary surroundings is a part of his occupation. Now-a-days is there not too much of the feeling among teachers, and of the permission of such a feeling by his employers, that he is hired for a few hours each day merely to direct the intellectual development of the child? We take a far broader view of his high professional and official relationship. He is put in charge of a body of youth, in the interests of the State, for the purpose of doing his utmost to make of them such material as will be available for its growth and prosperity. The oversight of the parent and the training of the citizen is for no inconsiderable time transferred to the teacher. To look after the ventilation and temperature and moisture of the room, to secure cleanliness on the part of the pupils, to see that the building and its surroundings are healthful, and that the scholar has secured to him the best conditions of progress, is far more intrinsic to his work than a lesson in geography or a trial of the spelling class.

The three essentials for the teacher in this regard are, (a) that he should himself have a fundamental and practical recognition of the subject; (b) that he should know existing evils and the most efficient remedies; and (c) that he should appreciate his own official responsibility. He must not compliment himself as doing gratuitous and philanthropic work, but know himself de-

fective as a teacher unless in such matters he conserves the highest interest of the wards under his charge, not less than in recitations.

The next condition of success in abating or preventing school evils is to have (a) such arrangements as shall permit the full application of the best known laws of health for school; (b) the ability to remedy known defects, and (c) such tests or knowledge as shall make it possible to acquaint himself with the actual embarrassments.

The first (a) necessitates the right choice of building ground, the right construction of the building and all those conditions which favor the best administration. These need not be specified here, but as it is much easier to construct aright than to amend, all these should be carefully understood by those who plan, and even by others, in order that they may know wherein their own prearranged buildings and methods are defective.

(b) Defects being known the remedies are such as will most nearly conform to what should have been or to those arrangements and conveniences which are granted to be desirable.

The third (c) necessitates a knowledge of the evidences of defect and the ability, if need be, to resort to those expert tests which manipulative science furnishes.

As affording some aid, it may be well for us here to recapitulate some of the best understood principles of management and of avoidance of evils, and to record such tests of defect as are of ready application.

These will not be exhaustive or complete, but will aim to present the best settled views of those who have given large attention to these great interests.

EYE DISEASES, AND HOW TO AVOID THEIR INCREASE IN SCHOOLS.

Have no windows in front of the scholar. Secure as much light as possible from above the level of desks. Outside cornices and near proximity of other buildings should not cast a shade or interfere with the light. The space around should bear proportion to the size and the height of the building and to the height of adjacent buildings, and the size of the windows should be from one-fifth to one-sixth of the floor space, (Cohn, Lincoln, etc.): Burnett insists on one-fourth. So a room twenty feet square

should have about twenty square feet of glass. If the building has its corners pointing to the cardinal points of the compass some advantage is gained as to the direct rays of the sun. (Olmsted.) Gray or blue tints are best for the inside walls and trimmings. Some advocate green, but yellow rays incline to mingle with the green and these are objectionable.

It is better to have the light coming from behind and next best from the left side. For this reason some advocate only left windows for school rooms. But the matter of ventilation is also to be considered. Lincoln sums up the best sustained view, as follows: "Windows on the right are slightly objectionable, as throwing a shadow on the page whenever the hand is used in ciphering, drawing and writing. Windows at the back throw the pupil's own shadow on his book, but this is not a serious matter, except for those who sit next a window, and they have light enough at any rate, while for writing they are extremely well placed as it is usual to turn partly to the left in this exercise. Windows at the left are entirely free from objection, as far as they can be free. The ideal light should come from over the left shoulder, or the right shoulder if one is sitting up and reading, but if looking over a desk this is rather inconvenient, and the best is then a very high light from the left and a little to the front. In brief, the rule for placing windows is *never* in front, *always* on the left; at the back, also, if you choose, but not at the right, if you can help it."

The child standing at the blackboard should never face the light. Blackboards between side windows should be dispensed with, unless the blinds are closed on the side used.

Not only is a squint or cast in the eye often remedied or prevented by proper light, as is shown in Donder's method of curing it by adapted spectacles, but short-sightedness (myopia) is caused or aggravated by studying with improper light, as is also that long-sightedness, which tires with the book or writing at a usual distance.

Indeed, the fatigue, the pain of the forehead, and often slight temporary squint show how the eye is being overtaxed.

SEATS AND DESKS.

Floor space is needed, not only for these, but for ventilation. The average should be not less than 25 cubic feet for each scholar.

A good rule as to the relative height of seats and desks is, "that the desks should be of such a height that the elbows may rest upon them, when the body is erect, without any displacement of the shoulders."

A straight back, or lightly curved at the top, is most available, and, unless coming to the middle of the shoulder blade, should not be high enough to touch its lowest angle.

The desk should usually slant about 30 degrees, but may be made adjustable so as to be accommodated to reading, writing and position.

The distance between the seat and desk will need to be accommodated somewhat to the size of the scholars, but should nearly enable the child to fill the seat while leaning forward. Other points have been already noticed. As desks and seats are exposed to much soiling, they should be made of hard wood, treated with hot linseed oil and varnished, so as to admit of easy cleansing.

All shelves should admit of removal for cleansing, and even ink wells should hold by the rim, so that there be no dust bins beneath them.

THE HEATING OF SCHOOL ROOMS.

The evils to be guarded are excessive heat, excessive dryness, excessive cold, too sudden variations of temperature, too much dust from the heating apparatus, hurtful gases from the heater.

(a) For excessive heat or cold, or too sudden variations of temperature, the thermometer is the ready test. There should be in each school room not less than two thermometers, about equidistant from the centre of heat, and the furthest point in the room. One of these should be about half-way between the floor and the ceiling, and the other about one foot from the floor. Where rooms are larger, and the points from which the heat is derived are more numerous, more thermometers are required. These are inexpensive, and in information to the pupils and regulation of the temperature, will well repay the outlay. It should be the duty of the teacher to register at the opening of the school, at the close of its morning session, and in the middle of the afternoon session, the thermometer records, and to have these

for the inspection of the trustees at their meetings. 68° (F.) is about the desirable average here, but variations from 66° to 72° are within the range fitted for the majority.

(b) Excessive dryness of atmosphere.

The usual wet and dry bulb thermometer, used by the meteorologists, is the most reliable test of this, and will do in place of one of the others. The reading of the dry bulb is the same as that of the wet bulb.

The most healthy state of the atmosphere can be obtained when the dew point of the air is not less than 10°, or more than 20° F. lower than the temperature of the room, and can be easily familiarized by the teacher.

"The dew point is that temperature when the air is just saturated with moisture, so that the least further fall would cause a deposit of water. * * What the thermometer indicates this to be is the dew point. When not thus saturated, the temperature of the dry bulb is above that of the wet bulb, and both, of course, above the dew point. The temperature greatly affects the amount of moisture, yet whatever the moisture may be, the lungs are giving off air nearly saturated. In a cold morning the watery vapor of the breath shows itself, and what is given off by the lungs and skin exceeds that by the urine. If there is excessive moisture with high temperature, we are oppressed with heat out of proportion to the registry of the dry thermometer, for evaporation is interfered with. If, on the other hand, there is great heat with undue dryness, evaporation from the lungs, skin, etc., goes on too rapidly.

"The air in the school-room should be three-fourths saturated with watery vapor. The best way to test the degree of moisture is to suspend two thermometers side by side, one in the usual condition, the other with a bulb covered with a thin piece of cotton cloth, kept constantly moist by dipping a portion of the cotton in a suspended cup of pure water. The difference in temperature between the wet bulb and dry bulb thermometer will indicate the relative dryness of the air. Thus, if the dry bulb marks 65° and the wet bulb marks 60° the air is exactly three-fourths saturated, and the difference between the wet and dry bulb thermometers should not exceed 5° in any school room." A simple contrivance for testing moisture is one suggested to me in a note from Prof. Kedzie, of Lansing, Michigan. "Write a

sentence with chloride of cobalt on white paper, using a little glycerine to keep the writing in a moist condition if the air is not too dry. When moderately moist, the chloride of cobalt is in a hydrated form, and is then pinkish but not strongly colored, and the writing is nearly invisible. In a very dry air the chloride becomes anhydrous and is deep blue, and becomes visible all over the room, especially if written with a camel's hair brush to make a broad mark." I have a single specimen sent me six months since which always, on being heated a little, becomes blue, but breathing upon it the blue soon disappears.

Even a hair as used in the hair hygrometer, by the changes on the dial plate, shows how decided is the effect of varying degrees of moisture. It marks the degree of humidity quicker than do the dry and wet bulbs.

In the school-room the almost universal registry, during the period of artificial heating, is that of too great dryness.

The remedy is to provide water for evaporation, not only in the furnace, or by warm water placed on the stove close enough to the fire to secure evaporation, but also by tin hot water holders inside of such registers as pass the hottest air.

Baked and dried air is very different from the outside air meant for breathing. Attention to this moistening of the air is indicated even where it is not thus tested each day. "For temperatures between 60° and 70° Fah., if we moisten the air we may reduce, by several degrees, the temperature without suffering discomfort."—(*Winsor*.)

Chilliness may denote dryness of air rather than a low registry of the thermometer.

"One result of the poisoning of the blood by impurity of air is the extreme susceptibility of the system to cold."

In the summer, it must be remembered also that the temperature of the school room and the humidity of the air are affected by exposure, by draughts and by proper *housekeeping*. The care of the janitor between school hours, as to airing, as to closing against direct rays of the sun and giving it the full advantage of night cooling, are all important. During school hours, too, the parts exposed to the sun should be shaded by the blinds and draughts secured in the best directions. While we may not regulate outside temperature, we find that the inside temperature of houses during the absence of artificial heat is greatly

varied by modes of construction, by airing, by regulation of light and of sun rays, and by the various devices or neglects of high graded and degraded housekeeping.

As dust and hurtful gases from the heating apparatus make a contamination of air, which naturally associates itself with dust and foul gases from other causes, these will be fully considered under the head of

VENTILATION.

The chief call for this in school rooms arises from,

- (a) Stagnation or imperfect motion of air.
- (b) Carbonic acid gas accumulated from breathing, from stoves and lights, etc.
- (c) Other gases from overheated stoves, or from decay of organic matter, as furnished by the individual and his surroundings.
- (d) Dust and organic particles of various kinds floating in the air.

Imperfect motion of air may be caused by the state of the atmosphere, or by conditions incident to the room in which the pupils are congregated. The chief difficulties arise from overcrowding, from imperfect provision for that circulation of air which takes place in the open and from the production in the room of those defilements of air which make its more rapid change desirable. The indication is to prevent as far as practicable all contamination of the air and then secure for it the greatest freedom of motion compatible with freedom from undue draft. Air may move at the rate of about two feet per second without perceptible motion or draught. Happily, even this velocity is not needed for ventilating purposes under usual conditions. It may be increased where extreme heat or moisture or other embarrassments render the air more stifling than ordinary.

A small instrument known as an *anemometer* measures the velocity of the currents of air. Casella's small air meter answers a similar purpose.

The revolving paper mills of children, or a light feather will often indicate the direction of air currents. These practical lessons in philosophy, in the hands of a good teacher, are a part of education as well as some of the instructions in natural

philosophy contained in the text books, and are fully as interesting as well as of immediate practical service. A thermometer in the line of a draught will show a degree of heat much less than one quite near it, not thus exposed.

To secure proper change of air various methods are devised. Some trust entirely to the windows, which according to the etymology given by some, were so called because found of service as wind doors. Windows ventilate best when slightly lowered from the top and raised from the bottom.

In other cases chimneys are made available, especially when occupied by fires. For summer and early fall ventilation these are of much service, and their flues may have connection with the school rooms which are easily regulated. A downward draft is easily detected by a lighted match or taper, and where there is need of an upward draft not found, the heat from a kerosene lamp or a gas jet, properly adjusted, is sufficient to move the body of cold air in the shaft.

Sometimes a shaft is provided through a building connecting with a louvre window or cupola upon the ridge of the roof by which an upper current is secured and rapidity of current increased.

These are ordinary resorts available in connection with what is known as natural ventilation.

There are besides two methods of artificial movement of air. In the one known as the plenum or propulsion method, by means of a fan or other contrivance, air is driven into rooms in imitation of a breeze, and is sought to be regulated in its introduction by various arts and appliances.

If this air thus propelled can be so atomized as to enter without sensible currents, you secure a regulated flow.

The other is that known as the aspiration, vacuum, suction, or exhaustion method.

Instead of pushing out air by driving in new air, and so making circulation, it pulls out air, and thus causes other air to rush in its place, and so currents are caused.

Sometimes the one method is applied to the introduction of pure air, and the other to the removal of the fouled air, or they are interchanged in other ways.

We can not here discuss the various methods and appliances of artificial motion of air, but only allude to them here in order

that by an outline of the principles involved, when used in our schools, those employing them should recognize that, in order to succeed in a hygienic sense, they must be carefully regulated. At present we think we may say that the introduction of air, by some method of propulsion, in cases where more than natural ventilation is needed, is more generally applicable.

CARBONIC ACID AS A POLLUTION OF AIR.

Our next inquiry is as to the evidences of the presence of carbonic acid gas, accumulated from breathing, from stoves, lights, etc.

The degree to which this needs guarding is apparent from the fact that while a cubic foot of pure air does not contain more than a cubic inch of carbonic acid gas, a cubic foot of air given out by the breathing contains seventy cubic inches of this gas. So one person in a tight place containing 56 cubic feet of pure air would, by his breathing alone, bring up its amount of carbonic acid to one per cent. To this must be added the amount occurring from the decayed particles always being given off by the lungs, the skin, and from various suspended particles undergoing decay in the atmosphere. Beside, if there is fire or light, every cubic foot of coal gas adds two cubic feet of carbonic acid and takes away ten of oxygen.

Three hundred and fifty cubic feet of air may be stated as an average of the amount needed each twenty-four hours. As we are thus constantly befouling the air of a room by our own breathing, and by organic particles, combustion, etc., in order that the amount of carbonic acid shall be kept at from 1-10th to 1-6th of one per cent., 2,000 cubic feet of air must be admitted each hour for each person. Practically we know that we cannot move the entire air in a room oftener than three times per hour without draught. On this basis about 650 feet of air is needed for one person; but the amount theoretically needed is modified by the shape of the room, by the fact that it is not air-tight, and that rooms themselves greatly vary as to their perviousness and other modes of ingress and egress of air. Thus the reckoning is often found extravagant for the open sitting room and inadequate for the close jail, the hospital, or the crowded soldiers' barrack. School-rooms occupy an intermediate place, and tests

already noted show that they are generally too confined. We therefore take the general guiding facts, and test their variations by actual experiment.

The most available test is that given by Dr. Angus Smith, which is varied in details by some experimenters. The direction is: Let us keep our rooms so that the air gives no precipitate when a ten-and-a-half ounce bottle full (*i. e.*, of air,) is shaken with half an ounce of clear lime water. Prof. Kedzie puts it thus:

To test whether air does not contain more than 8 parts of carbonic acid in 10,000 of air, fill an eight ounce vial with pure water (rain water). Empty out the water in or amid the air you wish to test; the vial will then be filled with the air of the room. Pour into the vial half an ounce of clear lime water and shake thoroughly. If it remains perfectly transparent, without any trace of milkiness or turbidity, it does not contain more than 8 parts of carbonic acid in 10,000.

Prof. H. B. Cornwell states it more fully, thus: "Shake burnt lime in a bottle with water, and allow it to settle clear. (You thus have fresh lime water.) Clean a very wide-mouthed bottle inside with a linen cloth, exhaust the air by suction through a tube, with great care not to breathe into the bottle, which would have to be cleaned again. Pour in one half-ounce of clear lime water and shake well. If the air contains not more than the percentages of carbonic acid below, and the sized bottles there given are used, no turbidity will ensue from the carbonate of lime."

Table to be used when the point of observation is "No Precipitate:"

20.63 oz., avoirdupois, bottle will have no precipitate if the carbonic acid is.....	0.039
15.60 oz., avoird., bottle, if it is only.....	0.040
12.58 " " " ".....	0.050
11.57 " " " ".....	0.060
9.13 " " " ".....	0.070
8.05 " " " ".....	0.080
7.21 " " " ".....	0.090
6.54 " " " ".....	0.100
6.00 " " " ".....	0.110
5.53 " " " ".....	0.120

5.15 oz., avoird., bottle, if it is only.....	0.130
4.82 " " " ".....	0.140
4.53 " " " ".....	0.150
3.52 " " " ".....	0.200
2.92 " " " ".....	0.250
2.51 " " " ".....	0.300
2.01 " " " ".....	0.400
1.71 " " " ".....	0.500
1.51 " " " ".....	0.600
1.10 " " " ".....	1.000

In other words, as instances from our table, a bottle holding eight and a half ounces of air, with a half ounce of lime water shaken in it, would show no precipitate or turbidity if the amount of carbonic acid was not more than .08, *i. e.* eight parts of carbonic acid in 10,000 of the air in the room and bottle.

