SIXTH ANNUAL REPORT

OF THE

BOARD OF HEALTH

OF THE

STATE OF NEW JERSEY.

1882.

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1882.

THE STATE BOARD OF HEALTH.

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REPORT OF THE SECRETARY OF THE BOARD.

To His Excellency, George C. Ludlow,

GOVERNOR:—In behalf of the State Board of Health of New Jersey, I beg leave to present to your Excellency the sixth report of the Board. In no previous year have the duties which have devolved upon it been so numerous, or its relations to the local and general interests of the State so responsible. This is because the public mind has become impressed with the fact that much of sickness arises from avoidable causes; because local Boards oftener have occasion to consult us as to the means of abating or preventing evils injurious to health and life, and because some laws passed by the last Legislature enlarged the field of our inquiry. Health administration on the part of the State is no longer looked upon as only a charity, or as one of the general ways which a government has of indicating its interest in its citizens. Neither is it a plan for meeting only the emergencies of a sudden epidemic. It takes the higher and well-sustained view that race vitality, physical vigor and the avoidance of the ascertained causes or concomitants of disease, are essential to the welfare of the people and to the prosperity of the body politic. It sees that a State, in its organic capacity, cannot ignore so indispensable a condition to its development and progress. Our social and national status is determined not less by the vigor of the body than by the education of the mind. Indeed, education which does not give large attention to bodily health is itself defective. Political economy no longer closes its eyes to the significance of inquiries into the health of the population, as bearing upon all questions of industry, finance and thrift. The health of the laborer is not only an element in "the production of wealth, but in the permanency of the State." The health of the family defines the capacity of wages to confer comfort and self-support, more than does the numerical statement of dollars and cents. Not less does it concern *all* citizens and all families in a common defence and a mutual interest to see to it that no oppressive tax is

levied by the burdens of avoidable disease. If so, palsied industries, depressed spirits and inadequate means conjoin to degrade the people, and life, liberty and happiness are alike imperiled. As a practical infusion of energy and power into the people, no plan would be so successful as that which would reduce to a minimum the occurrence of ill-health and disease. The power that a State has thus to appreciate and in fact determine the physical vigor of its population, is no longer questioned, and the importance of giving large attention to its securement is too often painfully manifest. Mr. Spencer, in his recent visit to this country, in a criticism as kind as it is discerning, says: "In every circle I have met men who had themselves suffered from nervous collapse due to stress of business, or named friends who had either killed themselves by overwork, or had been permanently incapacitated, or had wasted long periods in endeavors to recover health. I do but echo the opinion of all the observant persons I have spoken to that immense injury is being done by this high-pressure life—the physique is being undermined. That subtle thinker and poet whom you have lately had to mourn, Emerson, says, in his essay on the gentleman, that the first requisite is that he shall be a good animal. The requisite is a general one—it extends to the man, to the father, to the citizen. We hear a great deal about 'the vile body,' and many are encouraged by the phrase to transgress the laws of health. But nature quietly suppresses those who treat thus disrespectfully one of her highest products, and leaves the world to be peopled by the descendants of those who are not so foolish.

"Beyond these immediate mischiefs there are remoter mischiefs. * * * * Also, there is injury to the posterity. Damaged constitutions re-appear in children and entail on them far more of ill than great fortunes yield them of good. When life has been duly rationalized by science it will be seen that among a man's duties care of the body is imperative, not only out of regard for personal welfare, but also out of regard for descendants. His constitution will be considered as an entailed estate, which he ought to pass on uninjured if not improved to those who follow; and it will be held that millions bequeathed by him will not compensate for feeble health and decreased ability to enjoy life."

To this Board has been assigned the duty of taking "cognizance of the interests of health and life among the citizens of this State; of making sanitary investigations and inquiries in respect to the people, the cause of disease and especially of epidemics, and the sources of

mortality and the effects of localities, employments, conditions and circumstances on the public health." Such inquiries not only call for a general superintendence over the more vital concerns of population, but lead us to co-operate with local Boards and governing authorities in all that relates to information and advisement for the public health. Besides the broad field of inquiry which the constituting act suggests, the Legislature has, from time to time, specified the direction and method of special investigations, and so has not left us in doubt both as to the extent and significance of the work.

The year just closed gives us the general fact as to the vital movements of the population, that there have been 8837 marriages, 23,108 births, 25,942 deaths. The report of the Bureau of Vital Statistics more fully states and analyzes the significance of these figures. It may well be noticed here, however, that for the statistical year which ended July 1st, 1882, there was an increase of 5130 over the previous year. Some of the increase was directly owing to the exceptional winters and summers of the years 1879–80 and 1880–81. But when we take the low death rate of choice localities in the State and compare with it the losses in some cities, and then, again, in the excessive infant mortality trace the unfriendly influences which kill the younger population, and depress and shorten older lives, it is easy to see that much of this might be avoided. The occurrence of malaria and of two or three typhoid endemics, will be noted in another connection. Local outbursts of diphtheria have occurred at New Hampton, New Brunswick, Bridgeton, Dover, Newark and Phillipsburg, and to a less degree in a few other localities. Measles has been largely epidemic in the State, but not in a fatal form. The tables of death rate show a somewhat diffused prevalence of scarlet fever.

Small-pox, as noticed in the last report, affected many localities in the State. The efficiency of local Health Boards and the more intelligent views of early isolation and vaccination, alone prevented it from becoming a general epidemic. With an early infection of Camden and Hoboken and several foci of the disease started in the State, it was only the vigilance of local authorities that confined it within limits. We have had from various points most satisfactory evidence of the value of this attention, and have been able to help local Boards in rapidly perfecting methods of quarantine and protection. The experience of Paterson was more unfortunate, and was complicated by the distribution of some useless vaccine lymph. Yet here a severe epidemic was checked by giving additional powers to health officers.

Much has been learned as to methods of guarding against imperfect vaccine lymph. Papers which form a part of this report, give valuable information to the people as well as to physicians, on this subject. Fuller details as to other diseases will be found in the report of the Medical Superintendent of State Vital Statistics.

WATER-SUPPLY.