If a six ounce bottle is used, with the same amount of lime water, there might be .11 parts of carbonic acid to 10,000 of air, and yet there would be no turbidity; or if a two-ounce bottle was used there might be forty parts of carbonic acid to 10,000 of the air, and yet no turbidity ensue.

Now if a bottle of eight ounces, with a half ounce of clear lime water, gives turbidity, you know that there is more carbonic acid in the air than is regarded as desirable for a school room.

If a six ounce bottle, with a half ounce of lime water, gives turbidity, you will know that there is more than eleven parts of carbonic acid to 10,000, which is an excess.

If a two ounce bottle should give turbidity you then know that there are over forty parts of carbonic acid to 10,000, while there should be not much over eight parts to 10,000.

By testing with different sized bottles, after you have once found turbidity, you will be able to find out nearly the proportion of carbonic acid.

Although carbonic acid, in moderate excess over the amount found in the open air, is not so actively poisonous as some imagine, yet as displacing or substituting oxygen, and as poisonous when in large excess, its quantity needs watching. Our breaths furnish it, our heating and lighting appliances furnish it, and it is one of the gases of that decomposition or decay which is con-

stantly going on where organic particles are separated from their vitalized relationship.

So it is more apt to be excessive in quantity in close or heated rooms than are most productions of decay, combustion and change. Even beyond its own evil import, when it is present in excess it affords an approximate criterion of the deterioration of the air in other and worse regards.

Yet where there are special sources of contamination, as from bad surroundings, super-heated air, ill clothing, untidy habits, or unhealthy persons, the carbonic acid is not the full test. There are vitiations of air of which it can not be the measure. Ammonia, sulphuric acid, sulphuretted hydrogen, sulphide of ammonia, some of the nitrogen compounds, some of the acids formed by the oxidation of oleic acid, with nitric acid, some undefined gases, such as sewer gas, and various volatile excretions from the lungs and skins of animals, also contaminate the air or in their oxidation burn out its chief vitalizer.

Of these the excess of carbonic acid is not a very accurate test, although leading to suspicion as very likely to have them in company when found largely amid animal existence. Often the quantity from a lime kiln would not injure, while the same amount in school air would betoken a presence of other gases which are doing the most of the real harm.

Ammonia may be detected by the logwood paper. "Tincture of logwood is evaporated to dryness and the residue *dissolved* in ether; strips of filtering paper are dipped in it, to which ammonia gives a brownish color." Sulphuretted hydrogen is best detected by exposing strips of blotting paper dipped in a solution of acetate of lead.

Ammonia sulphide is detected by paper dipped in a solution of nitro-prusside of sodium.—(*Parkes*.)

The entire absence of ozone, or its speedy destruction when generated, generally betokens much organic matter, which is rapidly oxidized by this agent. The presence of ozone may be tested by Houzeau's test. "Expose litmus paper of a neutral tint soaked in a dilute solution of iodide of potassium; the potash set free by the action of the ozone turns the paper blue. The same paper, without iodide, would indicate the extent to which the effect might be due to ammonia vapor."

Both in this country and England patent ozone generators are in

use, which regulate the burning of phosphorus by which ozone, or negative oxygen, is produced. As ozone is a ready oxidizer of organic matter, and is in the state of a gas, it seems specially fitted for the removal of gases of decay from indoor atmosphere, while free ventilation both neutralizes and dispels organic matter. We believe that ozone may yet become a valuable aid in purifying crowded school-rooms during the hours of occupancy.

HEAT, AS A SOURCE OF HURTFUL GASES.

During a large portion of the school year in our climate, as we are dependent upon artificial heat, the maintenance of the purity of the air is much complicated thereby. Besides heat itself is the great factor in the regulation of currents, and so of ventilation. Artificial heat is very liable to introduce gases which deteriorate air, and so comes to be a source of contamination in common with other allied sources of befoulment. Our effort with artificial heating should be to furnish just for breathing what is furnished out of doors when the atmosphere is warmed by the sun. Our imitations are not very successful, as they become more artificial.

In combustion carbonic acid is, of course, always produced, and besides, from the nature of the heating material now generally used, and from the often imperfect combustion carried on by artificial apparatus, we get various gaseous and acid sulphur compounds, etc. While in a perfect system of heating these would all find their way through the smoke flue, yet with impeded or red-hot combustion, imperfect metal and imperfect joinings of parts, very much often escapes into the rooms.

The odor is detected, the stifling felt, or if not, the house plants, the books and the furniture in due time register the effects.

Sulphuretted hydrogen, sulphurous and sulphuric acid, and carbonic oxide are not unfrequently to be detected by chemical tests in the heated air. More recently special attention has been called to carbonic oxide, which contains one more equivalent of carbon than the carbonic dioxide generally known as carbonic acid gas. It is far more deleterious than the latter. Less than one-half per cent. has produced poisonous symptoms, and in charcoal suffocation more of the effect is due to it than to the

carbonic acid. It increases in quantity when fuel is burned with an inadequate supply of pure air.

It is very apt to be generated when anthracite coal heats cast iron cylinders to a red heat. Even wrought iron stoves, when overheated, will pass much of it out through imperfect joinings. The contact of the air with the over-heated metal seems also to deprive it of much of its oxygen.

Much of the weariness, headache and oppression arises from such air by heat diminished in its oxygen, by ill conducted combustion laden with carbonic oxide and various deleterious gases, and from the dryness produced by superheated air.

According to Prof. Böttcher, strips of linen or cotton soaked in a concentrated solution of chloride of palladium, as free from acid as possible, assumes a very black color when brought in contact with carbonic oxide.

The value of sensations as a test is not to be overlooked in close and wrongly heated rooms. Children, and especially those at home used to a pure air, are available and sensitive tests of impurities. When many complain of headaches, closeness of air, depression and discomfort, it is quite likely that something more than carbonic acid is the cause, and that organic matter or carbonic oxide, or some of the gases of decay, are present.

Scrupulous and enforced cleanliness of person is also of great importance for schools, as excretions from the skin and the soiling of clothing are equally contaminating with outbreathings and surroundings.

DUST AND ORGANIC PARTICLES IN AIR.

Dust and organic particles, derived from other sources than those mentioned, besides their tendency to decomposition, inflict evil by mechanical irritation. An examination of the minute particles in public buildings in New York City, revealed a considerable amount of fine powder of horse manure. Pollen and particles of various kinds are not unfrequently found mingled with the air, especially when it is very dry.

These are to be detected by sunbeams, by the microscope, and by optical experiments such as those of Tyndall in his recent lectures in this country. Under the British houses of Parliament they have an admirable arrangement by which all the air

is strained and moistened. The deposit left upon the dampened hemp or cloth is quite convincing as to the need of such a device.

In school rooms it is of especial importance that sweeping and dusting be done with care, for if there is much dust to raise it is pretty certain to be raised. The furnaces often add dust through the registers, some of which might be retained by moistened coverings frequently changed.

Dry cleansing of the walls and ceilings should be occasionally attended to, even during term time. There can be no doubt but that the application of lime-wash to the wall above the wainscoting, once or twice on Saturdays during term time, in very crowded schools, is of service.

It is thus evident that neither the scientific laws as to air nor artificial arrangements are entirely sufficient. We need to understand the general requisites, the sources of befoulment, the methods of test, and then to exercise that watchfulness without which most methods fail, and with which science and art now afford us sufficient aids to secure successful results. These none need more to know and apply than our school authorities, and with no class of interests in regard thereto is our State more identified than with that of its children and wards in its public schools.

WATER SUPPLY.

Having already alluded to the kind of water supply desirable, it only remains here to notice the easy tests which may indicate its condition, or which may lead to such suspicion as to call for laboratory investigation.

Water which tastes or smells badly or is turbid, is always suspicious, and either to be tested or refused. If organic matter is present a few drops of permanganate of potassium added will give a red color, which will quickly disappear. The water should be at a temperature of about 140° F., to make the test more satisfactory. The solution of permanganate of potassium becomes brown or turbid in contact with suspended or dissolved organic matter. "If water acts greatly and rapidly on potassic permanganate, nitrates or sulphuretted hydrogen will probably be found; if not, the rapid action is from organic matter which

is decomposing; probably animal, as vegetable matter acts more slowly."

A closer test as to appearance and taste is to put the water in a close flask or long bottle at ordinary temperature. It should still after a few hours be clear and colorless, and when shaken give no offensive smell.

It is important to know whether much chlorine is present in water, for although a little salt may be the innocent cause, yet as chlorides increase in proportion "as a water is contaminated by sewage, any unusual amount of chlorine is suspicious." Ordinarily 1 to 2.3 grains of chlorine per gallon is all that should be present.

Prof. H. B. Cornwell, E. M., of Princeton, kindly gives me the following method:

Procure a wide-mouthed bottle of clear, white glass, holding 5 ounces up to a certain mark. Put into it 5 ounces of the water to be tested, and add enough pure chromate of potash to give when dissolved a distinct, clear, yellow color. Get the druggist to weigh out for you 15 grains of crystallized nitrate of silver, and dissolve this in 16 ounces of rain water, caught after several hours of hard rain, in a clean vessel. (Distilled water is better.)

Some means of measuring out small quantities of this nitrate of silver solution will be required. A graduated *minim* measure, as used by druggists, will serve very well; if this cannot be procured, a homeopathic vial holding a drachm (one teaspoonful) may be graduated into quarters, or even sixths, by marks scratched on the outside with a file, and will then do very well.

To the five ounces of the well water to be tested, containing the chromate of potash, add from the graduated measure, with constant stirring with a glass rod, just enough of the nitrate of silver solution to produce a *permanent* reddish tint. A reddish orange color is deep enough.

Try the same experiment with two or three well waters, which, from their location and qualities, may be presumed to be free from sewage or similar contamination, and if it is found that the well water first tested requires half as much again of the silver solution, or twice as much, or possibly even more, to produce the reddish tinge, it certainly contains more chlorine than

the soil ought to yield and may be suspected of sewage contamination.

As regards using the homeopathic vial for a measure, considerable accuracy may be obtained by making first a rough experiment, and then a more careful one on a second portion of each well water, taking the precaution this second time to add the last quarter or half vialful of the silver solution (found to be necessary by the rough experiment) drop by drop, until the permanent reddish tint is produced.

It is best to set the bottle holding the water to be tested on a piece of white paper, and to rinse it thoroughly, before making the test, with some of the water to be tested. It is best not to make the test immediately after a heavy fall of rain. The silver solution will make an indelible stain on clothing. The reddish coating formed in the bottle used for testing the well water, after several experiments, is easily removed by nitric acid, as also the blackish stain that may be formed on the measuring vial. The nitric acid must, however, be very thoroughly removed by rinsing with rain water.

The silver solution should be freshly prepared, or if kept a very little time should be protected from the light. Water near the sea naturally contains more chlorine than that of mountain districts, but in most cases the test is informing, where there is no unusual addition of common salt or other chlorides to the soil.

Such are the principal matters to which in considering the care of children in the home and the school, it has seemed proper for us to invite executive attention, and, through you, the thoughtful consideration of the parents, teachers and guardians of our State free school system. The building of a body is as important as the building of a brain. If only we can help to impress all with the urgency of the need to guard carefully these school-room conditions, it is our hope that in the future we may aid in devising plans of improvement, and in suggesting such scientific and practical tests as will not leave us in doubt either as to real conditions or methods to be adopted for securing alleviation of existing evils. Our hope is thus to co-operate with those who are endeavoring by a free education to make each child fit for such life-work as shall bring happiness and prosperity to the people and thus confer a blessing on the State.

DOMESTIC HYGIENE.

BY J. M. RIDGE, OF CAMDEN.

The great and transcendent necessity of having pure air, pure water and pure food in the house, will be admitted by all candid persons. For if these, which are the chief sources which maintain life, are contaminated, then the citadel of life is in great danger of destruction. But to come at once to the more practical details of the subject. What are the avenues by which these stealthy foes, the germs of avoidable disease, enter to surprise and sap the citadel of life? The same as those through which the supplies for its garrison are introduced. The nostrils, into which benignant Deity once breathed the breath of life, are too often the conduits for the miasma of death, and the bread, which should be the staff of life, proves but a broken—even a poisoned—reed, piercing with a deadly wound the bosom that unsuspectingly leans on it for support. The object of the hygienist, then, is to convince the people of the absolute necessity for pure air, wholesome food, and healthful beverage to bodily vigor and length of days; to make them understand that to neglect to ensure these is to disregard the claims of laws as inexorable as those of gravitation; that when the head of the household, in the full vigor of manly maturity, or the darling of the family, in the early bloom of perfect health, is suddenly snatched away by the grim destroyer, it is no more the part of piety than it is of wisdom to prate with folded arms of the mysterious dispensations of Divine Providence, and urge submission to His will. This is but to charge the results of our own stupidity and neglect upon our Maker, or as another has forcibly expressed it, “to flout our filth in the face of Deity.” Preventable disease, which it may be fondly hoped will one day include all disease, may indeed be a scourge in the hand of the Almighty, but it is for the infraction of those of his laws which are written in the book of nature, not of revelation. The book of revelation does

indeed contain a hygienic, as well as a moral code, so comprehensive and searching in its conception as to indicate Divinity as its originator, and so clear and practical in its details that, were it studied with one-tenth part the devotion which is bestowed upon other portions of the book, and were an honest effort then made by Christian nations to live up to its strict regimen, we might almost look for a renewal of the forty years miracle of the desert in the complete stamping out of all disease. And the key note of this admirable system is *Purity*—purity of air, purity of food, purity of water, purity of clothing, purity of habitation, purity of person, purity of life. Beyond this we shall never get as a foundation principle for sanitary science. The hygienist will, however, but half have done his duty when he has educated the public conscience up to the highest pitch of sensitiveness to the sin of uncleanness. He must also show how it is to be avoided. To this end he must summon to his aid the chemist, both the detector and destroyer of impurities in whatever element of nutrition they may exist; the geologist, whose practiced eye reads upon the surface the occult conditions beneath, which may generate disease; the engineer, without whose aid he will make but sorry work in his efforts to remove those accumulations of filth, which he so well knows to be the hot-beds of pestilence; and the architect, in whom we must put our trust for an air as pure within our homes, our churches, our concert halls and our schools as that which sweeps, laden with health, over the beautiful and odorous hills. And now we come to the consideration of pure air, in our dwellings, as one of the necessary conditions to domestic happiness and health.

Pure air, according to the numerous analyses of Dr. Angus Smith, is composed of 20.99 per cent., by volume, of oxygen, .033 per cent. of carbonic acid, and the rest of nitrogen, watery vapor and traces of ammonia. We shall now direct our efforts to the pointing out of the means by which the air in our dwellings may become polluted, and also those by which it may be preserved in its purity. We change and pollute the air within our houses in two ways: 1. By admixture of substances which were not in the air when it came to us; and, 2. By changing its normal composition.

Both are unavoidable, but there are limits which must not be overstepped.

The impurities may be in the nature of gases or dust. We often become aware of them by our senses, by sight, by taste, but mostly by smell. The last sense is exceedingly sensitive for many substances; for instance, traces of ethereal oils. Nothing is more wonderful than its acuteness in some savages and animals. If we consider the minuteness of the substances left by hunted game on the soil, which it scarcely touches in its flight, and how the dog detects them even a long time after, we cannot sufficiently admire this acuteness of the sense of smell.

Other substances make themselves known in other ways, sometimes by some physiological effect. Oxide of carbon, for instance—a gas which is generated from burning charcoal—is not perceived by any of our senses, but if it is present in air to the extent of a half per cent. only it destroys human life after awhile.

Other substances again, as the products of distillation of fats, or the smoke of wood, irritate the membranes of the eyes. Other vapors and kinds of dust act on the taste; for instance, aloe-powder, etc., etc.

We rightly consider all air which acts on our senses or our feelings differently from air in the open, to be polluted.

The second way in which we render air impure on its journey through our houses is that of altering the quantities of its components. We deprive it of oxygen by our respiration, by the burning of lights and fires; we increase its carbonic acid and its water by the activity of our lungs and skin, and by numerous proceedings of the household.

All these pollutions and alterations are partly avoidable, partly unavoidable. Among the latter are those by our lungs and skin, because we cannot live without producing them. To the former belongs everything that from a want of cleanliness, careless treatment of waste and refuse, passes into the air-current. It is an inexcusable waste of ventilation, if it is directed against avoidable pollutions of the air. If I had a nuisance in my room I should be very silly if I kept it there and trusted to stronger ventilation. The rational way is to do away with the pollutions, not to keep them and to fight them by ventilation.

Without strict cleanliness in a house or public institution, all contrivances for ventilation will not do much good. The proper domain of ventilation begins when cleanliness, by rapid removal

or careful shutting off of air-polluting substances, has done its best. It is only against the deterioration of the air by respiration and perspiration, which is beyond the control of cleanliness, that ventilation can direct its power, and against this deterioration this power must be chiefly directed.

A series of examinations has resulted in the conviction that one volume of carbonic acid in 1,000 volumes of room air is the extremest limit which divides good from bad air. This is generally adopted and practically proved, provided always that man is the only source of carbonic acid in the space in question. And it has also been ascertained, by careful examination, that the quantity of air necessary to maintain man in a healthy condition, is 2,100 cubic feet per hour.

In the city of Camden and vicinity, so far as we have been able to observe, there is no system of ventilation attached to the private dwellings, and, therefore, the external air makes its ingress and egress through the doors and windows of the houses. Necessarily under such conditions the air of the dwelling houses must be more or less impure. In some instances we have found that the privies which are located in some of the houses, owing to the imperfect closure of their valves, admit foul air from the culverts into the houses to the great annoyance of the family, and, in a few cases we believe that typhoid fever has resulted therefrom. It is therefor, better never to have privies within the dwelling houses. Also, a very prevalent custom in our neighborhood is to close the windows and doors against the free admission of light which is as necessary to health in the house as good ventilation by pure air. We would, therefore, say to those who are fearful of the discoloration of their carpets and warping of their furniture that it would be better to cover their carpets and furniture, and thereby protect them from the light, but by all means to admit freely into their dwellings the *pure* and *harmless* sunbeams of heaven, which are so necessary to the maintenance of good health.

Another bad custom which has come under our observation not unfrequently, is that of using bed clothing which has been in contact with persons having contagious diseases—such as typhoid fever, typhus fever, diphtheria, scarlet fever, small pox, etc., etc. In some of the more virulent of these diseases it would be far better to burn the clothing rather than run the risk of using

it again, even after a thorough boiling and use of disinfectants. The case we will mention shows the dangers of this custom, as we believe. A little boy about 16 years old was affected with typhus fever in this city. We were summoned to attend him. We had him put in the third story of the house, in care of a good nurse. The family was not permitted to go to, nor remain in his room, but merely to send articles of food, etc., thereto. After he recovered we ordered the clothing burned, which, it appeared afterwards, was not done, but it was packed away in the garret, after being merely washed and dried.

The family moved out of the house in which the disease occurred into another some three or four squares away, and in the following winter the bed-clothing which was on the boy's bed was unpacked and used. Very soon after that, typhus fever broke out in the family in the most virulent manner, and did not cease until three members thereof had fallen victims to its ravages.

This case clearly indicates that all clothing which has been in contact with contagious diseases should be thoroughly disinfected, if possible, or burned.

In this connection we would commend to the attention of our citizens a system of ventilation which may be applied to both public and private buildings.

Whilst general hygienic laws attempt to protect the purity of the external air from vitiation, we must also secure free admission of it into our houses, and provide means for its escape as soon as it becomes unfit for use. This constitutes the science of ventilation, in which much is yet to be learned. In such a climate as ours it is necessarily associated with the subject of artificial heat. The old idea of ventilation was to admit fresh air at a low level into the room, and allow it to escape at a high level. This, however, was found to be very wasteful of heat, especially when the source of heat was a hot air flue; as the warm air on entering, immediately by virtue of its rarefaction, ascended to the ceiling and then escaped through the ventilating aperture, without having warmed the apartment, and leaving the air, which did not lie directly in the path of its current, cold and stagnant. Sanitarians, therefore, have been led to think that, both for efficient renewal of air and for economy of heat, the

true plan is to have the foul air escape near the floor, as it is in that most effective of all ventilators, *the old-fashioned open fireplace*.

In order to ensure this result in houses heated by warm air flues, a very ingenious device has been brought forward by a well-known citizen of Germantown, Mr. George R. Barker, which has so far met the approval of scientific men in Philadelphia, that it has been introduced into all the new buildings of the university, a practical endorsement which makes anything beyond a simple demonstration of its design quite unnecessary at this time. At about the level of the floor of the apartment which it is proposed to heat, the masonry hot-air shaft in the chimney is hermetically surmounted by a cylindrical tin or iron flue, somewhat diminished in diameter from the lower end for a short distance up, in order to leave a considerable space between it and the original flue walls, and curving over so as to discharge its contents horizontally into the room.

Immediately below its open mouth, terminating in a register, another register, entirely separate, although for the sake of beauty made in one piece with the first, opens into the primary flue. Now, what follows the entrance into the room of hot air from the supplementary flue? Simply this, that the warm air rises to the ceiling, becomes chilled, falls, and is distributed through the room, and finally, forced by the incoming stream of warm air, seeks an exit. This it discovers at the second register immediately below where it entered, having made the complete circuit of the room, given up its heat, and taken in return whatever of impurity it could come in contact with, of a portable or diffusible character. Here it finds the necessary element for ascension, namely, a heated flue, and readily passes out and up. A most complete circulation of the air of the apartments is thus secured, and at the same time the heat is all utilized.

Before we conclude this part of our subject, we will notice that attempts have been made from time immemorial to preserve the air of the sick room from contamination through unwholesome, offensive or contagious emanations from the persons and excretions of the patient, by the use of chemicals. Many substances so used have been simply deodorizers. Others have masked the unpleasant odor by a more powerful, but often disagreeable and pungent odor of their own. None have fully met the requirements of the case. Very recently, however, there has been a

most important addition to our armamentarium for such purposes, in the shape of a chemical known as salicylic acid. For the knowledge of the remarkable antiseptic properties of this agent we are principally indebted to Dr. Hermann Rolfe, of Leipsic, Germany, who was led thereto from the fact that he succeeded in making it from carbolic acid and carbonic acid, through the combined action of caustic soda and moderate heat. His investigations show that it scarcely has a rival as an antiseptic, and yet is inodorous, almost tasteless, and quite unirritating to the tissues, having none of the pungent or escharotic properties of carbolic acid.

One practical difficulty in its employment as a disinfectant of apartments, is its sparing solubility in water. European authorities advise the addition of phosphate of soda, as greatly increasing its solubility.

Mr. Shinn, however, a well-known pharmacist of Philadelphia, has discovered, as the result of experiments with a large number of solvents, that borate of soda, commonly known as borax, is very much more efficient.

This salt is the more desirable for this purpose, from the fact, but recently pointed out, that it is itself a powerful antiseptic. Salicylic acid, as an atmospheric purifier, should be dissolved with borax of soda, in the proportion of a drachm of each to three ounces of water, and distributed throughout the air of the apartment of the sick room by means of an atomizer. These articles may be obtained at any well regulated drug store in the country.

WATER AS RELATED TO DOMESTIC HYGIENE.

The place which water occupies in domestic hygiene is so important and extensive, that volumes would be required to give the subject that fullness of detail that would be desirable in a complete treatise on hygiene. We shall, therefore, in this report discuss only such points as are of primary importance and demand the attention of all.

All water comes from the atmosphere. There was a time when there did not exist any water in the liquid form on the surface of the earth. But as the earth has gradually cooled, the atmosphere has become less able to hold the watery vapor dissolved,

until now at the ordinary temperatures it contains but a very small per cent., and this is constantly varying with the changes in temperature and position.

Water vapor becoming condensed by change of temperature falls as rain in a very pure condition, and is returned to the air as vapor by various means, thus keeping up a constant and unbroken circle. Some of the water, as it falls, runs off into streams; some evaporates directly; some is absorbed by vegetables, and the rest soaks into the ground by its own weight and the force of capillary attraction, until it reaches an impermeable strata. Thence it follows the dip of this strata, and is discharged by springs to the rivers and ocean, where evaporation is rapid and constant.

For domestic uses water is obtained by sinking wells down toward the strata upon which the water lies, or through them, producing artesian wells, or from natural springs or rivers.

As rivers receive the water which washes the surface of the land, as well as spring water, river water contains a greater variety of impurities than any other. Spring or well water contains only those soluble substances which exist in the soil where they are located.

In selecting a site for building purposes, public or private, one of the first things to be considered is the water supply.

In the country where the land in the vicinity is kept clean, and no manures are used, and the soil contains no poisonous minerals, well water or spring water is always pure and healthy.

But in cities where the ground is covered by and saturated with poisonous organic and inorganic matter, *well* (or *pump*) water is not pure enough for domestic use, and we could not recommend it for such purposes.

We have not as yet been able to investigate the water supply of the different towns and cities of our State, but in regard to the water supply of Camden, we can say that it is taken from the Delaware river, and was purer last summer than that of Philadelphia taken from the Schuylkill, though our river is poisoned by the drainage of six large cities, which deposit tons of organic matter into it as it ebbs and flows.

Camden is situated upon an alluvial deposit and partly on "made" ground, very poorly adapted for wells. Some fifteen or twenty years ago there existed one or two good springs in the

city, but these have been destroyed. There are in Camden a number of pumps, which are not healthy, though much used. We noticed three cases of typhoid fever which appeared traceable to one of them.

On Mickle street, above Third, there is an artesian well. This well is about eighty feet deep, and passes through two or three strata of clay. Between these clay strata there were sandy, water-bearing deposits, but the water appeared to be surface water, and was offensive to the taste and smell. The water, which rises in this well to within a few feet of the surface of the ground, has the appearance of having come from the Delaware river by percolating through its bed, and was very good, but now seems to be contaminated by surface water, perhaps through some imperfection of the tube. Here I would especially call attention to a fact that seems almost, if not entirely, lost sight of by well-makers, namely, that when a well wall or tube passes through impermeable strata, as clay or rock, which has above it surface water of inferior quality, *water-tight* connection must be made between the wall or tube and this impermeable layer, or there will be contamination. The wall must also be completely water-tight from bottom to top.

Perhaps one of the best ways to provide water for domestic purposes is to collect the rain from the roofs of houses, or from surfaces made for that purpose. This has been demonstrated at Atlantic City, for last summer the best water I found at any place was there, where the inhabitants depend altogether upon the roofs for fresh water. The first washings from the roof should not be allowed to run into the cistern.

The average yearly rainfall throughout the State of New Jersey is about thirty inches, but varies in different parts, some towns receiving six inches more than others.

The average yearly fall in Camden is about forty-four inches. This amount has varied as much as twenty inches in different years.

In calculating for a water supply from rain, the yearly rainfall and the longest period of drought are important factors.

It is usually calculated that one person requires about twelve gallons of water per day for all purposes, though in some places a supply of three or four gallons is all that is had, but of course the people are not cleanly. In large towns and cities there is

generally allowed about ten gallons daily per individual for domestic purposes, ten for public and ten for manufacturing purposes, and forty gallons per head is even supplied in many cities.

A healthy adult requires daily about 85 ounces of water as drink and in food as a nutritive. The other demands, such as cooking and personal cleanliness, vary much according to the individual. Cleanliness is not only next to godliness, but is absolutely necessary to health, and, from Hippocrates down, every intelligent physician has recommended water bathing, both as a prophylactic and curative agent, when properly used. How few persons seem to appreciate the value of the *bath*.

In this respect the ancients shame us, for their arrangements for bathing were among the most important and extensive works in all towns and cities, and the remains of some of the ancient public baths exist to-day as monuments of art and culture.

Water, in a state of purity, is a compound of oxygen and hydrogen, containing 8 parts, by weight, of oxygen to 1 part of hydrogen. This oxide of hydrogen is what the chemist calls pure water; and for many of the purposes of chemistry it is necessary to obtain it as nearly as possible in this condition of absolute purity. This is usually effected by distillation, more or less frequently repeated, according to the degree of purity required. But when speaking of water as applied to drinking and culinary uses the term has a somewhat different signification. A water which appeared bright and clear, and possessed an agreeable taste, would be by most persons called pure; and if it contained none of those injurious substances that are undistinguishable to the taste, it might be considered pure, as far as all domestic uses are concerned. Chemically pure water is not an agreeable beverage. The sparkling appearance and slightly pungent taste of good drinking water is due to foreign substances which it contains in solution. All natural waters, whether obtained from springs, rivers, lakes or wells—even rain water itself—contains these foreign matters to a greater or less extent. It is the *nature* and *quantity* of the impurities that constitute the difference between good and bad water.

The purest natural water is rain water, when obtained as it falls directly from the clouds, without having come in contact with any terrestrial object in its passage downward to the earth. The first portions that fall are contaminated with dust and other

matters that are always floating in the atmosphere, and this is especially the case in and about populous localities.

After the rain has fallen for some time the air becomes in a great measure cleansed from these floating particles, and the water may then be collected, free from solid impurities. It, however, contains varying proportions of oxygen, nitrogen and carbonic acid gas, which it dissolves in its passage through the atmosphere; and, in addition to these, traces of ammonia and nitric acid are almost always to be found in rain water.

In natural waters obtained from terrestrial sources, more or less solid matter is always present. These dissolved solids vary in amount from less than one grain to several hundred grains in a gallon; in some saline springs even amounting to 20 or 25 per cent. of the total weight.

Much of the rain that falls upon the surface of the earth is absorbed by the porous soil, which contains much soluble matter. The water, in its downward percolation, dissolves portions of this soluble matter, the quantity usually increasing with the depth to which the water penetrates. For this reason the water of springs and wells generally contains much more dissolved matter than surface water. The water of rivers and lakes usually contains a much smaller proportion of dissolved solid matter than that of springs and wells.

But the impurities of water may consist not only of substances in solution, and therefore invisible, except by the color they sometimes impart, but also of matter mechanically suspended. Running streams are obviously subject to this kind of impurity, for the water of springs in its percolation through the earthy strata becomes completely freed from suspended matter, and issues clear and sparkling; while in a running stream, the action of the water on its banks and bed tends to disturb and carry away the materials of which they are composed, the motion of the water at the same time interfering with the subsidence of finely divided matter that may be washed into it. In streams possessing a rapid current the amount of mineral substances thus carried down is frequently enormous. "The water of the Mississippi contains forty grains of mud to the gallon; and it is estimated that this river carries four hundred million tons of sediment per annum into the Gulf of Mexico. The Ganges is said to carry down 6,368,000,000 cubic feet annually."

The impurities contained in natural waters are very numerous, as may well be supposed from the complex character of the crust of the earth, and the great variety of substances with which the water comes in contact. Springs whose waters contain mineral constituents in so great a proportion as to be plainly evident to the taste, as well as to produce a decided therapeutic effect upon the system, are known as mineral or medicinal springs. But the limits of this report prevent us from going beyond the consideration of those impurities that are liable to be present in water used for domestic purposes. The most common of these are sulphates of soda and lime, chlorides of potassium and sodium, bicarbonates of lime and magnesia, sometimes iron, and occasionally lead, which may be dissolved by the water in its passage through leaden pipes.

The hardness of many kinds of spring and well water is mainly due to the presence of sulphate or bicarbonate of lime, or both. These salts decompose the soap used in washing, forming an insoluble compound, and destroying its detergent properties. When bicarbonate of lime alone is present in the water its hardness is destroyed by boiling. A portion of the carbonic acid is driven off by the heat, and the lime converted into a neutral carbonate, which is insoluble in water and does not decompose soap.

The bicarbonate of lime may also be removed by the careful addition of lime water. This, by combining with the excess of carbonic acid, converts the whole of the lime into carbonate, which, being insoluble, is precipitated. For this reason, the presence of bicarbonate of lime in water constitutes what is termed temporary or removable hardness. Sulphate of lime is, however, not removable by boiling, and therefore this salt makes the water permanently hard. The presence of these salts to a moderate extent does not injure a water for domestic purposes. Most sanitary authorities are of the opinion that "water of moderate hardness is preferable to a very soft water" for domestic uses. The proportion said to be most desirable is given as about 6 grains of carbonate of lime to the gallon. The French authorities are so well satisfied of the superiority of hard water, that they pass by that of the sandy plains, near Paris, and go far away to the chalk hills of Champagne, where they find water even harder than that of London; giving as a reason for the preference that

more of the conscripts from the soft water districts are rejected on account of the want of strength of muscle, than from the hard water districts; from which they conclude that the calcareous matter is favorable to the formation of the tissues.

In addition to these solid matters, good water contains varying proportions of atmospheric air, and carbonic acid gas, to which it mainly owes its sparkling appearance and pleasant taste. But it is only in small quantities that these saline constituents are beneficial. The presence of lime or magnesia salts in large proportion is liable to produce dyspeptic and other affections.

"It is said that horses acquire a rough coat if supplied with water containing a large quantity of sulphate of lime. Goitre and cretinism are attributed to these impurities in water; at least the facts observed make this inference extremely probable. The goitre appeared in the Durham jail, afflicting a large proportion of the convicts. The spring water with which they were supplied was analyzed and found to contain 77 grains of lime and magnesia salts per gallon. On substituting for this a water containing only 18 grains of these salts, it was found that the old cases rapidly improved, while no new cases made their appearance. In the limestone districts of England, Switzerland, and Central New York, this goitre has been traced over considerable areas. At Goruckpoor, in India, where the waters are quite calcareous, 10 per cent. of the adults are afflicted with goitre, and many of the children are cretins. Even cats and dogs are said to be affected with cretinism. It is a curious fact that in Ireland, on the Waterford side of the Suir, where sandstones and slates prevail, goitre and cretinism are almost unknown, while on the Kilkenny side, where limestones abound, goitre is not uncommon.