The securement of a healthy water-supply for the citizens of this State is so obvious a necessity that we only have reason to point out the risks of its pollution, and the sources from which a supply is to be derived. In order for this the water-sheds of the State and its natural drainage need to be carefully considered. The pollution of wells in crowded cities is almost inevitable, and hence the chief reliance has to be placed on a general water-supply. Driven wells have been used in some parts of the State to advantage. These are often found to be impregnated with mineral matter, so as to be unpalatable, and even organic matter, through sandy soil, reaches them far deeper than would be supposed. Cisterns properly constructed and under careful supervision, provide for many places where well-water, or a public supply, is not available. About thirty of our cities already have water-works. Somerville and Orange have introduced water the past year, and Princeton, Asbury Park, Atlantic City, Gloucester City and other towns are busy in the planning or execution of methods. There is need of the wisest forethought in providing for present and prospective population, and especially in reference to that area included within thirty miles of New York city, which alone contains one-half of the population of the whole State. Your Excellency, it will be remembered, drew the attention of the Legislature of 1882 to the subject in your first annual message, as follows:

"The two largest cities of the State, and much of the thickly-settled surrounding country, derive their supply of water from a stream defiled by the emptyings of manufactories and sewers for miles above the point at which it is drawn. This condition of affairs must continue to grow worse, since the natural growth of the communities increases alike the demand for pure water and the contamination of that upon which they depend. Fortunately, the evil is not irremediable. The natural channels of the Passaic river bring to within fifteen (15) miles of Jersey City, and a shorter distance from Newark, each day over four hundred million (400,000,000) gallons of pure

water, gathered from streams, springs and lakes of a mountainous and thinly-settled district of country. This immense quantity is delivered in a pure condition at a point one hundred and fifty (150) feet above the level of the sea, from which an easy descent can be made to the places where it is to be distributed. There is urgent necessity that this should be utilized for the benefit of the three hundred thousand (300,000) people who need it, especially as it is, at all times, liable to be pre-occupied by mills or taken by some single municipality, or, possibly, bought to satisfy the pressing want of the neighboring metropolis. The importance of this subject cannot well be over-estimated, since it includes within itself the health and prosperity of the most densely-populated and thriving portion of our State."

J. Bailey Denton, in his work on "Sanitary Engineering," p. 37, says:

"In mountainous and hilly districts, where sufficient areas of impervious gathering grounds can be found is the best means of supply, because it is of a character over which the engineer has most command. * * * I refer to the storage of rain-water therein off uncultivated surfaces, and collected before it becomes contaminated by foreign matter."

The Legislature, in the protection of this interest, passed "An act to provide for the appointment of commissioners to determine upon plans for the storage of any of the waters of this State for the purpose of furnishing to cities and towns a joint water-supply." (Ch. 189, Laws of 1882.)

Under this act Ashbel Welch, C. E., of Lambertville; Henry L. Butler, of Paterson; George Randall, of Newark; and Andrew Clerk, of Jersey City, were appointed commissioners. The sickness and lamented death of the distinguished chairman of the commission have delayed action. The commission will, no doubt, give thorough attention to the important work committed to its investigation.

Camden and other cities in the south and west of the State, also need carefully to guard their sources of supply. Because of the changes that are constantly taking place in the head-waters of streams or the various pollutions to which they may be subjected, there is constant need of supervision by the Water Boards in charge.

DRAINAGE.

"Drainage for Health," is one of the subjects, the importance of which needs to be most earnestly impressed.

"Perhaps," says Engineer Denton, "the most fruitful source of impurity of air in dwellings, is the damp condition of the ground immediately beneath and adjacent to them, which often becomes saturated with liquid filth by the too frequent practice of throwing the slops of the dwelling on the surface of yards or gardens, or by heaping upon it solid refuse of all sorts, to be washed into the soil by the rainfall, and to give off effluvia from their accumulated heaps, or to spread their minute particles in the air and be taken into the lungs by respiration. Soil, where drained or aërated, has an (p. 13) almost immeasurable power of cleansing any liquid that may enter and pass through it." But it is because in cities the ground is so often soaked with water as to furnish it stagnant water in place of circulating water and circulating air, that it becomes filth-sodden. Having no crop to consume the organic materials, it gives off its gases to the air to be inbreathed by persons. Such soil is also kept so wet as to reduce its temperature, while, by evaporation, greater cold is produced upon its surface. Such ground is always subject to such variations as are most unfriendly to health. Hence, "drainage has the effect of improving the temperature of the air incumbent upon the ground, as well as of raising that of the soil beneath."

After illustrating, by many facts, the effect of insufficient drainage on health, he says:

"The maintenance of pure air by the under-drainage of the soil surrounding or beneath dwellings, is an object only inferior in importance to the removal of putrescible matters. That this object is one of the most important that can engage the attention of the sanitary engineer cannot be denied, when it is shown, upon the authority of Dr. De Chaumont, that long-continued exposure to bad air tends to the production of scrofula and consumption—of which latter disease it is probably the most efficient cause. That it promotes enteric fevers; that it fosters ailments of the respiratory organs, such as catarrh, bronchitis and pneumonia; that it is frequently the cause of inflammation of the eyes, and that it adds to spread of the small-pox, measles, scarlet fever and the like, while it renders the rapid cure of wounds and sores of all kinds a work of great difficulty, is well known."

When it is remembered that water-courses or nature's natural drainage areas are constantly being disturbed by obstructions such as mill-dams, or by excavations and embankments, we are to see to it that some compensations are made for these. In cities, especially where ground is shaded by buildings, and an amount of water added to the soil which doubles the usual rain-fall, we are not to be surprised if there is an increase of most forms of disease and a lowering of the general vitality. It is not by a figure of speech that cities thus become "the graves of mankind." Science would prove what must be, even if experience had not proven it beforehand. In these modern days, with great increase of activities and with more ready means for rapidly distributing air and earth and water, we must inevitably have an increase of disease, unless some of our abilities at construction are applied in the direction of preservation and of compensation for evils which are otherwise destructive. Hence, a low level of ground-water is desirable for all cities, and only such access of storm-water and household-water supply as does not seriously or permanently raise the ground level. The facilities for drainage and the modes of its accomplishment are now well understood, so that the advantages thereof can be applied to the prevention or relief of much of the sickness that now occurs from over-damp building sites. In the same city there is often a great contrast as to strata and the average height of ground-water. Statistics, such as those of Pettenkofer as to Munich, of Dr. Snow as to London, and of Dr. Knight as to the Rochester and Medway districts, seem conclusively to show how mortality is increased by a wet subsoil.

MALARIA.