"The products of the decomposition of animal matter in water is, however, the most objectionable impurity. Organic matters produced by the decomposition of vegetable substances are not especially dangerous, but the products of decomposing animal substances are highly dangerous, even when in minute quantities. These impurities do not make themselves apparent to the taste. On the contrary, such waters are frequently considered unusually fine in flavor, and persons go a great distance to procure them. Nevertheless, they contain an active poison. Many diseases of the most fatal character are now traced to the

use of water poisoned with the soakage from soils charged with sewage and excremental matters. Sudden outbreaks of disease of a dysenteric character are often caused by an irruption of sewage into wells, either from a break in a sewer or cess-pool, or from some peculiarity of the season. Such contamination of the water is not indicated by any perceptible change in the appearance of the water. The filtered sewage, clear and transparent, carries with it the germs of the disease.”*

Prof. Chandler thus enumerates the characteristics of a good drinking water:

“Its temperature should be at least 10 degrees lower than the temperature of the atmosphere, but it should not be much lower than 45 degrees, Fahrenheit. It should be free from taste, except, perhaps, a slight pungency from oxygen and carbonic acid, which is an advantage. Taste is, however, a poor guide. When one becomes accustomed to a certain water, pure water tastes flat by comparison; 50 grains of chloride of sodium in a gallon would hardly affect the taste perceptibly.

“A third requirement is freedom from smell. This should not be apparent, even when a bottle is half filled with water, placed in a warm place for a few hours, and then shaken.

“It should be transparent; not that it is necessarily injurious if not transparent, but it is preferable to take our solid food in other forms. Sometimes water may contain peaty matter from swamps, or vegetable matter from new reservoirs, which is not necessarily unwholesome.

“With regard to the total quantity of impurities admissible in good drinking water, the Sanitary Congress which met in Brussels decided that water containing more than 35 grains of impurity in one gallon is not wholesome, and there should not be much more than one grain of organic matter. 35 grains is a large quantity for city water, though well-waters frequently contain more.”

The published analyses of the Delaware river water at Philadelphia give the total amount of solids at about 3 or 4 grains per gallon, while that of the Schuylkill somewhat exceeds this in amount.

The most important points to be determined in the examination of water intended for domestic uses are: the degree of hard-

ness, the amount of sulphates of chlorides, and of organic matter.

The total amount of solids may be ascertained by evaporating a measured quantity to dryness, and weighing the residue.

The presence of lime salts is shown by the formation of a precipitate when solution of oxalate of ammonium is added: (“6 grains of lime per gallon gives a slight turbidity, 16 grains a distinct precipitate, 30 grains a large precipitate.”)

If magnesia is present it is precipitated by adding ammonia and phosphate of soda to the water, after the lime is removed by the oxalate of ammonium.

A less delicate test for magnesia consists in the addition of ammonia alone to the water. “A good water should give only a slight haziness or none at all with ammonia.”

Chlorides.—Acidulate the water slightly with nitric acid and add solution of nitrate of silver; a white curdy precipitate indicates soluble chlorides. The amount may be roughly estimated from the copiousness of the precipitate.

Sulphates—Acidulate with muriatic acid and add solution of chloride or nitrate of barium. A white, pulverulent precipitate shows the presence of sulphates in the water. “A good water should not give more than a slight haziness.”

Organic Matter.—It would be impossible to describe in our present limits the methods employed by chemists for the determination of the kind and quantity of organic impurity in water. A simple and convenient method for its detection consists in adding to the suspected water sufficient solution of permanganate of potassa to impart a pinkish tinge. If oxidizable organic matter is present the permanganate will be decomposed and the color destroyed. The amount of permanganate decomposed by a stated quantity of water, and the rapidity of the action, is proportionate to the amount of organic matter present. This method, though by no means accurate, enables the amount of organic impurity to be estimated with sufficient accuracy for general purposes, especially if a comparative experiment be carried on at the same time with water of known purity. The presence of this kind of impurity may also be detected by evaporating a portion of the water to dryness, and subjecting the residue to a heat approaching redness. If the mass blackens, organic mat-

* Extract from a lecture by Prof. C. F. Chandler.

ter is present; and if an offensive odor is at the same time given off, it indicates that it contains material of animal origin.

Among the processes for the purification of water, filtration is the most commonly employed. But filtration through ordinary porous media, as sand, sponge, paper, &c., removes only those matters that are mechanically suspended in the water. For the removal of dissolved impurities other means must be resorted to.

When the impurities of water consist of an excess of soluble salts, it may be said that, in general, no practicable method of purification save that of distillation is known, except in the case of bicarbonate of lime, which, as before stated, is removable by simple boiling. But it is organic matter that constitutes the most insidious and dangerous impurity of drinking water. The well-known property which charcoal possesses of absorbing many organic matters, and the ease with which it may be obtained, render it peculiarly suitable as a purifying agent. "On this account water casks are generally charred on the inside to the depth of an eighth of an inch or so; and it is a common practice, when rain water cisterns become foul, to throw in a bushel or two of fresh charcoal." Many organic impurities are destroyed by boiling the water, and this is often adopted as a precautionary measure by travelers in malarious countries. Permanganate of potassa is one of the most efficient agents for the purification of water contaminated with organic matter. By the addition of a little of this salt to such water its impurities are oxidized, and destroyed as effectually as they would be by fire. Magnetic oxide and carbide of iron have been proposed as purifying agents, and by many authorities are highly recommended.

But for general use there is, perhaps, nothing better than the common charcoal filters. They have the advantage of being readily extemporized of materials always at hand. They are also now manufactured in various forms, and supplied to the market at prices so low as to be within the reach of all.

No water containing an appreciable quantity of organic impurity, especially where an animal origin may be suspected, should be used for cooking or drinking purposes without having been submitted to some one of these well-known methods of purification.

REPORT ON EPIDEMICS AND ENDEMIC

THAT HAVE OCCURRED IN THE STATE OF NEW JERSEY SINCE 1870.

BY THEODORE R. VARICK, M. D.

At the inaugural meeting of the State Board of Health, held in the city of Trenton, May, 1877, it was

"Resolved, That a committee be appointed to give a brief statement of endemics or epidemics that have occurred since 1870 in this State, and their causes, so far as ascertained."

The president appointed me as chairman, and Drs. J. E. Culver, of Hudson county, and Franklin Gauntt, of Burlington county, the other members of the committee.

The want of commissions for the collection of vital statistics was sorely felt, and the only source of information remaining, was a reference to the published reports of district societies, of which I gladly availed myself.

It is on occasions such as this that the system of annual reports, adopted by the State Society, exhibits its real value. By this system there is preserved a complete medical history of the State for each year, recording not only epidemics and endemics, but also individual cases of interest.

In making up this report I have culled from these communications facts bearing on the subject, for which this committee was appointed.

The medical year, according to the published transactions, runs from May to May, and I have adopted the same division in this report, as it would be impossible to separate each calendar year without creating inextricable confusion.

Extending over a period of seven years, the accounts of disease must of necessity be brief.

It will be perceived as we progress, that each county report is laid under contribution in alphabetical order, and if statistical information is deficient it is due to the facts already stated.

YEAR ENDING MAY, 1870.

Burlington County.—There is reported an exanthematous disease with catarrhal and anginous symptoms, in an epidemic form.

There seems to have been a doubt as to whether the disease was scarlatina or epidemic roseola.

Dr. Townsend, of Beverly, states "the eruption was precisely similar to measles, and has been universal since its first appearance. Most of the cases have ulceration of the tonsils similar to that in scarlatina, followed by glandular swellings, and in some cases dropsical effusions."

Dr. Budd, of Mt. Holly, "is confident that it is epidemic roseola."

It seems to me that the occurrence of adenitis and dropsical swelling settles the question in favor of its being scarlatina.

Dr. Cooper, of Camden, reports an epidemic of scarlet fever.

"The epidemic at first was mild, but in a short time assumed a much graver character, and when it once entered into a family of children it was almost certain to attack every member, and in many instances adult members suffered as well.

In most of the fatal cases, where death occurred early in the disease, cerebral symptoms, succeeded by profound coma, were first developed.

Such cases were almost always fatal, the system seeming to sink under the depressing effects of the poison before the disease had time to run its natural course.

In another class of fatal cases, the patient passed through the febrile stages with safety, the throat being only moderately sore, and the tongue not all dry, except during the height of the fever; but after the stage of desquamation had been completed, the patient seemed to sink into a typhoid state, with a small, frequent and feeble pulse with dark offensive sordes collecting about the mouth and on the teeth, with an entire disgust of food, the little sufferer finally sank from debility and exhaustion, in spite of iron, tonics and stimulants, in some cases as late as the third or fourth week from the commencement of the attack."

Dr. Marcy, of Cape May county, reports an epidemic of influenza, formerly known as Tyler's grip, and remarkable for nothing except pertinacity.

Diphtheria is reported as having become endemic, being found at all seasons, and sometimes of decidedly malignant type.

From Essex county we have the report that "the nearest approach to anything like an epidemic has been scarlatina, which has prevailed to a greater or less extent, often with great malignancy, throughout the year, and especially during the summer and winter, and up to the present time.

In Bloomfield, Essex county, an epidemic of diphtheria is reported by Drs. Tinsley and White; the type seems to have been mild and but few fatal cases occurring.

Dr. M. A. Miller, of the Jersey City Charity Hospital, reports the occurrence of a number of cases of typhus and typhoid fever, "lingering with us for months; resisting, too, the most earnest efforts directed towards ventilation and disinfection."

There was no evidence that either fever originated in the neighborhood. On the contrary, the source of contagion was traced directly to vessels in the harbor.

The cases of typhoid all recovered.

The first case of typhus was recognized in a sailor who was admitted to the hospital February 4th, from the steamer Tripoli. The disease ran a mild course and the patient recovered.

From this case a nurse who was in attendance contracted the fever February 26th, and died March 4th.

The second nurse employed in the fever ward was seized with the fever April 2d, and died April 4th.

The fever in both cases manifested a very malignant type, running its course in a short period of time.

In the latter case the eruption was very abundant over the extremities, as well as the trunk, and appeared on the second day of the disease.

A patient was admitted to the hospital April 6th, with symptoms of fever, was placed in the fever ward, and on April 10th a very copious eruption of typhus made its appearance, which continued prominent for fourteen days, and then began to recede, disappearing in the course of two or three days, the patient convalescing rapidly.

Dr. C. W. Larrison, of Hunterdon county, reports that erysipelas prevailed as an epidemic in January, 1870. "Those attacked suffered extremely from pain, stiffness of joints, irritability of the stomach and general debility."

Dr. Henry R. Baldwin, of Middlesex county, reports a number of sporadic cases of scarlatina occurring during the fall of 1869, which in the following winter assumed an epidemic form.

"It was a noticeable fact that it appeared in the Romish school and attacked those brought into immediate contact; when having exhausted all the susceptible, it traveled to the public school of the district of New Brunswick, and numbered many victims among the attendants. The sequelæ were unusually severe, many cases of albuminous nephritis following the attacks."

Dr. E. M. Hunt, of Metuchen, writes: "This disease (diphtheria) has prevailed at times in epidemic form at various points in the townships this side of the Raritan, almost from the period when first it was known in our country as a primary affection. In the small village of New Market, some six years since, it showed great fatality, between twenty and thirty persons dying thereof, and many of them adults, and at many other places it has occurred with persistence."

In Monmouth county an epidemic of mumps is reported, which attacked both children and adults.

YEAR ENDING MAY, 1871.

Burlington County.—Epidemic roseola still continues to be the master epidemic. Its symptoms are sometimes grave, and differ widely from those of the common rose rash. Severe inflammation of the fauces, attended with exudation of much catarrhal matter, were sometimes the most prominent symptoms. Also, inflammation of the submaxillary glands, extending to, and ending in great tumefaction and suppuration of the cellular tissue, were occasionally seen. Sometimes a furfuraceous desquamation was one of the sequelæ.

From Camden county we glean the following: "At the period of the close of the report of last year we noticed the fact that scarlatina of a severe type had been prevalent almost as an epidemic in the city of Camden and some of the neighboring villages.

"The united testimony of physicians from all parts of the county agree in the assertion, that both intermittent and remittent fevers have been on the decline for several years, and in

some neighborhoods, where they were constantly met with every summer and fall, they have almost entirely disappeared."

This, so far as the city of Camden and vicinity are concerned, is justly attributed to a system of underground drainage. This system "is still being each year extended, with a manifest and decided improvement in the health of the inhabitants of the districts in which such improvements have been made."

At a meeting of the Cumberland County District Medical Society, the question, "Are miasmatic diseases produced by salt marshes?" was introduced before the society for discussion, and it was unanimously decided "they are not," every member present having something to say on the subject. Nearly all have more or less practice in the neighborhood of salt marshes, and the opinion of some was that the influence of salt marshes was beneficial in miasmatic diseases, through its tonic qualities.

The experience and opinions of the profession of Cumberland county are somewhat at variance with the report from Essex county, to whom the same question was propounded by the chairman of the Standing Committee of the Medical Society of New Jersey.

The report states that the extensive meadows lying between Newark and Elizabeth City, known as the "salt meadows," do produce all forms of miasmatic diseases.

This seeming inconsistency may be reconciled by taking into consideration the fact that the meadows alluded to are not purely salt, but the water is, to a great extent, brackish, and seems to be particularly favorable to the evolution of malaria.

This remark will also apply to the Hackensack Meadows, in the region of Snake Hill and throughout Seacaucus, where intermittent fever is especially prevalent.

In Hunterdon county "an epidemic of typhoid fever occurred in this village (Ringoos) and vicinity, in the months of July, August and September, of a somewhat peculiar nature. The course of the disease was more rapid than that of any other typhoid epidemic that I have witnessed." The reporter, Dr. C. W. Larson, continues: "The emaciation was very rapid, but when the materies morbi had been entirely eliminated the patient recovered rapidly." The cause of the epidemic was traced to "a stagnant pool, into which was thrown, from time to time, dead hens, dead pigs, &c., and into which the fluids of the barnyard were drained."

Dr. W. W. L. Phillips, of Mercer county, writes: "There is a locality in Trenton, situated near the junction of the canal and feeder, familiarly known as the Swamp, which is inhabited principally by negroes. The ground is some six feet below the level of the canal, is naturally swampy, and is illy drained. During the months of July and August last there prevailed among the denizens of this locality a fatal disease, which gave rise at the time to considerable alarm and discussion. Some twenty negroes were attacked and died. The cases were nearly all fatal, some dying as early as the second day. The disease was undoubtedly a malignant malarial fever. A few cases assumed the hemorrhagic type, bleeding profusely from the mucous membranes.

"The white people living in the vicinity were not attacked by the disease. After proper drainage and policing of the malarious district the disease abated."

YEAR ENDING MAY, 1872.

Dr. Frank Wilmarth, of Essex county, reports the fact "that epidemic influences have prevailed to a considerable extent, over a large portion of the district, for the year ending May 1, 1872.

"From May 1, 1871, to April 26, 1872, nine hundred and thirty cases of small-pox were reported in the city of Newark one hundred and twenty of which proved fatal. The largest number (two hundred and three) occurred in May, 1871; the smallest (fifteen) in September. Between these three months there was a gradual decline in the number of cases. Since September there has been a gradual increase, the number in March, 1872, reaching one hundred and eleven.

"On the 20th of May, 1871, the same disease made its appearance in the city of Orange. From that time until the present (May 1, 1872,) seventy-one cases have been noted, sixty four cases occurring before the 3d of August."

Dr. Lloyd records the fact that "sixty-one cases came under his observation; of this number, thirty-seven only had ever been vaccinated. Twenty-four cases were fatal; of these seven had been vaccinated, fifteen had not been; while evidence concerning the remaining two in this particular was doubtful."

Two of the fatal cases occurred in puerperal women.

In four instances the patients had been revaccinated from four

to six days previous to being attacked, the vaccine disease appearing with its characteristic pustule, following its usual course.

In Hudson county, small pox prevailed principally in Jersey City and Hoboken.

Prior to the establishment of a small pox hospital on the county farm, at Snake Hill, all cases occurring among the pauper population were sent to the Jersey City Charity Hospital.

From May, 1869, to the end of December, 1874, there were admitted of varioloid 66 cases, of which one died, a mortality of $1\frac{1}{2}$ per cent.; of variola, 325 cases were committed, 122 died, 203 recovered, leaving a mortality of $37\frac{1}{2}$ per cent.