What to do to prevent malaria and malarial disease is not likely to cease to be a subject of earnest inquiry for long years to come. The fact that the evil has extended to parts of New England, where it had not before existed, and that in New York State and this State some places are affected which had long boasted of exemption, shows that there is at least no decrease in extent. New Jersey is not more exposed to the circumstances which occasion it than some other States, but we have especial need to study and guard against it, because where it does not cause death or find record in intense sickness, it does depress vital force, interfere with labor, become chronic in its effects and give a type to many fatal diseases. All the more because the agencies in its production are multiplied by the activities of such a State as this.

The removal of forests, the changing of water-courses, the excavations for railroads and various public improvements, the rapid building of cities and the mining of ore, clay, marl, etc., all tend to provide the best conditions for the malady. So far from diminution, we are only to expect its more rapid increase or more frequent recurring epidemics thereof unless we avail ourselves of methods of restriction. Dr. Snow, of Rhode Island, has so well stated its incursion into parts of that State, and illustrated so well the points at issue in dealing with it, that we quote from a letter of his to the Common Council of Providence, May, 1882:

"For a better understanding of the subject, it may be well to refer briefly to the cause or causes of fever and ague. In this vicinity, where we have never been familiar with the disease, there is much uncertainty and difference of opinion among the people in relation to its causes, and the most absurd theories are given upon the subject. In the locality referred to, we have been told that cases of the disease were caused by the water in Mashapaug Pond, other cases by heaps of animal matter, others by offensive sink drains, &c.

"In places where fever and ague has been a long time prevalent there is no such difference of opinion in regard to its causes. The real cause is well known. It may be stated briefly to be a poison in the atmosphere, commonly called '*malaria*,' which is generated in and arises from swamps and swampy places. Water alone, in ponds or running streams, can never cause fever and ague, dry earth can never cause it, decaying vegetable matter alone can never cause it; but it is produced by the combination of water, earth and decaying vegetable matter in the conditions usually found in swamps and so-called swampy places. It may be stated as a general truth, that so far as is known, fever and ague has never been produced except by swamps or swampy places.

"It is true that all swamps do not produce fever and ague, and none of the swamps in Rhode Island have produced it, within the memory of the oldest inhabitants, until within the last two or three years. Within that time a new element has come into the swamps of Rhode Island which did not exist there before, and which, existing in the swamps, produces the malaria of fever and ague. What this new element is, whether vegetable, animal, or something else, no one knows. We know that it has been gradually traveling from the vicinity of New York city, up the rivers and valleys of New England, during the last ten or fifteen years. We know that whenever it has reached a swamp, or swampy region, it has remained permanently, and has given rise to fever and ague, from year to year. But the fact still remains true, and this fact is important to be remembered, that fever and ague is never produced except by swamps and swampy places, and if the swamps are removed the disease is effectually prevented. Let us now return to the district about Mashapaug Pond, where the fever and ague has been prevalent during the last two years. * * *

"There is a considerable number of ponds and low swampy places in the malarial district referred to that are not marked on the city maps. The height of the water in all of these ponds and swamps, as well as in the ground throughout the malarial district, *is governed entirely by the height of the water in Mashapaug Pond.* At the present time, the water in Mashapaug Pond is three and a half to four feet above its natural level. The results of this are as follows:

"1. There are many acres of swamp on the borders of Spectacle Pond and on the brook leading from Spectacle to Mashapaug Pond, that are made swamp wholly by the extra height of the water in Mashapaug Pond. All these acres of swamp would be dry ground if Mashapaug Pond was kept at its natural level.

"2. The high water in Mashapaug Pond keeps all the numerous swampy places and hollows in that district in a swampy condition, so that all the dangerous effects of swamps are produced by them.

"3. The high water in Mashapaug Pond keeps the ground water in the whole district so high that many hollows are more or less wet, and many cellars are damp and unhealthy.

"4. In the swamps made by this high water the vegetable growth is luxuriant, and as the water falls in the late summer and autumn this vegetation dies and produces the conditions most favorable for the production of fever and ague.

"The conclusion from the preceding seems to be unavoidable—

"That the high water in Mashapaug Pond in the spring and early summer, making much swamp and swampy land with rank vegetation, and the fall of the water in the late summer and autumn producing decay of vegetation, are the principal, if not the sole cause, of prevalence of fever and ague in that vicinity.

"The important question is, What can be done to prevent the disease? Generally and everywhere, the disease can be prevented by the destruction of the swamps, and in no other way."

The cases referred to not only illustrate the correct views as to the combination of influences at work to produce remittent fever, intermittent fever, chills and fever, periodic neuralgia, and an interfering type of periodicity in other diseases, but also shows how a condition of high water in a lake, which would seem effective for the prevention of malaria, causes it to abound in adjacent grounds.

If there is any one point established in medical experience it is the relation of water, earth and decaying vegetable matter, acted upon by heat, to the occurrence of malaria. This does not assert that in every instance the coincidence or co-existence of these will produce malaria, any more than it is asserted that certain conditions of heat and filth will always give rise to cholera, scarlet fever, typhoid fever, etc. Sometimes a swamp or pond, filled with vegetable matter, seems to catch the malaria, and ever after to be able to reproduce and furnish it, and then our only remedy is to get clear of the pond. In other cases, all the factors of the disease seem to have met in just the proportions to produce the disease, and then we have it arising *de novo* or spontaneously, and ever after it is found endemic there unless the original cause is removed.

It is no harder to account for the coming of malaria to a certain locality, where it had not been before, than it is to account for the arrival of potato bugs to a section they never had invaded before. A

disease, like a plant or animal, locates where it finds food adapted to it. Unlike a plant or animal, it sometimes originates perhaps by chemical, perhaps by germinal forces from a place adapted also to its nourishment. When, as in very many diseases, we cannot detect the particle that infuses the disease into a human system, we may, nevertheless, detect the surroundings or influences which tend to foster the infection, as also the laws of its selection, both as to places and individuals, and the preventions or limitations which we may institute. While not ceasing to look for the germinal cause, or to feel the radical advantage of finding it, practically we do very much to vacate the disease if we can remove the surroundings which produce, nurture or multiply it, or define what persons it is most liable to attack, or how its attacks shall be prevented. On all these points we know far more than we are permitted to execute. For instance, the preservation or restoration of natural water-courses, or the providing of drainage where there is need of additional drying, the thorough cropping of the soil and limitation of vegetable decay, will do much to limit or prevent the disease. And as to persons, the avoidance of exposure to damp and night air, the sleeping in upper apartments, regular living, and, in some cases, the use of prophylactics and especial care until a kind of acclimatization has been attained, have practically much to do with the prevention of malarial diseases.