A large proportion of the fatal cases were of the hemorrhagic variety, and several dying of œdema glottidis and others of pneumonia supervening during the attack. Its greatest prevalence was from December, '71, to December, '73.

Outside the hospital, its habitat was mostly in the more filthy parts of the city, and those portions occupied by tenements which, as is usually the case, were crowded to excess, and in a condition for the germination of disease in any form.

In Mercer county, in the month of July the city of Trenton "was invaded by an alarming epidemic of small pox. It first made its appearance in the central part of the city, in the most thickly populated portion and among the better class of citizens."

"It seemed for a time to be confined within a narrow circle of the business portion of the community; but, notwithstanding every precautionary measure was immediately taken by the Board of Health and the Common Council, to prevent the spread of the disease, it gradually spread until isolated cases were found in almost every part of the city.

"The disease was of a very severe type, and the number of deaths, in proportion to the number of cases quite large, being about one in six."

During the month of August small pox made its appearance in the city of Camden in a locality inhabited mostly by colored people.

The hygienic condition was particularly bad.

The houses and yards were small and filthy, with pig-pens and privy-wells often overflowing in close proximity to the houses, and a large portion of the population unprotected by vaccination.

Of a necessity the disease spread. By a thorough "policing" of the locality the disease was temporarily held in abeyance until October, when it spread to the surrounding districts.

At this time the disease existed in an epidemic form in Philadelphia.

To the constant intercourse of the inhabitants of the two cities is attributed the increase of the number of cases in Camden.

In the small-pox hospital the mortality reached 18.02 per cent., while in those cases treated in their own homes the fatal cases reached 16.04 per cent.

The mortality among the unvaccinated amounted to 37 per cent.

"Most of the deaths among those who had been vaccinated were from some intercurrent disease."

Dr. Goodell, of Sykesville, Burlington county, reports the following history of an endemic in his neighborhood: "The village of Pointville, which was visited by a peculiar form of fever during the summer and fall of 1872, contains about thirty families, composed of mechanics and laboring men, noted for their temperate habits and the cleanly and tidy appearance of their dwellings. Its elevation is about 160 feet above tide-water, and is the highest elevation, within an area of several miles, with good drainage.

"The soil is aluminous and fertile, bordering on white sand formation, which covers the surface of the pine region.

"There are no swamps or marshes sufficiently near to damage the salubrity of the village.

"This endemic numbered about fifty cases, sparing neither age nor sex. A general feeling of lassitude and headache was succeeded in a few days by a protracted chill, followed by a dry, hot skin, a feeble, irregular pulse, rarely under 120, attended with nausea and vomiting, with increased headache, pain in the eye-balls and intolerance of light.

"Delirium often accompanied this stage with extreme wakefulness, which, in some cases was succeeded by stupor approaching coma. The pupils would contract under a strong light, then dilate before the light was removed. The bowels were generally constipated, but readily responded to a mercurial cathartic. An unsatisfactory convalescence would sometimes commence about the ninth day, dating from the chill, but this was often followed by a relapse, protracting the case to five or six weeks. Some-

times pneumonia, either in an active or latent form, would complicate the case after the second or third week. The red tongue of typhoid fever was absent, and though they had irritable stomach and pain on making pressure over different parts of the abdomen, I never observed tympanites nor hemorrhage from the bowels. The skin was often examined for petechial spots. Other practitioners who attended some of the cases thought they discovered indistinct traces of this specific eruption.

"Regarding the disease as a cerebro-spinal fever, with a strongly marked typhus tendency, much depletion, even in the commencement, was not ventured. I ought to remark that the cases which occurred were shared with four other practitioners, whose success was equal to my own, however much we might differ in theoretical views or therapeutic measures. I report but one fatal case, caused by a neglected pneumonia after convalescence seemed to be established."

Cumberland County.—Dr. R. M. Bateman reports: "An extended epidemic of scarlet fever raged throughout that section (Cedarville and Fairton, Cumberland county) during the latter part of the winter (1873-4), particularly fatal in the neighborhood of Fairton, also at Greenwich, in the same county. In the greater portion of the fatal cases, brain symptoms seemed to predominate. Adults as well as children suffered from the disease.

"Mumps prevailed epidemically in many parts of the county."

Dr. Love, of Montclair, Essex county, has met with a number of cases of typhoid fever, which, although not in an epidemic form, were so directly traceable to recognized causes that I give his report in full:

"All of them caused by either defective water closets in houses, or by want of cleanliness in reference to drains, privies or cellars."

"That in this day of enlightenment, as to the commonest rules of sanitary science, architects should plan and people should build expensive houses, in which and around which are water-closets, sewers and privy vaults, whose foul emanations pollute the air and the drinking water of the inhabitants, is to me a thing incomprehensible. To my personal knowledge, many an elegant villa and beautiful country residence is so constructed that the stench from the pipes leading to the above-mentioned receptacles is such that the servants can scarcely endure to use stationary wash tubs, and the opening of the lid

of the slop-hopper in the second story fills the room with an abomination of putrescence. The servants have intermittent, madam has neuralgia, dyspepsia, and a host of ailments; the children have gastric fever and diphtheria, and they all wonder why country air don't agree with them. They go to the seaside in the summer, and to the city during the inclement winter months; the house is shut up, and a man servant is left to take care of it, who sleeps in the hall bed-room nights, and has typhoid fever. As it is impossible for running streams to purify themselves when polluted with sewage, so it is impossible for human beings to live with such surroundings and not contract disease."

YEAR ENDING MAY, 1874.

In Jersey City puerperal fever prevailed during the early part of the year to a considerable extent; in fact it assumed an epidemic character, continuing through a period of several months.

Quite a number of cases proved fatal, especially in primiparus, yet many recoveries serve to mark the mildness of the disease towards the latter part of the epidemic.

In reference to the subject, Dr. M. A. Miller, of Jersey City, writes: "Experience suggests that a distinction may be drawn between the cases as they have occurred. In severe attacks, terminating fatally, a post-mortem examination has invariably revealed extensive peritonitis, with puriform collections coexisting with hysteritis. In other cases the mildness of the symptoms would indicate that the inflammatory process has been limited to the proper tissues of the uterus, or involving also the uterine appendages; when such attacks have terminated in resolution and recovery, it may have been without exposing the organs to serious injury, or limiting the injury to adhesions between contiguous portions of the serous membrane. If, however, the fallopian tubes have been involved in the inflammation, the cavity of one or both may be obliterated, preventing altogether their ordinary functions. The following symptoms have been noted in connection with the cases under observation:

In the milder cases ending in recovery, the disease has been found to commence usually on the third or fourth day after confinement, and generally with rigors, followed by heat of skin,

thirst and headache, the heat of skin soon subsiding, the pulse rises in frequency to 100 or 110, the tongue dry and furred, and to these symptoms succeed nausea and vomiting and increased sensibility of the uterus.

As the disease advances the abdomen generally becomes tympanitic. The lochia are sometimes suppressed for a few days, and often fetid. The secretion of milk is usually arrested for the time. In one case convalescence was established within two weeks; in other cases deferred until the third and fourth week; but weakness and debility have been found to linger longer with the patients. In the more severe cases, the invasion of the disease on or before the third day after delivery has been marked by rigors, followed by heat of skin, thirst, flushed face, quickened pulse, and hurried respiration; the heat of skin, however, subsides under free perspiration, and during the further course of the disease may not exceed the normal standard.

These symptoms are soon followed by nausea, vomiting, pain in the head and tenderness in the iliac region. The patient early complains of pain in the abdomen, which generally commences in one of the iliac regions, and especially the right, radiating over the abdomen. Shortly after the disease is established, the abdomen becomes tumid and tympanitic; the tympanitis being due to air contained either in the intestines or peritoneal sac. The lochial discharge is usually suppressed early in the attack, returning after a few days changed in color and offensive in odor. The secretion of milk is suspended. The pulse is uniformly frequent throughout the disease, ranging from 110 to 140 generally small and wiry, but often feeble. The tongue may be found coated with a whitish fur in some cases, while in others it is dry and brown in the centre, with a white fur at the edges. The stomach is disturbed at a very early period, and the nausea and vomiting continue at intervals throughout the attack. Obstinate constipation marked most of the cases. The intellectual faculties have been but rarely affected: the patient retaining her consciousness and senses till very near the end.

A fatal termination has been usually found from the fifth to the tenth day from the invasion of the disease. In the several post-mortem examinations held at the Jersey City Charity Hospital, great uniformity has been observed in the morbid appear-

ances. On opening the abdomen, which, as a rule, was swollen and tympanitic, the intestines were found greatly distended with gas. The peritoneum generally exhibited signs of inflammatory action, being more or less vascular, especially that portion covering the uterus. The peritoneal sac contained a large quantity of a thick, yellowish, white-colored fluid. The omentum was reddened and congested, and covered by thick layers of pus, with layers of lymph agglutinating the omentum and intestines together. The uterus was surrounded by puriform matter, and not manifestly enlarged, but usually contracted to nearly the normal size. In opening the uterine cavity, false membranes of coagulable lymph, mixed with blood and lochia, were found on the lining membrane, which was thickened and congested. In all cases the lining membrane of the fallopian tubes was reddened and congested throughout."

Dr. J. L. Bodine reports from Mercer county that "Whooping cough, mumps, scarlet fever and measles have prevailed in an epidemic form during the year. In the month of November the State Normal and Model Schools were closed on account of the prevalence of scarlet fever. Whooping cough was the epidemic of the summer, mumps of the fall, and measles of the winter months, although these diseases have been distributed through the other seasons of the year.

"Trenton is largely engaged in the manufacture of pottery ware, and the nature of their employment produces certain forms of disease in the operatives in these works. Lead enters largely into the glaze upon the ware, and cases of lead poisoning are not infrequent.

"A peculiar form of pulmonary disease, known as potters' asthma and potters' consumption, is caused by inhaling the small particles of clay, quartz, plaster of paris and other articles which float in a pottery atmosphere. Chronic bronchitis, emphysema, dilated bronchia, consolidation and destruction of lung tissue result. Post mortem examinations show cavities of various sizes in the lungs, and obliteration of the ultimate vesicular structure of the lungs."

In Monmouth county we have reported an epidemic of diphtheria of the most malignant and fatal character, prevailing during the winter months.

YEAR ENDING MAY, 1875.

Dr. Frank Wilmarth, of Essex county, reports: "In the central part of the county epidemics of parotitis and diphtheria have appeared, the former somewhat extended. Cases of the latter affection were not so numerous, but a majority were severe. In Orange and its vicinity it hovered about low, poorly drained localities almost entirely, leaving but little doubt that its origin holds a close relationship with unfavorable sanitary surroundings. The attending physician, in one instance where several members of a family had been attacked, found the drinking water from the well markedly impure, as evidence in smell and taste, and in the deposit of a sediment in which the microscope discovered a fungous development analagous to, if not precisely like, that which has been observed in the exudation characteristic of the malady. The well was in close proximity to a cess-pool, whose impurities had found easy access to the water. Long before the diphtheritic troubles were encountered, the family had noticed the unnatural features of the water; but persisted in its use, ignoring the notion that nauseous odors and tastes are bestowed for a benevolent purpose."

From Dr. Chas. F. Deshler, of Mercer county, we learn that "epidemic diphtheria prevailed in the eastern portion of the county from November to April. According to the testimony of the neighboring physicians, in the vicinity of Hightstown alone there occurred more than one hundred cases."

YEAR ENDING MAY, 1876.

Dr. A. S. Burdett, of Hackensack, Bergen county, writes: "Diphtheria has been rife; its fatality in some localities fearful."

Dr. D. A. Currie, of Englewood, writes: "During the month of December, 1874, and January, February March and April, 1875, diphtheria raged to an alarming extent in this valley. The disease was uncomplicated diphtheria, and proved fatal sometimes by the accession of croup consequent upon the extension of the disease into the larynx and trachea: at others by exhaustion.

The first case occurred in a family of five, living in a large tenement, all of whom had the disease. The case died.

"The family being Irish, the usual 'wake' was held, although three other cases were found to exist at the same time. In three days afterward twenty-eight cases were found in families who had sent delegates to the 'wake.' From this time until about the middle of April there were new cases occurring almost daily."

Dr. C. reports 135 cases as having occurred in his practice, within a period of five months.

In Essex county, in the city of Newark and suburbs, diphtheria raged during the colder months, and also in Montclair, proving fatal in a large number of cases.

"In the neighborhood of Paulsboro, Gloucester county, diphtheria has prevailed as an epidemic, for a time very fatally."

In Hudson county, diphtheria prevailed extensively during the whole year. No locality was exempt from its attack, although it was particularly fatal in damp, illy ventilated and filthy localities.

It is reported that it comprised 17.4 per cent. of the entire mortuary record for the year. In reference to the fatality of the disease, the percentage was 32 for the fall, 29 per cent. in winter, 21 per cent. in summer, and 18 per cent. in the spring.

In Hunterdon county, Dr. M. Abel writes that in the region of Quakertown "diphtheria has prevailed almost the whole year. The type of the ailment has been mild, and from it there have resulted but few deaths."

Dr. D. C. English, of Middlesex county, reports that "diphtheria has never, we believe, been so prevalent and of so malignant a type as in the city of New Brunswick and in South Amboy; and we think it owing largely to the neglect of the adoption of proper hygienic or sanitary measures for the prevention and mitigation of disease.

"During the past five or six months there have been according to the statements of our undertakers, over 250 deaths from this disease in New Brunswick; and we reckon, from the meagre statistics we have been able to collect, that the mortality has been about 20 per cent."

In South Amboy, according to the accounts given by Dr. Treganowan, the ratio of mortality was about the same.

"The instances were exceedingly rare where children under eighteen months have taken the disease, the vast majority having

been from three to ten or twelve years, between which ages was also by far the greatest mortality. Adults almost invariably recovered, some of whom were severely attacked."

In Monmouth county "diphtheria of a malignant type has prevailed at Long Branch and vicinity with great mortality, leaving few families who do not mourn the early departure of some little one, and in some cases it has counted all among its victims."

In Morris county diphtheria prevailed as an epidemic at Rockaway, Boonton and Middle Valley. In the vicinity of Rockaway there were about one hundred and fifty cases, with a mortality of twelve per cent. At Middle Valley there were perhaps forty cases. At Boonton there occurred thirty-five cases, with a death rate of twenty per cent.

In Sussex county, Dr. Moore, of Deckertown, records an epidemic of diphtheria during the preceding winter and spring.

In Union county, in the city of Rahway, there is reported an epidemic of diphtheria of a mild type, with a small rate of mortality.

There is also reported an epidemic of the same disease at Oxford and in the borough of Washington, in Warren county.

YEAR ENDING MAY, 1877.

In Mercer county diphtheria prevailed throughout the whole county. In Hightstown, Dr. Deshler reports, that "it assumed epidemic proportions during the fall and winter ('76-7) with an average fatality of about twenty per cent. Sporadic cases of this disease had been in the neighborhood during several preceding years, the last one occurring some six months before the appearance of the epidemic."

Dr. D. further reports, "reliable testimony places the number of cases of diphtheria at one hundred and forty; probably had all the cases been reported the number would not be below one hundred and sixty, distributed through fifty-seven families.

"There were thirty deaths, divided among twenty families.

"*Origin.*—The first cases appeared in July, shortly after a warm rain, in several families living in the same locality.

"The land is low, with an impervious subsoil, is water soaked except when drained by artificial means, has a small brook run-

ning through the centre of it with low banks, on which this portion of the town is situated; the houses are mostly without underground cellars, or if there are such they are always wet, except where protected by cemented walls.

"Without entering into details, we may justly say, that at this examination the condition of the streets, yards, and outhouses, with few exceptions, were decidedly unsanitary. The brook was so obstructed in many places by accumulations of refuse and fæcal matter as to change it from a running stream into mere pools of filthy water, exhaling offensive vapors. An important drain also was found partly obstructed by putrefying animal and vegetable substances.

"Effluvia from these sources vitiated the surrounding atmosphere and rendered it decidedly unwholesome.

"*Nature of the Soil.*—In an attempt to determine the influence exerted in the production and propagation of this disease by the character of the soil, the following was noticed:

Of the 57 house infected

16 had good natural drainage.

41 had not good natural drainage.

Artificial drainage rarely received adequate attention. Further examination revealed:

15 houses with dry cellars in which were 40 cases.

12 houses with wet cellars in which were 29 cases.

30 houses with no cellars in which were 71 cases.

Deaths are distributed as follows:

9 in houses with dry cellars.

8 in houses with wet cellars.

13 in houses with no cellars.

"*Social Relations.*—These include the conditions of domestic life as regards space, food, air, clothing, vocation, habits, etc., and are estimated as follows:

12 families with 29 patients, good.

9 families with 25 patients, ordinary.

34 families with 84 patients, bad.

Deaths as follows:

8 with social conditions good.

22 with social conditions not good.

"*Seasons and Weather.*—Deaths occurred as follows:

2 in July.

3 in August.

2 in September.

7 in October.

7 in November.

1 in December.

2 in February.

1 in March.

2 in April.

1 in May.

2 not known.

"The 79 cases recorded, are distributed as follows:

22 in August.

4 in September.

33 in October.

4 in November.

7 in December.

4 in January.

4 in February.

1 in April.

"*Contagion.*—In 29 families, which may be taken as a type of all affected, 23 received it by contagion; 5 not known, though contagion probable; 1 contagion not probable, as the house was located in the suburbs, to which the children had been scrupulously confined.

A majority of the cases traced their origin to the public schools, and as these are efficient agents of communication in this, as well as all similar diseases, it is a question whether the closing of them under these circumstances should not be imperatively demanded.

"*Forms.*—Seventy-nine recorded cases show variations of form as follows: Twenty-eight of catarrhal variety, in which the constitutional symptoms were mild, the exudation limited in extent and confined to the tonsils; fifty-one of the croupous form, in which the constitutional disturbance was marked, the exudation copious, and extending to the other portions of the throat. In forty-three of these it was confined to the pharynx; in five, extended into the nasal passages, and in three into the larynx.

"Terminations—Nine in death:

3 from croup.

5 from direct effects of the poison.

- 1 from the sequelæ, hemiplegia.
- 22 in paralysis:
- 6 muscles of the neck.
- 8 muscles of the extremities.
- 5 muscles of the soft palate.
- 2 muscles of the eyes.
- 1 hemiplegia.

The Doctor concludes with the following resume :

"Houses—

- 26 per cent. with dry cellars.
- 21 per cent. with wet cellars.
- 53 per cent. with no cellars.

"Nature of Soil—

- 28 per cent. good natural drainage.
- 72 per cent. not good natural drainage.

"Social Relations—

- 22 per cent. good.
- 16 per cent. ordinary.
- 62 per cent. bad.

"Deaths—

- 30 per cent. in houses with dry cellars.
- 27 per cent. in houses with wet cellars.
- 43 per cent. in houses with no cellars.
- 27 per cent. social relations good.
- 73 per cent. social relations not good.

"Contagion—

- 79 per cent. traced to contagion.
- 21 per cent. not traced to contagion.

"Results—

- 20 per cent. terminated in death.
- 28 per cent. terminated in paralysis."

In the practice of Dr. Newell in the western section of Mon-

mouth county, diphtheria is reported as being unusually malignant, and assuming in many cases a croupous form.

The reporter from Morris, referring to a previous report, writes that diphtheria began to prevail at Middle Valley in the fall of 1875, and during its subsidence, at the present time, 1877, was attended with a mortality of about 8 per cent.

There is also recorded the interesting fact that the town of Chester, only five miles distant, was not attacked until September, 1876, notwithstanding the constant intercourse between the two towns.

The disease reached its climax about the first of January following.

Although many of the cases were of a severe type, the death rate was small. "In the winter of '75-'76 it was quite prevalent in Morristown, and yet it did not reach Whippany, a village only four miles distant, until August last, when it appeared in a most malignant form. At first the death rate was 100 per cent., but the disease became much less severe in type, and began to subside in December.

Dr. Miller, the resident physician, reports twelve cases under treatment since the first of January, all ending in recovery.

About 10 per cent. was complicated with paralysis of one part or another. The paralysis continued for periods, varying from a fortnight to three months, and in a few instances complete muscular use was not obtained until a much later time.

MALARIAL FEVERS IN HUDSON COUNTY, BEING A PART OF THE REPORT ON ENDEMICS AND EPIDEMICS. BY J. E. CULVER, M. D.

Malarial fevers are to be found at all times in all parts of Hudson county. Remittents occur oftenest in the low lands; intermittents abound everywhere. Their prevalence is, however, observed to vary with the changing seasons; for example, the cold weather of winter diminishes the attacks to the minimum number, spring and summer increase them, and the maximum is reached in the early autumn months. During my service in St. Francis Hospital this year, throughout which the number of patients in hospital remained nearly the same, there were treated ten cases of malarial fever in January, eleven cases in May, and forty-one cases in September. In October just past,

there were thirty cases in the same hospital. The different types of malarial fevers are somewhat interchangeable, and in no wise do they habitually conform to the strict classical descriptions of them. An intermittent under bad management may become remittent; and a remittent under proper treatment may become intermittent. So likewise may quartans and tertians become quotidians, and vice versa. There occur, indeed, occasionally, both ephemeral and mild continuous fevers of malarial origin. In process of rapid recovery, all types soon become indistinguishable.

In the mortuary statistics, published by the Hudson County Board of Health, thirty-three deaths in 1875, and twenty-three deaths in 1876, are ascribed to remittent fever. Possibly these are but so many errors of diagnosis; for the Health Board has to accept all "pathists" and midwives as competent to sign burial certificates. In a practice of almost thirty years, I have never met with a death from malarial fever, except three or four fatal cases of pernicious intermittents. These "congestive chills," as they are styled, occur very rarely, and, as far as my experience goes, they destroy only youths of great vascularity, full of blood and lymph, mostly females about the period of commencing menstruation. The fever begins as a mild quotidian, the fatal chill taking place on the second, third, or fourth day, initiated by a marked venosity of the blood, and ending tragically in sudden and profound collapse.

Perhaps the most conspicuous of all the characteristics of malarial fevers, is their tendency to recurrences, or relapses. If a patient under successful treatment for intermittent fever, discontinued his remedies immediately when the fever is "broken," it will, in most cases, return in one, two or three weeks. Every resident of Hudson county is perpetually made conscious of malarial influences in his own person; and he is fortunate indeed who does not suffer every year from repeated attacks of fever. An old gentleman, a native, intelligent and observant, once told me, that for sixty years he had averaged a renewal of his periodic fever not less than twice yearly. The theory of acclimatization is here totally fallacious; none are exempt. The converse maxim, namely, that the more one has suffered from malarial influences the less power he has to resist them, is nearer the truth. Accordingly, change of climate is a most efficient remedy.

It is memorable in the medical world, that, not very long ago, an effort was put forth to contradistinguish "Relapsing Fever" from all other fevers; but the symptoms and peculiarities on which its differentiation was sought to be established, are not more material than are contrasts which present clinically between different cases of the same fever; and its most distinctive feature, the relapse, furnishes strong presumptive proof of its identity with fevers of malarial origin. The relapse indicates that the pathogenic agent acts continuously.

The victims of malarial influences are subject to all the vicissitudes of our ever-changing climate, and they embrace a multitude of persons who have already acquired pathological conditions, from causes both climatic and non-climatic. These complicating circumstances appear quite sufficient to account for the almost limitless range of symptoms, their varied prominence individually and relatively; and their dissimilar groupings in different patients. But however multiplex and inconstant are the symptoms of malarial fever, the following conditions are unfaillingly present, varying only in degree.

1. A sense of weariness and inaptitude for exertion, both mental and physical hyperesthesia.
2. The fever fluctuates diurnally.
3. There is venosity of the blood and excess of the blood-corpules, with relative deficiency of fibrin.
4. During the febrile exacerbation there coexist a rapid pulse, obstructed circulation, local congestions, turgid veins—especially of the portal system.
5. Uric acid and its salts are found in the urine in abnormally increased proportion, the urea being relatively diminished.
6. The urine is scanty. The respiratory mucous membranes are abnormally dry during the chill and febrile stage; and accordingly as moisture returns to them, and respiratory evaporation becomes re-established, the temperature of the body declines throughout the scale from highest fever heat to normal. During the chill and early fever the skin is dry also, but at length a superabundant perspiration breaks forth, which evaporates from the entire surface of the body, and assists to restore the normal temperature; and, *ceteris paribus*, according to the continuance of the perspiration, will the apyrexial stage be partial or complete.

The number of cases of malarial fevers decreases during cold weather; it does not increase *pari passu* with the accessions of summer heat. Dryness of the atmosphere favors recoveries and lessens the number of seizures, both during warm weather and cold alike. Therefore neither cold, nor heat, nor dryness, but dampness of the atmosphere, appears to be the climatic condition essentially conducive to the development of our endemic fevers.

Putrefaction, fermentation and the eremacausis of ligneous matters do not, separately or conjointly, cause malarial diseases. I recognize the fact that a growing vegetation, from every leaf, sends forth its daily modicum of aqueous vapor into the surrounding atmosphere, and thus contributes its share in maintaining a damp climate. But the plant-growth of Hudson county is mostly all husbanded, or washed away, or destroyed by fire; and there are not many places in this latitude, throughout the habitable world, where, acre for acre, so little humus is added to the soil annually. Moreover, the products of ligneous decay are water, carbonic acid, carburetted hydrogen and the residuary humus; all innocuous, and pre-eminently so as regards the etiology of malarial diseases. Fermentation yields to the atmosphere only carbonic acid gas, and a slight loss of vapor of the commercial product obtained. Concerning putrefaction it need only be remarked in this place, that it is a matter of fact of daily observation, that malarial fevers occur altogether independently of either putrefaction, fermentation or eremacausis, and that they exhibit none of the pathological phenomena to which either of these chemical processes may give rise.

Suppurative fever imitates malarial, inasmuch as it presents a distinct chill, a fever, and a sweating stage, but here the resemblance ends; its prevalence is not governed by the changing seasons; its symptoms have not their diurnal recurrences; the blood and urine have a different composition; its therapeutic indications, means and results, are not the same; and the formation of pus is its etiological *sine qua non*.

Our climate is eminently moist. The broad gulf stream, warm, and teeming with vapor, stretches eastward more than a thousand miles, and nearly that distance southward. The west and southwest winds come to us over the expanse of a continent checkered with water surface and a humid soil. Bergen Hill, the principal

habitable part of Hudson county, a ridge of very unsymmetric shape and variable width, averaging perhaps three-fourths of a mile wide and fourteen miles in length, trends a little west of south, sloping from the "Palisades" where it is 250 or 300 feet high, down to the ocean level at Bergen Point. It is trap, rock broken and precipitous along its eastern face, generally covered on its top with hard-pan overlaid with a thin soil; its western declivity gradual, and composed of water-worn pebbles, gravel, and sand, here and there piled in irregular mounds, and terraces, and undulations, the whole landscape sloping down to the Hackensack marshes. These prairie-like marshes cover an area of more than one hundred square miles. Besides, the eastern border of our county also is skirted with marshes and lowlands. Over these paludal regions, east and west, fogs brood at night, and sometimes they rise above the highest summit of the hill. The annual rainfall is about fifty inches deep; but even this is no criterion of the atmospheric moisture. Observations made with the hygrometer and thermometer repeated morning, noon and night through several years, show that our atmosphere is surcharged with moisture during all the warmer months, a few brief intervals excepted; that saturation at sundown is the general rule; and that in the hottest middays of midsummer, the wet bulb commonly stands only 5° to 7° Fahrenheit below the dry.

Now let us inquire what are the known and necessary consequences to the performance of the vital functions of man, of his breathing constantly an atmosphere nearly saturated with aqueous vapor.

1. The inspired vapor is warmed and expanded in the lungs, and it excludes just so much air as would fill the space it occupies. It dilutes the air and thereby renders the respired oxygen a less energetic supporter of combustion. Wherefore, less oxygen is admitted to the lungs; its affinity for the oxidizable constituents of the blood is weakened, and the vital fires burn low.

2. The inspiratory effort not only draws air from without into the alveoli of the lungs, but thither also, simultaneously, by the same vacuum force, carbonic acid from the blood traversing the alveolar network of capillaries. To this force, at the temperature of venous blood, the bicarbonate of soda it contains gives up one proportion of carbonic acid. But the watery vapor inhaled,

warmed and removed from atmospheric pressure in the lungs, expands perchance even more rapidly than the air it sophisticates, whereby it more or less counterbalances the vacuum force, and to this extent, defeats the physiological disengagement of the carbonic acid from its alkaline base.

3. Whatever the hygrometric condition of the *inspired* air, the *expired* air as it issues from the air passages of man in health, is always saturated with aqueous vapor. By this method from one to three drops of water are expelled from the body with every expiration, amounting to a total of from three and one-half to ten pints in twenty-four hours. But in an atmosphere saturated with vapor at a temperature of 96° Fahrenheit, respiratory evaporation ceases absolutely, and life cannot long be maintained; and exactly in proportion as the air contains moisture, this principal outlet of water from the body is shut off. It is because the capacity of the air for moisture is diminished by that which it already contains, that pulmonary and cutaneous evaporation fail in a damp atmosphere. At first the secretion of urine augments a little; and then it, too, falls below the normal amount. Water accumulates in the blood, and the vascular system is soon replete to a degree of tension, that perverts and obstructs every physiological function. Relief comes at length—often a partial relief only—but not until the vital force is well-nigh exhausted, do the emunctories of the skin give way and the pent-up torrents find vent.

4. Evaporation is a cooling process. As a vital function it takes place chiefly in the respiratory apparatus. In a state of perfect health the cutaneous transpiration is insignificant in quantity—the older physiologists to the contrary notwithstanding. Forsooth the most important function of the skin depends on its dryness and impermeability to moisture. I once had a patient sick with scarlet fever from whose body desquamation removed the entire cuticle; and the consequence was an exudation of a serous liquid containing albumen, amounting to from two to four pints per day, and jeopardizing life. Renewal of the cuticle betimes put a stop to the morbid drainage. Respiratory evaporation physiologically outmeasures the cutaneous at all times. Nevertheless, cutaneous evaporation is considerable in a dry atmosphere when the surface of the body is wet with perspiration. But whenever and to whatever extent beyond the physi-

ological limit, the dampness of the air arrests evaporation, the heat of the body accumulates abnormally. In fact pulmonary oxygenation falls off at the same time, but it does not stay the pyrexia. Fever, of every type, is attended with dryness of the skin and respiratory mucous membranes and with obstructed and feeble circulation: and herein, in the consequent arrest of evaporation, lies the true explanation of the origin of fever heat.

5. Either hyperpyrexia, or congelation, can destroy life. In both these antipodal temperatures of the body alike, man dies by total anesthesia of sense and motion. A deficient respiratory evaporation—deficient, that is to say, below the range of physiological variations—causes not only pyrexial rise of the temperature of the body, but hyperemia and hyperesthesia at the same time as well. Hyperesthesia is a morbidly exalted sense of fatigue, pain—intolerance of light, sound, smell, taste, contact,—weakness and inability to put forth and control muscular effort. It accompanies hyperpyrexia and ends in death by exhaustion of nerve power and complete paralysis. External cold causes anesthesia in a direct manner; not, however, unattended temporarily by local pains in parts rendered relatively hyperesthetic. The conclusion seems incontrovertible that normal innervation, no less than normal temperature, is maintained and governed by the physiological balance of the calorific and the cooling processes. When an atmosphere burdened with moisture disturbs the equipoise of the vital functions, then hyperesthesia arises as surely as do hyperemia and pyrexia. In point of fact hyperemia alone, regardless of coexisting fever, implies hyperesthesia; examples of which can profitably be studied in our climatic neuralgias.

6. A damp atmosphere, in proportion to the vapor it contains, increases the uric acid and diminishes the urea in human urine. In certain extreme pathological phases, human urine also exhibits a trace of uric oxide. These excreta are the nitrogenized residua of the disintegration of connective tissue. The capillary blood vessels are neither more nor less than unlined tunnels through the connective tissue, whose walls are continually reamed and worn away by the chemical action upon them of the oxygen brought hither by the blood-corpuscles. Urea is the almost exclusive excretion of animals having biconcave red corpuscles, as the mammalia (the urine of carnivorous

mammals yields only faint traces of uric acid); uric acid, of animals having biconvex red corpuscles, as the oviparous vertebrata; and uric oxide has been found to be the normal urinary constituent of some of the lower invertebrate animals, the araneidans for example. The biconcave corpuscles contain more iron and carry more oxygen; the biconvex contain less iron and carry less oxygen; and the blood-analogue of the araneidans contains too little iron to form blood-corpuscles, and carries of oxygen least of all.

The formula for urea is $C^2H^4N^2O^2$.

The formula for uric acid is $C^5H^4N^2O^2$.

The formula for uric oxide is $C^5H^2N^2O^2$.

To complete the combustion of urea requires the addition to it of six equivalents of oxygen only, while uric acid takes nine, and uric oxide ten. Urea in human urine is the product of a perfect physiological oxidation of the nitrogenized connective tissue disintegrated; uric acid is the product of imperfect oxidation, and uric oxide of an oxidation more imperfect still. When, therefore, the moisture of the air respired is observed to increase the uric acid in human urine, and, pre-eminently, if it add thereto a trace of uric oxide also, a retardation of tissue-metamorphosis is indicated thereby, which is unmistakably pathological.