Also, we regret to say that we are too often multiplying its causes, when, for instance, a house, a village or a city is found without any previous deep drainage system. By the houses we build, and various other changes, we are interfering with evaporation and dampening the ground. Rain-water and refuse matter no longer yield themselves to a crop vegetation and sun-heat increases. Thus, unless additional drainage is instituted there is new water soaking, and there is fertilizing without cropping, and all the conditions either for producing or inviting the locality of malaria. Hence, each city tends to make of itself a centre of malaria, and even when partially caring for itself by avoiding vegetable decomposition, is apt to load its suburbs with all the materials of a malaria manufactory. Added to all, the natural drainage is very often interfered with. Our nearest way out of this trouble is to avail ourselves of our excellent State provisions for drainage, and to commit all our cities and townships to the care of such local Boards as will appreciate the cause of disease, and aid in giving correctness to public opinion until a sufficient number will

appreciate the necessity and authorize the work. It is fortunate that the advantage to property is as real as that to the general health.

CITY SEWERS.

Whatever may be the theories of individuals as to various modes of delivery of sewage, the fact must be admitted that the weight of authority inclines more and more to the approval of sewers as the appliance for the riddance of water-closet material and the general liquid refuse of households, factories, etc. It is no longer a question that these can be constructed so as to secure air and water-flushing, and be so connected with houses as to prevent evils from sewer gas and furnish safe conduits for the delivery of house liquid refuse. Great advance has been made in the last few years, in our knowledge of how to construct sewers properly and economically; how to secure proper flushing and ventilation; how, by traps and ventilators, to prevent the passage of air therefrom to houses, and thus how to make of them safe conduits for the prompt delivery of material which has no place within city limits. Objections made apply to avoidable imperfections or to neglects in administration rather than to inherent and unavoidable defects. While dry systems or cart delivery may serve in special cases and for smaller towns and villages, these generally fail, as applied to close populations. The question whether sewers shall be made to carry storm-water as well as house liquids, or whether land drainage shall be in any way combined, are questions to be decided by locality and circumstances; also, the question whether the outflow shall be into a river or into the ocean, or for surface or subsoil irrigation and fertilization of farms, or over a filter-bed previous to a river-flow—all these are subsidiary and collateral questions, to be decided on their merits for the locality. The one fact that city filth should not have city storage or be allowed to find its way into the soil, the water or the air of a city, is so important and undeniable that no city should satisfy itself with neglect or with half methods. The language and illustrations of Capt. Douglas Galton, in his recent address at the Fifth Congress of the Sanitary Institute of Great Britain, are worthy of note, as emphasizing the importance to be attached to the method of sewage and carriage. He says:

"There is no doubt that in the sewering of towns, want of experience in the construction of the works has, in some cases, led to deposits in the sewers, and to their failure to remove these dangerous gases, and that evil consequences have ensued;

but it may be accepted as certain that in every case where the sewerage has been devised on sound principles, and where the works have been carried on under intelligent supervision, a largely reduced death-rate has invariably followed. The records of New Castle afford evidence of this fact. The quinquennial period, beginning in 1868, showed a death-rate of 27.6; the quinquennial period ending in 1881, showed a death-rate of 23, whilst the death rate of 1881 was only 21.7.

"At the recent Sanitary Congress at Vienna, some remarkable results of the effects of the sewerage of certain German towns were given, which are very striking. Munich is the residence of one of the ablest sanitarians of Europe, viz., Dr. Pettenkofer. His admirable illustrations of the effect of the impurities which were accumulated in porous cesspits, upon the air of the town and the death-rate of the population, form a text-book of sanitary knowledge. At Munich the enteric fever mortality per 1,000,000 of inhabitants for quinquennial periods, was as under:

1854 to 1859, when there were absolutely no regulations for keeping the soil clean	24.2
1860 to 1865, when reforms were begun by cementing the sides and bottoms of the porous cesspits	16.8
1866 to 1873, when there was partial sewerage	13.3
1876 to 1880, when the sewerage was complete	8.7

"Similarly, at Frankfort-on-the-Main, the deaths from enteric fever per 10,000 were:

1854 to 1859, when there was no sewerage	8.7
1875 to 1880, when the sewerage was complete	2.4

"At Dantzig, the figures present some more striking characteristics; the deaths from enteric fever per 100,000 living, were as follows:

1865 to 1869, when there was no sewerage and no proper water-supply	108.
1871 to 1875, after the introduction of water-supply	90.
1876 to 1880, after the introduction of sewerage	18.

"Hamburg has been drained by Mr. Lindley, and he has stated that in his plans he carefully followed the principles laid down by Mr. Chadwick. In that town, the deaths from enteric fever per 1000 of total deaths, were:

From 1838 to 1844, before the commencement of the construction of any sewerage works	48.5
From 1871 to 1880, after the completion of the sewerage works,	13.3

"During the time that the works were in progress, viz., from 1872 to 1874, the mortality from enteric fever per 10,000 living, was:

In the unsewered districts	40.0
In the districts for the most part sewered	32.0
And in the fully sewered districts	26.8

"These results illustrate the effect of purifying the air of towns by the rapid abstraction of refuse matter, so as to prevent it from remaining and putrefying in and upon the ground."

Dr. J. W. Tripe, another eminent authority, thus speaks of the relations of soil, air and organic matter:

"As all the interstices of the ground are filled with air, the more porous the soil the greater is the quantity of contained air. The quantity is sometimes greatly in excess of what is commonly believed, as Professor Hartley states that it has been shown that the bulk of a gravelly soil consists of about one-third air, whilst Pettenkofer says that it varies ordinarily between 3 and 10 per cent., and occupies the space between the stones and the particles of sand. If a cesspool or leaky drain-pipes are placed in this kind of soil, offensive emanations will be given off. These may, especially under variations of temperature and pressure of the air, travel a rather considerable distance, and make their way into houses, especially when the air of a house is raised by fires to a much higher temperature than that of the ground. Dr. Fyffe mentioned an instance where the foul air of a cesspool was drawn a distance of 27 feet into a house. Ground-air must also escape from the soil more quickly when the atmosphere is much warmer than the soil, or when a considerable diminution of barometric pressure suddenly occurs. It is, therefore, important that houses built upon gravel, and especially on made ground, should have the whole of the surface inside the walls covered with six inches of concrete, to prevent the entrance of ground-air. Ground-air consists chiefly of atmospheric air intermixed with carbonic acid, marsh gas, and occasionally sulphuretted hydrogen. If there be any putrefying organic matter in the soil, the ground-air will also be contaminated with injurious gases resembling sewer emanations.

"The ground-air is also displaced by rain, which raises the level of the ground-water, and also causes a rapid escape of air from the interstices of the soil. Winds, by their drying action on the surface of the soil, also assist in producing movements in the ground-air and in the level of ground-water Fevers, cholera, diarrhœa and dysentery are said to be caused by the escape of ground-air into houses."

DISPOSAL OF SEWAGE, ETC.

The care of all the liquid and solid refuse incident to household life, to city nearness of habitation, and to the various trades, factories and industries that necessarily aggregate in close relationship, is and must continue to be one of the most essential requisites to the preservation of health and life. No one is now found so bold as to dispute the causal relations of accumulated filth to some diseases and to general devitalized conditions. While many perplexing and undecided questions may arise, the common consent of observers founded on experience is, that the offalings incident to life must be removed or disposed of in such a way as not to poison the air we breathe, the food we eat, the water we drink, or the surroundings with which we are necessarily brought in contact. If all such material could be for a limited time prevented from any change and stored in the soil ready for the use of vegetable life, or if it could be submitted to ready oxidation or other such chemical or mechanical changes as would render it innocuous, it would certainly be best at once to fulfill these indications. It is not because the ideas of preservation, of utilization, etc., have not been entertained

or experimented upon that they have so rarely been adopted in large cities. It is because there has been found a practical limit to such plausible and reasonable suggestions, either by reason of expensiveness or insuperable difficulties of administration. This does not mean that plans of utilization, or chemical processes of precipitation, or dry removal, or separation or some other methods may not still be operated in certain localities, but it does mean, as a historical fact, that under the most careful advisement and with large experiences of different methods, some plan of removal by means of a sewer system has been constantly gaining in approval for cities of fifty thousand inhabitants or over. The history of the present system of Berlin and the caution with which it was entered upon after trials or consideration of various plans, is but an illustration of an experience that is becoming more and more uniform. Happily there has been a great increase of knowledge both as to the most efficient and least expensive plans. A city that has occasion to consider the question of sewage disposal, should always commit the determination of methods to skilled sanitarians and engineers. The municipal authorities while judging of capacity for expenditure and of the business methods of procedure, must come to feel the choice of method is as foreign to their judgment as would be the construction of a suspension bridge. So long as corporations or individuals sit in judgment on methods and engineering details, instead of submitting said points only to the judgment of their chosen advisers, we shall have plans which lack unity and fitness both in organization and execution. Reference to our former reports will furnish many suggestions to guide in those places where no sewer system has been adopted.

A paper accompanies this report that suggests a method of preventing cesspools from filling up so rapidly. It is a modification of the usual plan of grease trap, by which the grease is retained and the liquid slops and filth are enabled to find more ready access to the ground. Where the usual water level of a city is fifteen to twenty feet below its buildings, cesspools may be available, but in all other cases, they keep the filth too near the subsoil and the people.

OFFENSIVE TRADES AND MANUFACTORIES.

This Board has heretofore drawn the attention of local Boards of Health to the importance of guarding against those nuisances which now so often arise, either from dense smoke or from trades and factories which emit odors in a high degree offensive. Reference may well

be had to page 28 of the first report, and page 13 of the third report. From year to year there is an increasing tendency to locate such establishments in this State, in many cases because New York and Philadelphia authorities will not allow them within city limits. Many of these industries are desirable from a business standpoint, if only they are not allowed to become nuisances. For most of these vapors there are now well-known methods of consumption and of exclusion from the common air. Smoke-consuming apparatus is now so perfect that sanitary authority has recently said that there is no excuse for smoke nuisance. The real difficulty is that most of the apparatus and its care add to the expense. Also the stoker or other person in charge needs to be very vigilant as to his methods and thorough in their use. Such a book as that of Dr. Ballard, of the local Government Board of Great Britain, "As to effluvium nuisances arising in connection with various manufacturing and other branches of industry," as contained in the sixth, seventh and eighth annual reports (1876, Appendix 6, 1877 and 1878,) shows how thoroughly the difficulties have been recognized and met. Over and over again has the question been settled in England and in some of the large cities of this country, that such nuisances are infringements upon personal rights at common law, and must not be tolerated. Many of them are proven to be deleterious to health, but if they were not, if they disturb to a large degree the comfort of the average community, the principle and necessity of the abatement is obvious. It is not enough that the workmen are not destroyed thereby, or that they have acquired toleration of the offensive odors. It is the right of the citizen not to be subjected to such annoyances, when in kind and degree they permanently disturb the comfort of those resident in the vicinity. First of all, Boards of Health should be vigilant in notifying those proposing to start such manufactories or to introduce offensive trades, that they will be held to strict accordance with these views. When complaints are made there should be promptness in attending to them. Generally, the function of a local Board, is not in applying to them the police law of nuisances, such as is necessary in some sudden evil needing very rapid suspension, but to proceed or to unite with others in procuring such injunction or such indictment before grand juries, as shall restrain or abate the nuisance. The common law of this State has usually taken strong position as to t' necessity, and not only have injunctions been granted, but as ir Elizabeth nuisance the Chancellor has ordered a special com' of experts with full and speedy powers of jurisdiction and a'

Those who thus proceed will find no greater embarrassments than those which attend most forms of litigation, and will be able to prevent or remove many of the evils which in parts of this State have become most obtrusive and offensive.

STATE SANITARY SURVEY AND OBSERVATION.