7. The most variable constituent of the air is moisture. The quantity of moisture which a given volume of air will hold, increases with the temperature, but in a much faster ratio than the temperature. It follows from this law, that, in a damp climate like our own, the diurnal changes of temperature dependent on the presence of the sun's rays by day and their absence by night, are vastly exceeded by the diurnal fluctuations in the amount of moisture diffused through the air. All the vital functions of man must needs feel and respond to these regular atmospheric alternations, potent as they are, and of life-long continuance. And, verily, man has his diurnal mutations of temperature, of energy, of vascular fulness, of gland-secretion, &c., which he tolerates well within the accustomed physiological range; but which are liable by stress of weather to extend beyond the limits of tolerance and health into the domain of pathology. Malarial fevers are but picture-expressions of the abnormal exaggeration of these diurnal ebbs and floods that run through all vital phe-

nomena, whensoever, and inasmuch as, they exhibit diurnal exacerbations and remissions, intermissions and recurrences.

If, therefore, all the pathological conditions of malarial fevers are demonstrably identical, each with each, with the functional disturbances which of necessity result to man from dwelling in, and breathing an atmosphere highly charged with aqueous vapor; if the records of cases and the readings of the hygrometer, combine to show that when and where continued excess of atmospheric moisture coexists with great diurnal variations, then and there malarial diseases prevail most numerous; or, if we regard the fact that the alternating atmospheric influences of day and night, and of the changing seasons, stamp their impress on malarial diseases in unmistakable minuteness of detail; the conclusion seems to be unavoidable that the true *malaria*, the etiological factor in the origin of our climatic fevers, is *atmospheric moisture*.

The philosopher who revels in visions of final causes, and has an intangible myth for every unexplained phenomenon, attributes to "poisons," "spores" or "disease-germs," all pathological appearances, the source of which he fails to comprehend. It has, of late years, grown to be fashionable in scientific circles, the world over, to peer through a microscope deep into the innermost intentions and capabilities of these pristine parents of disease. How often have M. Pasteur and his disciples, by this means, caught sight of some abhorrent infinitesimal in the very act of manufacturing a pestilence! This most excellent method of discovery commends itself to plausible students of a metaphysical turn of mind, too indolent for genuine scientific investigation. Should any such professional *savant* take exception to the views here enunciated, he has only to exhibit a "self-propagating disease-germ" gravid with embryo intermittents, and to point out to me that other class of diseases, not malarial, to which the morbid influences of a moist atmosphere are accustomed to give rise, and I shall most cheerfully relegate the malarial fevers of our country back to the misdeeds of "algoid cryptogams" and "the scientific uses of the imagination."

NOTES ON LOCALITIES INJURIOUS TO HEALTH BY REASON OF IMPERFECT DRAINAGE.

BY GEORGE H. COOK, STATE GEOLOGIST OF N. J.

The prevalence of intermittents and other diseases which are limited to particular districts, is an indication of an unwholesome state of the earth, or of the atmosphere over it. As a general rule, such diseases are peculiar to localities which are badly drained. There are many such spots in our State, and every year the sickness and suffering from insufficient drainage are such as to excite the sympathy of every lover of his race. And the losses from suspensions and derangements of business make up a large amount of value, taken from the wealth of the country, by this very unnecessary cause of disease. Pond holes, half drained swamps, flat grounds subject to overflow in freshets, and illy-drained pastures and meadows, are the localities which are particularly exposed to the visitation of these periodic diseases. Such localities are more common in the northern than in the southern part of the State.

A few facts in regard to the unwholesome effects of such grounds will best illustrate this subject.

"The Drowned Lands" occupy the valley of the Wallkill from Hampton, three miles west of Goshen, in Orange county, to near Hamburg, in Sussex county, a distance of 37 miles by the course of the stream, and of 20 miles in a straight line. They cover 25,600 acres, of which 15,600 are in Orange county, and 10,000 in Sussex. As early as 1742, Dr. Cadwallader Colden, Surveyor General of the Province of New York, wrote of the insalubrity of these lands. "The inhabitants along the Wallkill are yearly afflicted with intermittent fevers during the summer season, and a constant fog or vapor is observed almost all the summer (except in the time when the northerly or northwest winds blow), to arise over the river, and to remain there at a certain height

and distance every morning." In the Medical Repository for 1809, Dr. D. R. Arnell stated in a Report to the State Medical Society of New York, "that an act was passed before the Revolutionary war to enable the proprietors of those lands to drain them. An attempt was then made, and about two thousand pounds expended at the outlet of the Wallkill; but the Revolution coming on, put a stop to labors." He also said that, "along the Wallkill and Otterkill or Murderer's creek, the tertian intermittent and remittent fevers prevail to a great degree in the fall of the year; but on the west side of the drowned lands they put on a more dangerous and formidable appearance than they do in other parts of the county." In the American Medical and Philosophical Register for 1810, is "an account of the fever which lately prevailed at the drowned lands in Orange county, by Dr. D. R. Arnell."

Omitting much of detail, he says "the lands are generally overflowed with water the greater part of the season;" also "the water was confined back on the drowned lands during the day, but at night the gates were opened and it was suffered to pass off." "The proprietors have been incorporated into a company for draining them, and have employed a large number of workmen for that purpose the last three summers. The country around them is hilly, rough and uneven, and has been visited with remittent and intermittent fevers during the autumn for a number of years past; but the fever has never put on so malignant and dangerous an appearance as it has the two last seasons, at the outlet of the drowned lands, among the workmen and hands employed in draining them."

In an article on the Drowned Lands of Orange county, N. Y., and Sussex county, N. J., published by the American Public Health Association, in their second volume of Reports, is a note from Hon. Wm. Owen, who resides near Pine Island, in those lands. He says, "chills and fever are common in autumn, everywhere along the borders of the drowned lands and on the islands. Before the outlet was cut there were seasons in which the majority of the residents were sick with intermittents. Since that time such diseases have been less common, though they still prevail to an unpleasant degree. The hill country, which borders this part of the valley, is entirely exempt from chills and fever. It is thought, too, by some careful observers, that pulmo-

nary disease is more common along the eastern border of this tract than it is along its western side, owing to the prevailing westerly wind, which carries the damp, chilly air from these wet and really drowned lands."

In the same article there is also a note from Samuel E. Gale, Esq., of Pine Island, upon the same subject. He says, "About forty-five years ago we derived considerable benefit from an improved drainage, the effect of cutting a canal lower than the old bed of the Wallkill at Hampton, and a small portion of these lands was redeemed and made tillable, demonstrating the fact that a system of perfect drainage is all that is required to make this the strongest soil, and also the most productive of any in either of the States in which it is located. Previous to the cutting of this channel these lands were entirely under water for from three to four months each year, and were productive of nothing but wild grass and weeds, of no value and unfit for use. Not only would perfect drainage be a benefit to the soil, but I think it would have a good effect upon the health of the residents upon and around the lands. For the past forty-five years chills and fever have prevailed in the summer, making it almost impossible for strangers to escape the dreaded disease. I notice the percentage is far greater here on the islands than on the hilly districts of Orange and Sussex. Although the freshets are not so great or of as long continuance as before the cutting of the canal, yet every spring and fall these lands are overflowed, and our crossroads almost impassable by reason of being for a week or ten days from six to thirty-six inches under water. Last season, while the dry weather ruined all the hay crops on uplands, our redeemed drowned lands were covered with a heavy burden of good grass. A freshet came before the people had time to secure the grass, rendering it impossible to get on the lands, and thus nine-tenths of the crop was destroyed. These are facts in regard to the drowned lands which any resident near them will corroborate."

In the same article is still another from Dr. Wm. B. Bradner, who is practising near the drowned lands, and describes the effects of the stagnant waters of one of the branches of the Wallkill, which joins it there. He says "our creek flows through and should drain 3,000 acres of heavy boggy land, but probably half of the year, 2,000 acres are overflowed and covered with stagnant

water, and then slowly drying into pools and water soaked soil, and in very dry seasons becoming passably free from water. Now last spring the rains were sufficient to cover these lands, and it was summer before they were dried out; but the summer was very dry at first, until nearly all the marsh land was drained and dried up, then came the heavy rains, and everything was again afloat there, then another dry time followed. The result is this, miasmatic diseases have reached a pitch unknown here, and who can doubt the cause? When I say 40 years, I refer to a historic period, for about that time the physicians residing here compelled the citizens to destroy a mill-dam below the village, and thereby secured a passable drainage of the meadow lands south of us. They did so in hopes of removing the cause of a most terrible fever then prevailing here, and when the mill-dam was gone and the meadow drained, there was an end of the fever. The same creek is now checked with debris and sand bars, so that we are suffering the same way our fathers did nearly a half century ago. I have attended very many cases this year, nearly all of them occurring in the valley. True, some were sick on the mountains, but it is a noteworthy fact that the only case I have seen sick with any form of miasmatic disease on the mountains this year, was a man who had worked daily in the valley, and doubtless contracted the disease there, and not on the hill tops."

The annual report on the progress of the Geological Survey for this year, has an account of the drainage of the Great Meadows on the Pequest in Warren county, in which there is testimony to the former insalubrity of that region. Drs. Blackwell and Cooke of Hackettstown, Dr. Roe of Vienna, and Dr. Hartpence of Oxford, all of whom have practiced along the borders of the meadows, say that autumnal fevers and malarial disorders prevailed there much more than in the hilly country around, and they attribute these to the stagnant water and undrained ground of the meadows. Dr. Blackwell says "it appeared to me while sojourning in this neighborhood and marking the effect of these blighting influences upon the health of the people, that I could perceive in the lessened vigor and robustness of many of the residents, the results of this insidious and baleful poison. According to my observation, this is by far the worst malarious district in this part of the State. The outbreak of malaria always occurs when the overflow of the Pequest drying up, leaves its sedimentary matter,

as well as the earth soaked with deadly gases, to the full influence of the fierce autumn sun."

The Passaic river has numerous large bodies of undrained land along its borders, in Morris, Union and Essex counties. Between 20,000 and 25,000 acres of land are there, liable to freshets and overflow, and to bring upon the people living on or near them an annual attack of chills and fever. Such diseases are very prevalent in seasons when the freshets occur, after the grass is grown, so as to hold back the water that overflows the meadows, and let it become stagnant. A single extract from a letter of Dr. E. R. Laine, of Caldwell, Essex county, is sufficient to illustrate this, though it is not a thousandth part of the ill effects that have been experienced from this lack of proper drainage. Writing in the winter of 1875 he says: "On the 10th of August, 1875, there occurred a heavy rain storm, which completely submerged the lowlands bordering the Passaic above Little Falls. This storm was followed by a warm, dry spell of weather, which caused the tall vegetation to rapidly ferment and decay to such an extent as to give the water of the river the appearance of strong tea, so saturated was it with vegetable juices. Upon the subsidence of the water from the inundated meadows and exposure to the hot sun, they emitted an extremely unpleasant odor that was perceptible a mile off in some directions.

"The above condition of things led me to think it a most favorable one for the development of malarial troubles, and to anticipate an early epidemic of intermittents. I was not mistaken in my surmises, for in three weeks from the time of the storm it made its appearance. I soon had my hands full, though there were a great many cases that did not come under my notice—the patients treating themselves with quinine and other well-known remedies. A curious circumstance connected with the cases under my treatment was the fact that some four or five patients had the paroxysm commence on the same day and same hour of the day, and continue in the same manner for some time.

"Most of the cases occurred in the neighborhood of what are known as the Great and Little Pieces on Horse Neck, where there were fifteen. There were six cases at Pine Brook, and on the higher grounds there were only four which came under my treatment."

One of the gentlemen having charge of the draft that was made

in Morris county for soldiers in the late war, informs us that the number of persons exempted on account of lack of physical health and vigor, was by far greater in the townships in which these undrained lands lie, than in any other. And it was understood by those concerned in the examination, that failure of health and vitality was owing to the insalubrious atmosphere to which they were so unfortunate as to be exposed.

There are many other tracts of ground of smaller extent within the State, from which other testimony of the same kind could be obtained. But the above is sufficient. The evil is one of great public importance in the present condition of our State. Located near the great centres of business on this continent, and having a delightful climate, it attracts new residents to all its pleasant and salubrious districts, and is destined soon to be the most densely populated of any of the United States. The removal of these few causes of disease will help to make it most uniformly healthy.

Heretofore, drainage in the country has been done only for its agricultural benefits, and the lands drained have been assessed to pay the expenses. The damage to individual health, and the loss of life to families, have been borne without aid or relief from the public authorities. Mill-dams, and obstructions hindering the free flow of streams, have been considered of too much value to be removed on any ground of public good or sanitary benefit. The time has come when public authorities must interpose to protect suffering communities, and by a judicious and equitable use of their credit, authorize and encourage well-planned works of drainage.

METEOROLOGICAL TABLES.

NEWARK, N. J. 1873—1877.

No. 1.—Showing the Minimum, Maximum and Mean Temperature, and the quantity of Water from Rain and Melted Snow for each Month.

MONTHS.	Years.	MIN'M TEMPE.		MAX'M TEMPE.		Mean of Month.	Inches of Rain and Melted Snow.	Mean Temperature, 5 years.	Mean Water Fall, 5 years.	
		Date.	Degree.	Date.	Degree.					
January.....	1873	30	12	16	42 $\frac{1}{2}$	24.77	5.820	28.20	3.812	
		4	16	9	23	61 $\frac{1}{2}$	32.61			
		5	19	3	22	37	22.92			3.310
		6	14	12 $\frac{1}{2}$	2	65	34.90			1.200
		7	6	7 $\frac{1}{2}$	27	42 $\frac{1}{2}$	25.80			3.060
February.....	1873	24	1 $\frac{1}{2}$	8	47 $\frac{1}{2}$	27.41	3.885	29.12	3.292	
		4	2	3 $\frac{1}{2}$	23	68 $\frac{1}{2}$	28.66			3.168
		5	10	1 $\frac{1}{2}$	24	48 $\frac{1}{2}$	22.92			2.400
		6	5	6 $\frac{1}{2}$	13	55 $\frac{1}{2}$	32.13			5.355
		7	14	11	21	49	34.46			1.650
March.....	1873	5	8 $\frac{1}{2}$	23	52	34.47	2.760	35.57	4.958	
		4	13	15 $\frac{1}{2}$	4	63 $\frac{1}{2}$	37.83			2.135
		5	1	10 $\frac{1}{2}$	30	56	31.84			3.820
		6	19	10 $\frac{1}{2}$	7	66 $\frac{1}{2}$	36.13			10.000
		7	19	13	23	59 $\frac{1}{2}$	37.56			6.075
April.....	1873	1	33 $\frac{1}{2}$	28	64 $\frac{1}{2}$	46.58	5.835	45.87	4.823	
		4	5	20 $\frac{1}{2}$	15	66 $\frac{1}{2}$	41.48			8.715
		5	19	22	2	68	43.42			3.135
		6	9	29	14	69 $\frac{1}{2}$	48.46			3.305
		7	3	30 $\frac{1}{2}$	24	78 $\frac{1}{2}$	49.40			3.125
May.....	1873	4	36 $\frac{1}{2}$	28	83	57.97	3.755	59.35	2.432	
		4	3	33 $\frac{1}{2}$	10	88 $\frac{1}{2}$	58.62			2.755
		5	3	36 $\frac{1}{2}$	21	85 $\frac{1}{2}$	60.13			1.595
		6	1	35 $\frac{1}{2}$	7	85 $\frac{1}{2}$	59.46			3.045
		7	3	37 $\frac{1}{2}$	18	87	60.56			1.010
June.....	1873	3	47 $\frac{1}{2}$	19	88 $\frac{1}{2}$	68.59	1.715	70.10	2.677	
		4	2	50 $\frac{1}{2}$	29	91	69.41			3.580
		5	14	47	25	92	68.75			2.335
		6	1	47 $\frac{1}{2}$	26	90	72.18			1.585
		7	23	53 $\frac{1}{2}$	26	93 $\frac{1}{2}$	71.58			4.170

No. 1 (Continued).—Showing the Minimum, Maximum and Mean Temperature, and the quantity of Water from Rain and Melted Snow for each Month.

MONTHS.	Years.	MIN'M TEMP'E.		MAX'M TEMP'E.		Mean of Month.	Inches of Rain and Melted Snow.	Mean Temperature, 5 years.	Mean Water Fall, 5 years.	
		Date.	Degree.	Date.	Degree.					
July	1873	12	53	3	91½	74.13	6.615	75.33	5.172	
		4	5	59½	15	83½	73.48			4.230
		5	24	58	6	91	72.88			5.985
		6	27	58	9	98	78.31			3.060
		7	14	60½	26	99	77.86			5.980
August	1873	24	56½	3	88½	74.40	7.765	73.05	6.139	
		4	27	53½	20	-89	69.21			2.785
		5	3	56½	31	83½	70.94			10.215
		6	22	53½	7	92½	74.15			2.450
		7	6	60	8	94½	76.57			7.730
September	1873	15	42½	1	84½	63.89	3.550	64.55	4.701	
		4	22	48	11	88½	66.79			9.050
		5	23	41	3	85½	62.50			1.930
		6	23	45½	1	88	62.81			7.505
		7	23	47½	14	85	66.74			1.470
October	1873	30	30	5	71½	53.37	3.740	52.63	3.608	
		4	15	33½	29	70	53.69			2.435
		5	14	33½	25	69½	51.83			2.370
		6	30	30	6	71½	48.67			1.260
		7	23	35½	16	75½	55.57			7.735
November	1873	21	20½	3	57½	36.12	4.670	40.72	4.569	
		4	14	20½	6	64½	40.98			2.860
		5	30	8	13	61½	37.98			4.360
		6	29	27½	2	70	43.92			4.040
		7	21	25½	9	65½	44.82			6.915
December	1873	31	16½	4	64½	34.38	2.476	31.87	2.266	
		4	15	7½	3	50½	31.19			2.810
		5	20	2½	23	58½	32.30			2.610
		6	10	4	13	44	23.81			2.515
		7	2	22½	20	58½	37.65			0.920

No. 2.—Showing the Minimum, Maximum and Mean Temperature, and the quantity of Water from Rain and Melted Snow in each year, with the number of days on which it was fair or on which rain or snow fell.

YEARS.	MINIMUM.		MAXIMUM.		Mean Temp.	Inches of Rain and Melted Snow.	Fair on Days.	Rain on Days.	Snow on Days.
	Date.	Degree.	Date.	Degree.					
1873	Jan. 12	-12	July 3	91½	49.34	52.580	232	97	33
1874	Feb. 2	3	June 29	91	50.41	50.193	239	92	28
1875	Jan. 19	-3	June 25	92	48.20	44.565	219	102	44
1876	Dec. 10	4	July 9	98	51.23	45.320	216	96	31
1877	Jan. 6	7½	July 26	99	53.21	49.340	228	98	13
Average of the five years.....					50.48	48.500	227	97	30

No. 3.—Showing the Minimum, Maximum and Mean Temperature and the quantity of Water deposited in each Season.

SEASONS.	Years.	MINIMUM.		MAXIMUM.		Mean Temp.	Inches of Rain and Melt'd Snow.	Mean Temp, 5 years.	Mean Water Fall, 5 years.	
		Date.	Degree.	Date.	Degree.					
Spring	1873	Mar. 5	8½	May 28	83	46.27	12.350	46.91	12.213	
		4	" 13	15½	" 10	88	45.97			13.605
		5	" 1	10½	" 21	85	45.13			8.550
		6	" 19	10½	" 7	85	48.05			16.350
		7	" 19	13	" 18	87	49.14			10.210
Summer	1873	June 3	47½	July 3	91½	71.04	16.095	72.56	12.042	
		4	" 2	50½	June 29	91	70.70			10.595
		5	" 14	47	" 25	92	70.36			18.545
		6	" 1	47½	July 9	98	74.88			7.095
		7	" 23	53½	" 26	99	75.34			17.880
Autumn	1873	Nov. 21	20½	Sept. 5	84½	51.12	11.960	52.63	12.873	
		4	" 14	20½	" 11	88½	53.82			14.345
		5	" 30	8	" 3	85½	50.77			9.160
		6	" 29	27½	" 1	88	51.73			12.805
		7	" 30	27	" 14	85	55.71			16.120
Winter	1872-3	Jan. 30	-12	Feb. 8	47½	25.59	13.490	23.92	9.942	
		3-4	Feb. 2	3	" 23	68½	32.21			11.308
		4-5	Jan. 19	-3	Dec. 3	50½	25.67			8.520
		5-6	Dec. 20	2½	Jan. 2	65	33.11			9.165
		6-7	" 10	4	Feb. 21	49	28.03			7.225

NO. 4.—SHOWING THE AMOUNT OF SNOW FOR THE LAST FIVE YEARS—STATION, NEWARK.

INCHES OF SNOW EACH WINTER.

MONTHS.	1872-3	1873-4	1874-5	1875-6	1876-7
October.....				1	
November.....	3½			0½	
December.....	25	8	21	11	13½
January.....	14	6	17	11	21½
February.....	23½	22	5	10	1½
March.....	2	5	17½	6½	7½
April.....	3	5	7½		
Total each winter.....	71	46	68	20	43½

NO. 5.—APPROXIMATE WINDS—NEWARK 1877.

From observations of the general course of the wind each morning and afternoon. The figures being the result of the addition of half days:

MONTHS.	N.								E.								S.								NO. DAYS.
	N.	N. 10 N.	N. E.	N. E. 10 E.	E.	E. 10 S.	S. E.	S. E. 10 S.	S.	S. 10 S. W.	S. W.	S. W. 10 W.	W.	W. 10 N. W.	N. W.	N. W. 10 N.									
January.....	1	2	3	...	...	2	...	1	...	8	2	4	9	5	1	31							
February.....	1	3	2	...	...	1	...	...	...	3	4	1	3	7	3	28				
March.....	1	3	7	1	...	1	2	...	...	4	1	2	1	7	1	31							
April.....	...	2	8	3	3	2	3	...	...	2	...	...	1	4	2	30					
May.....	2	1	2	1	1	...	4	...	2	5	1	2	1	8	1	31									
June.....	...	1	2	1	2	1	7	2	1	...	8	3	1	...	2	30									
July.....	...	2	5	5	...	2	6	1	...	4	2	2	1	5	1	31									
August.....	...	2	3	1	1	1	3	1	1	...	4	1	6	...	6	31									
September.....	...	1	3	...	1	...	5	2	...	1	9	...	1	5	...	30									
October.....	1	...	5	...	1	...	4	...	...	5	1	6	...	7	1	31							
November.....	1	1	5	1	1	...	2	...	1	...	5	1	4	1	6	30									
December.....	1	...	8	1	...	...	...	1	...	5	3	5	3	3	1	31						

METEOROLOGICAL SUMMARY FOR 1877 OF OBSERVATIONS BY E. R. COOK.—STATION, TRENTON.

Thermometer highest—August 29..... 93°
 Thermometer lowest—January 3..... 7°

Rained on 69 days; *Snowed 3 times; 17 thunder showers; 15 fogs; †27 frosts; 5 hail storms.

First frost, September 22; first ice, November 7; first snow, November 21.

Amount of rain fallen in each month:

	INCHES.
January.....	2.10
February.....	1.31
March.....	5.65
April.....	2.70
May.....	0.91
June.....	4.45
July.....	7.40
August.....	5.47
September.....	3.45
October.....	6.50
November.....	8.41
December.....	2.90
	51.25

* Snows since November 21.
 † Frosts since September 22.

METEOROLOGICAL RECORDS FURNISHED BY EZRA A. OSBORNE, C. E.

BAROMETER.

Monthly and Annual mean pressure—July, 1875, to June, 1876, inclusive.

STATIONS.	1875.						1876.						Annual Means.
	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	
Atlantic City.....	29.996	30.036	30.040	30.061	30.087	30.020	30.149	30.115	30.028	29.995	30.061	30.010	30.045
Barnegat.....	29.987	30.030	30.026	30.093	30.067	30.003	30.136	30.108	30.019	29.986	30.055	30.004	30.034
Cape May.....	29.989	30.028	30.043	30.009	30.092	30.032	30.163	30.127	30.039	30.009	30.064	30.018	30.052
Long Branch.....	29.987	30.043	30.032	29.994	30.076	30.024	30.132	30.112	30.013	29.982	30.048	29.998	30.037
Sandy Hook.....	29.971	30.024	30.011	29.977	30.070	30.006	30.112	30.092	29.999	29.963	30.026	29.981	30.019

THERMOMETER.

Monthly and Annual mean temperature—July, 1875, to June, 1876, inclusive.

STATIONS.	1875.						1876.						Annual Means.
	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	
Atlantic City.....	73.0	72.0	64.1	54.5	40.7	35.3	37.0	34.5	36.5	46.1	55.5	61.2	51.5
Barnegat.....	72.3	71.6	64.3	53.9	40.4	36.4	37.0	34.5	36.3	46.0	56.0	61.3	52.1
Cape May.....	72.3	71.6	64.7	55.4	41.3	38.5	39.7	37.5	37.3	47.7	57.3	70.5	53.1
Long Branch.....	72.3	71.6	64.1	54.4	41.3	38.5	38.3	34.2	37.3	45.5	56.5	63.4	51.3
Sandy Hook.....	73.0	71.7	64.0	53.4	40.9	34.3	36.4	33.3	36.7	46.3	53.7	71.7	52.6

RAIN FALL.

Monthly and Annual amounts of rain fall, in inches, from July, 1875, to June, 1876, inclusive.

STATIONS.	1875.						1876.						Annual Amounts.
	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	
Atlantic City.....	1.30	4.78	2.45	2.17	4.19	4.28	1.05	3.53	4.78	1.86	3.92	1.78	36.09
Barneget.....	5.97	4.18	3.99	1.67	5.40	4.63	1.55	4.04	9.18	3.06	3.79	1.45	49.88
Cape May.....	3.13	10.16	2.70	2.03	4.75	3.39	1.14	1.78	7.31	3.10	3.25	5.67	49.41
Long Branch.....	7.19	11.93	4.05	3.40	7.27	4.32	1.62	3.69	10.57	3.51	4.73	4.54	68.82
Sandy Hook.....	4.44	8.96	2.98	3.50	5.36	3.40	1.35	5.80	11.04	3.92	4.47	5.96	61.18

SIGNAL STATIONS IN NEW JERSEY.

ATLANTIC CITY.

Latitude.....	
Longitude.....	39° 22'
Mean barometer for the year ending June 30, 1876.....	74° 25'
Mean temperature for the year ending June 30, 1876.....	30.045
Amount of rain fall for the year ending June 30, 1876.....	51° 5
	36.09 inches.

BARNEGAT.

Latitude.....	
Longitude.....	39° 48'
Mean barometer for the year ending June 30, 1876.....	74° 9'
Mean temperature for the year ending June 30, 1876.....	30.034
Amount of rain fall for the year ending June 30, 1876.....	52° 1
	49.88 inches.

CAPE MAY.

Latitude.....	
Longitude.....	38° 56'
Mean barometer for the year ending June 30, 1876.....	74° 58'
Mean temperature for the year ending June 30, 1876.....	30.052
Amount of rain fall for the year ending June 30, 1876.....	53° 1
	49.41 inches.

LONG BRANCH.

Latitude.....	
Longitude.....	40° 13'
Mean barometer for the year ending June 30, 1876.....	73° 59'
Mean temperature for the year ending June 30, 1876.....	30.037
Amount of rain fall for the year ending June 30, 1876.....	51° 8
	68.82 inches.

SANDY HOOK.

Latitude.....	
Longitude.....	40° 23'
Mean barometer for the year ending June 30, 1876.....	74° 1'
Mean temperature for the year ending June 30, 1876.....	30.019
Amount of rain fall for the year ending June 30, 1876.....	52° 6
	61.18 inches.

REFERENCE TO FORMER STATE LAWS BEARING ON PUBLIC HEALTH.

VITAL STATISTICS.

1. An act relating to the registry and returns of births, marriages and deaths in the State of New Jersey. Pamphlet Laws of 1848, page 155.

2. A supplement to an act entitled "An act relating to the registry and returns of births, marriages and deaths in the State of New Jersey," approved March third, eighteen hundred and forty-eight. Pamphlet Laws of 1851, page 434.

3. A supplement to an act entitled "An act relating to the registry and returns of births, marriages and deaths in the State of New Jersey," approved March third, eighteen hundred and forty-eight. Pamphlet Laws of 1862, page 161.

4. A further supplement to an act entitled "An act relating to the registry and returns of births, marriages and deaths in the State of New Jersey," approved March third, eighteen hundred and forty-eight. Pamphlet Laws of 1863, page 405.

5. A further supplement to the act entitled "An act relating to the registry and returns of births, deaths and marriages in the State of New Jersey," approved March thirtieth, one thousand eight hundred and forty-six. Pamphlet Laws of 1863, page 472.

(A mistake has been made in the title of this supplement in referring to the act of "one thousand eight hundred and forty-six," for I find no such act.)

6. An act to provide for a board of health and vital statistics in the county of Hudson, and to prevent the spread of diseases. Pamphlet Laws of 1874, page 569.

7. A supplement to the act entitled "An act concerning marriages, births and deaths," approved March twenty-seventh, eighteen hundred and seventy-four. Pamphlet Laws of 1876, page 158.

(The title is wrongly quoted.)

8. A supplement to an act entitled "An act concerning marriages, births and deaths," approved March twenty-seventh, eighteen hundred and seventy-four. Pamphlet Laws of 1877, page 168.

9. An act to amend an act entitled "A supplement to an act entitled 'An act concerning marriages, births and deaths,'" approved March twenty-seventh, eighteen hundred and seventy-four, which supplement was approved April seventeenth, eighteen hundred and seventy-six. Pamphlet Laws of 1877, page 214.

10. Special law for the city of Newark entitled, "An act for the registration of births, marriages and deaths in the city of Newark." Pamphlet Laws of 1871, page 805.

MEDICINE AND SURGERY.

11. An act to reorganize the Medical Society of New Jersey (former act and all supplements repealed.) Pamphlet Laws of 1864, page 250, and Revised Statutes of 1877, page 675.

QUARANTINE.

An act to relieve owners and officers of vessels owned in New Jersey from detention at quarantine. Pamphlet Laws of 1874, page 57, and Revised Statutes of 1877, page 300, relates to quarantine.

PUBLIC HEALTH.

An act concerning unwholesome food, making the selling of unwholesome food criminal. Nixon's Digest, page 206, section 77.

An act relating to public health. Pamphlet Laws of 1874, page 47.

An act to establish a State Board of Health. Pamphlet Laws of 1877, page 220.

An act relating to the appointment of a sanitary commission. Pamphlet Laws of 1866, page 982.

An act relating to the sanitary condition of the public schools. Pamphlet Laws of 1873, page 152.

INFECTIOUS DISEASES.

1. An act to prevent the introduction of malignant and other infectious diseases in this State, (former act repealed.) Pamphlet Laws of 1871, page 84, and Revised Statutes of 1877, page 300.

An act to prevent diseases among cattle. Pamphlet Laws of 1866, page 981, &c.

NOTE.—The permission of the New Jersey Agricultural Society to be obtained, for the shipment of cattle from foreign countries, by public advertisement in three newspapers.

ADULTERATIONS.

1. An act making it a criminal offence to manufacture, or sell, or import already manufactured for sale, any adulterated or spurious liquors in the State of New Jersey. Pamphlet Laws of 1871, page 105.

2. An act to prevent the adulteration of milk, and to prevent traffic in impure and unwholesome milk. Pamphlet Laws of 1875, page 58.

NUISANCE.

Nuisance at common law deemed a misdemeanor. Revised Statutes of 1877, page 261, sec. 192.

VACCINATION.

Commission to report what they may deem important respecting "the vaccination of the indigent." Pamphlet Laws 1866, p. 982.

PHARMACY.

An act to regulate pharmacy. Pamphlet Laws of 1877, page 211.

An Act to establish a State Board of Health.

1. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That the governor shall appoint seven persons, who, together with the Secretary of state and attorney general as ex-officio members, shall constitute the board of health of the State of New Jersey; the persons so appointed shall hold their offices for seven years; *provided*, that the terms of office of the seven first appointed shall be so arranged that the term of one shall expire each year, and the vacancies so created, as well as all vacancies occurring otherwise shall be filled by the governor.

2. *And be it enacted*, That the board shall take cognizance of the interests of health and life among the citizens of this State; they shall make sanitary investigations and inquiries in respect to the people, the causes of disease, and especially of epidemics and the sources of mortality, and the effects of localities, employments, conditions and circumstances on the public health; and they shall gather such information in respect to these matters as they may deem proper for diffusion among the people; they shall also make inquiries and reports in reference to diseases affecting animals, and the methods of prevention; they shall appoint a chairman, who shall call meetings as often as every three months, or when requested to do so by three members of the board; they shall, in the month of December, make report to the governor of their investigations and opinions during the year ending December first, with such suggestions as they may deem necessary; *provided*, that the provisions of this act shall not apply to any city, borough or township in which there is a local board of health.

3. *And be it enacted*, The board shall elect a secretary from their own number who shall superintend the work prescribed in the law, as the board may require; the entire expense in prosecuting inquiries and securing the desired information shall not exceed one thousand dollars; and said amount shall be payable by the comptroller on account rendered, and signed by the president and secretary of the board and approved by the governor.

4. *And be it enacted*, That this act shall take effect immediately.
Approved March 9, 1877.

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