It is well recognized among sanitarians that the material and layers and adjustments of the earth's surface, its relations to water and soil, its topography and locality, have much to do with the health of those living upon its surface. In addition, they often in certain conditions of health, afford the most intelligent indications for change. In order to promote this kind of observation and the recording of their experience by those best adapted for the purpose, this Board early in the year secured copies of the geological map of New Jersey for 1881, to be used by chosen observers in the study of these conditions. The results of such observations can only be had after a considerable time. The earlier work will be imperfect because it is so difficult to secure close record and analysis. Yet it cannot but be without excellent effect upon the local care of the population, and aid much in directing attention to local causes that appreciate or deteriorate the health of the inhabitants. The effect will be greatly aided by the topographical map of the State, a part of which is already completed. While the geologist and the engineer collect the data and so make them available, it is for us to study these for the welfare of animal life. Questions of drainage, of water-supply, and of weather are intimately associated with telluric or earth conditions. Not less intimately do lung and other diseases depend upon these. By careful study and observation we are thus able to acquaint ourselves with local exposures, and more fitly and pliably to adapt human life and its surroundings to each other.

LOCAL HEALTH BOARDS AND THEIR DUTIES.

The Health Boards of the State vary in efficiency according to the intelligence of the people of the respective districts as to health matters, and the powers conferred upon the Board, and the capacity and tact of the officers who compose them. In the few districts where there is little progress and where the people never inquire into the causes of ill health, and never suspect that the art of right living has

to do with wellness and success, the only thing to do is to let in the light gradually, as you would let in the sunlight on weak eyes, until at length they come to exercise an educated vision and not, like the owl, to regard daylight as a failure simply because not accustomed to it. Such communities are to be dealt with patiently, because their stolidity results from want of knowledge in this particular direction. It is gratifying to know that one after another we find such districts coming to the apprehension of some needs which can only be met by obtaining information. In other cases there is felt need, and Boards which are constituted attempt to do something but fail either from lack of power or lack of pecuniary means. Boards, for instance, like that of Newark, pass ordinances in abundance and enforce some of them mostly because the persons concerned do not see fit to resist or to test the law. These operate only under the old law, never having adopted the laws accepted and adopted by several other cities. Elizabeth, New Brunswick, Trenton, etc., as large cities have called to their aid this more recent legislation, and so are on a par with the townships and smaller cities of the State in their power to enforce ordinances. The law as passed last winter was fully reviewed by able lawyers, and is now such as gives increased powers to those Boards organized under it, of which there are now about two hundred in the State. No case under it has yet been carried to the higher courts. The permanent efficiency of Health Boards and the application of the laws under which they operate will largely depend upon the judiciousness and intelligence of the Board itself, and the ability of the citizens to comprehend the need of their work. Health Boards must always expect that their methods and their acts will be criticised. It is human nature for persons to assume an attitnde of resistance toward any one who questions a man's right to do as he pleases with his private property, or who suggests that it harbors a nuisance. The way to overcome this is to have clear reasons for what is done, to do properly what is to be done, to avoid wasteful expense, and to combine firmness with expediency. Then whatever resistance individuals may offer, a constituency will always be found to claim that a householder has no right to maintain a nuisance to the injury of his neighbor, and that public perils to the public health must not only be removed when existing but prevented when possible.

Some of the more important duties of local Health Boards have already been set forth in the circular of May 10th, 1881, as contained n the fifth report.

It is important that all these Boards should understand both the scope and the limitations of their sphere and of their powers.

Some of them are disposed to advocate the conferment of greater powers upon the State Board, and such as would give it certain local authority.

It has always seemed to this Board that its work should be, so far as local authority is concerned, co-operative and advisory, rather than mandatory. Local Boards should have large local authority, and should be aided by the counsel and influence of the State Board. But local government in such matters is best sustained by popular favor, or, if not, the locality must suffer the consequences. There are certain rare cases in which local neglect may so imperil the citizens of the State at large as to justify plenary power on the part of the State authority, but such instances of jurisdiction should be well defined.

A local Board that does not expect to meet with some opposition and occasionally to be unsuccessful in its efforts, ought to die, just as any man ought to die who expects that radical efforts for good will not be opposed. There ever will be those who, from habit, have becme content with unhealthy conditions and surroundings, and do not know the dangers to health and to life incident to their situation. Others, from prejudice and because these evils have not, as yet, produced a severe visible effect, doubt the opinion of those who advise them, simply because they are unaware of the facts. Others have to struggle for a livelihood and are disturbed at any proposed change, lest it shall entail additional expense as well as toil. All such need to be taught and persuaded, if possible, since their resistance is more their misfortune than their fault. Many such have come to know the sanitary adviser is their best friend, and, by warding off diseases, aids them in comfortable living. A more disturbing class is that which fears to oppose evils because the opposition is unpopular or may interfere with personal aspirations. Yet how many such have come to find that aid to the public health is good policy as well as good propriety. Another class is made up of those who have accumulated property and so oppose improvements in order to avoid taxation. We do not complain that such should narrowly watch their financial interests. But the way to do this is not by opposing what ought to be done, but by guarding against all extravagant expenditure and improving their property by advocating those measures which conduce to the health and the growth of the community in which they dwell. What ought to be done is an expert question, on which most persons

are not competent to sit in judgment, unless they have professionally studied the subject. Their chief office is to see that what is declared to be necessary by those of competent skill, is done with thoroughness and at only such cost as is reasonable. The inertia of ignorance or prejudice is a dead weight, which can only be lifted by proper efforts at information, supplemented by the force of law. Political or pecuniary considerations often give way before the progress of facts. The steady progress which has been made in lowering death-rates in many cities often dispels the objections of popular leaders and of landlords.

A great work can be done by local Boards in acquainting the people with the causes of ill-health, and in providing ways and means for the prevention, as well as for the abatement of nuisances. Systems of local inspection are of very great value. Where a nuisance is contemplated or being arranged for, a Board can often prevent or restrain it. In cases of actual nuisances, not so rapid in their operation as to be suddenly dangerous, the local Board may deem it best to proceed by seeking injunction or by complaint before a grand jury. For some cases this is undoubtedly the most effective method, and needs the action and co-operation of the local Board.

Sanitary law is of two kinds. The abatement of nuisances is fully recognized as belonging to common law, and as to be procured under its provisions.

But as there are cases requiring more summary proceeding, and which would be practically irremediable, either by reason of the great expense or the slower processes of common law, national, State and municipal authorities have recognized the necessity of conferring police powers and summary rights upon sanitary officers. These are not arbitrary, except so far as most summary proceedings are arbitrary. If wrong is done, there is subsequent redress. Quick action is allowed, because a greater wrong to all society is imminent unless such powers are conferred. No laws have a better right to take their place among police measures than some of those relating to sanitary jurisdiction, since no peril can be more serious than such as sometimes invades the public health.

In our own State it was not to be expected that the enactment of new laws conferring such powers, would be without some opposition and even without some difference of judgment on the part of courts. It has taken several years in England, in Massachusetts, in New York, in Michigan and other States, to settle the point that a Board

of Health has the full right to declare what is and what is not a nuisance, and to proceed as if their decision were final. Also, that the judgment of a nuisance in such cases is not of the nature of a trial, and warrants summary proceeding. It is recognized that in our own courts some of these points are yet to be decided. But, in the meantime, there are abundant functions for local Boards to exercise in the interests of the people. Points which are now doubtful will meet their right issue when a sufficient number of litigations have occurred to test decisions. Laws and precedents have growth as well as sciences and arts, and there will yet be decisions inconsistent with former ones, only because the garments which well fitted the childhood of sanitation are not adapted to an increased stature. Special suggestions to local Health Boards will be found in connection with the Summary of the Local Reports.

HEALTH OF OPERATIVES.

The consideration of the influence of trades and occupations upon the health of those engaged in them is very important. It is always to the interest of a State to reduce to a mininum the burdens of the working classes. The oppression of having to live in unhealthy houses, amid foul streets and alleys, without means for the removal of filth, is no slight burden. The man, woman or child who goes to a day's work ought to be protected by law from those taxes upon health and vigor which are not necessarily incident to his or her employment. English law has wisely passed a series of acts known as factory laws, and appointed government inspectors to secure proper protection to operatives. It has besides, made, thorough inquiry into offensive trades and occupations and the modes of remedy or alleviation.

"If a thorough inspection should be made into all our mills and shops, it would be found that the health of many operatives was suffering from working in too crowded rooms and from impure air. It would be found in many quarters that there was a great want of proper ventilation, that in basements or lower floors there is frequently a dampness that is unwholesome; that in some rooms the temperature is too high and in others too low for health; and that in certain kinds or stages of manufacturing, the air is impregnated with steam, vapor, gas or particles of matter that are injurious to health. While it may not be easy to remedy all these evils, yet when the principles of sanitary science become better understood, far greater attention will be paid in every kind and department of manufacturing to those laws, the violation of which impairs health and shortens human life."

Instances of this kind have already been noted by us in hatting and pottery, and are known to exist in glass-blowing, leather and other industries. We are glad to find here and there a factory which has not overlooked these interests, but as a rule there is great defect in methods of ventilation, in regulation of temperature, in caring for dust and floating particles, etc.

STATE-HOUSE.

During the fall a careful examination was made of the sanitary condition of the state-house. The building itself in its location has many advantages, although exposed to some of the evils of soil-pollution and saturation which obtain in the part of Trenton in which it is situated. The basement and cellar portions are guarded by good walls and cemented floors, and there is some effective drainage about the building which either discharges into the sewer pipes or direct into the water-power at the rear. The surface water and the gathering from roofs find exit in the same way.

The heating is by steam, and indirect except for office rooms. Outside air is supplied to the furnace. The air is heated mostly under the first floor and distributed by registers to the building. Part of the year a fan is used to force currents of air over the radiators. An exhaust fan also is used as necessary. Sometimes when rooms are overheated the steam is shut off from the radiators, and cold air passes through the same channels. Hot or cold air can be let under the raised floors of the legislative halls. So far as apparatus is concerned, all hot and cold air is let in from or near the floor, except that in the Assembly room there is also a register about four feet from the floor. A ventilating stack surrounded by heat aids in the inside ventilation.

The basins, water closets and other arrangements for removing soiled liquids or matter of any kind are of various patterns, and the rooms or places in which they are located of various degrees of propriety. The most objectionable is that nearly opposite the room No. 5, on the first floor, which is not well ventilated and has poor closets. Those on the third floor are of similar construction. At least four or five forms of closets are to be found, some of which should be early removed and others ere long be replaced by some form of Hopper closet. Direct and self-operating Hopper closets are used in the basement. Buildings used irregularly, and in which constant and close housekeeping inspection cannot be always fully exercised, generally do better with a form of

closet having little apparatus and no receivers where solid particles can gradually accumulate out of the reach of the flush. When such material is lodged in the pan or valve space, and above the trap, its decomposition will cause odor at each use. Traps are mostly of the usual S variety, or the Adee, and are located near the basins.

The pipes from the various closets are connected with three different main soil pipes conveniently located and running from top to bottom, and so joining the outside sewer pipe, to be emptied into the water-power below the water level.

There is here considerable defect as to ventilation. These cast iron soil pipes do not run out at the roof so as to have air vent there, and have no opening for air at the bottom or in all their course to the water-power. It is now well understood that every main soil pipe should have, besides its outside trap, a ventilating pipe at or near its entrance into a building and another opening on the roof, so as to secure a constant presence of fresh air, which is the best preventive of and neutralizer for sewer gas. Some ventilation is afforded by the entrance of the roof-water leaders into this system, but this is not deemed enough, and especially as it gives no bottom opening, and as during storms these openings become filled and tend to syphon traps. Other minor points have been noted to the officer in charge. It is believed that with a few inexpensive but important changes, the general system as now existing is safe under such efficient oversight as it receives. There is no artificial apparatus or appliance for ventilation in the various rooms and halls, except that the legislative halls have adjustable openings in the ceiling and the gas fixtures are made to aid in ventilation when lighted.

Both the heating and ventilation of the building have been planned with considerable skill, but must depend very much upon administrative care. So little of it is automatic that ill judgment might easily produce draughts and great variation of temperature. The engineer in charge seems fully to comprehend the machinery and its management and to adjust it with skill, as also to appreciate some minor defects. The heating and ventilation, especially of the legislative halls and Supreme Court room, require much judgment. When cold northwest winds prevail the regulation is often difficult.

The water supply is direct from the general water works and satisfactory, except that some of the closets cause unnecessary wastage. There is no fire escape for the upper rooms and no fire extinguisher on the premises.

SANITARY EXHIBIT.

The sanitary exhibit of the present year was the best which has ever been made in this State. It has now been held for four years, in connection with the annual fair at Waverly. It has helped to acquaint our people with various devices for heating, ventilation, sewerage, the care of garbage, and the many other conveniences needed in connection with household life. The same kind of work is now being done by other means. The American Public Health Association is giving its encouragement to a great national exhibit, probably to be held in 1884, under the auspices of the Naval Museum of Hygiene, at Washington. Although the exhibit has involved but small expenditure, it has probably answered its most important purposes, and will not need to be sustained permanently.

The New Jersey Sanitary Association has continued to hold its annual meeting for the presentation and discussion of the various sanitary topics affecting the interests of citizens of the State. In the death of Ashbel Welch, C. E., of Lambertville, and that of Dr. H. A. Hopper, it has lost two of its most active and valued members. While many of the measures it has advocated have received public and legislative attention, it still has a sphere of usefulness. Some abstracts from its most valuable papers will be prepared for the next report.

Several additions have been made to the library, a list of which will be found by reference to the catalogue.

GRAVE-YARDS AND CEMETERIES.

The experiences of the past show the importance of careful consideration in the selection of burial places. The geological structure of the earth, the character of the soil, its water-bearing strata, its slope, and its deep and effective drainage, have much to do with its adaptability. There is great difference in the capacity of ground to dispose of the products of decay. Cases have been brought to our notice where school-houses are located at or very near burial grounds, or where basements of churches, located in among graves, are used for school and meeting purposes. A hot furnace, in such a place, may do much harm.

Burial grounds within cities often become a source of evil. This became so apparent in London that one of the first health efforts was

to get rid of burial grounds, or limit intra-mural interments. As there is a great tendency to form cemetery associations and to select burial sites, there should be some law or some Health Board power by which these selections shall not be made without careful consideration of the interests of the living, and of the future growth of cities. In one county in this state two cemeteries have been reported as causing sickness, as shown by statistics. The Weehawken Cemetery has required legal proceedings on the part of the authorities of Hudson county. A communication as to it on file in this office and accompanied by affidavits, gives series of facts such as show it even now to be a great public peril. There are many cities in which cemeteries should not be located within several miles of the present city. Cities for the dead should be chosen where cities for the living are not likely to come. Where these choices have already been made, much is to be done by way of regulation.

There is also laxity in the reception of bodies by sextons or the keepers of some cemeteries. It should be a law that no burial should take place in any grave-yard of any church or denomination, or in any incorporated cemetery, until a certificate of death or permit has been *shown* as well as procured, and the name of the person buried, the date of the burial, and the name and post-office address of the undertaker or other person in charge, should, at the time, be registered in a book kept for the purpose. Such provisions are not unduly troublesome, and, with the certificate recorded by the State, greatly aid in guarding life and the rights of property. Here and there a county grave-yard has an unknown burial. Such cases are not for the public welfare, and the interests of the State require protection against such occurrences.

The whole subject of the location and management of cemeteries is so vitally related to the interests of the living, and the evils of interments amid close population are so great and so difficult to remedy afterward, that we have deemed it expedient to have, as a part of this report, a thorough article upon the subject. Besides, it will be found to contain much bearing on the origin of pestilences, and on the methods by which the air we breathe is contaminated, and so life is embarrassed or destroyed.

CONTAGIOUS DISEASES OF ANIMALS.

The Board, in its oversight of the contagious diseases of animals, has had the co-operation of the Agricultural Department at Washington in guarding and inspection of cattle arriving from the South, and the assistance of five experienced veterinarians. Much of our effort is in the way of watchfulness and prevention. By correspondence with local Boards of Health, by an early investigation of reported or suspected cases, and by prompt measures in case of the outbreak of disease, we have been able to aid in preventing any wide-spread epidemic. Pleuro-pneumonia has occurred the last year only in the borders of Union and Essex counties, and has extended to but three farms. In one case we found it necessary to secure indictment for breach of quarantine, but in general, instructions are carefully followed out.

The cases in Morris county in a herd of one hundred head, which were under quarantine at our last report, did not extend beyond that herd. Inoculation in that case seemed to check the spread of the disease. Some improvements in method have been recently introduced. We have received the following letter in reference thereto from the most distinguished authority in England, Prof. Geo. Fleming, F. R. C. V. S., of the Royal Veterinary Service: "Inoculation, as a protective measure for bovine contagious pleuro-pneumonia, has been and is now most extensively practiced on the continent of Europe and in this country, and there is no evidence that inoculated animals, while suffering from the immediate effects of the operation, can communicate the disease. There is only one such instance recorded (it is found in my Vet. Sanitary Science and Police), but the circumstances attending it throw great doubts upon its correctness. I, myself, discredit it. I have absolute faith in the effects of the operation, as a prophylactic measure, and would most certainly counsel its adoption when the disease prevails—subject, of course, to suitable precautions as to the time and manner of performing the operation. This should be as carefully attended to as vaccination is with children."

Many cases are reported to us, which, upon investigation, prove to be some other malady. The outbreak of malignant anthrax which occurred in Salem county at the close of last year, did not extend beyond the place at which it occurred. At Secaucus, in Hudson county, there was, in October, a similar outbreak. There have been two outbreaks of the Texas cattle disease in the State—one in Bur-

lington county and one in Salem county. Both were in cattle recently brought into the State and the disease did not extend. In one case of a large herd we found it necessary to kill four cattle. As the meat of cattle affected with this disease is not considered fit for use, cases of the disease need especially to be guarded in the interests of public health. Cattle-owners and dealers should be on their guard against this disease, and newly purchased cattle should not at once be turned in with the general herd unless the full history is known. *Post mortem* examination of these cases is always interesting, not only in its relation to general animal diseases, but also to such as affect human beings. All the more because, by many authors, the inception of this disease is associated with imperfect water-supply and long-continued exposure to a malarial atmosphere. All these comparative studies are attracting more and more attention not only as respects food-supply, but in their analogies and elucidations of human diseases.

The disease of swine known as pneumo-enteritis or hog cholera, has prevailed in three or four localities. It seems persistent as an endemic, and recurs in pens in which it has proved fatal. The directions as to it, in Circular E of this Board, need to be borne in mind. While thus far the execution of the last law as to contagious diseases of animals has not involved much outlay, it is to be remembered that if pleuro-pneumonia or other contagion should occur but in a few valuable herds, it might require considerable outlay to stamp it out. Therefore, too much caution cannot be used by way of prevention. While inoculation to prevent contagious pleuro-pneumonia is recognized as allowable under direction of the Board, it is to be remembered that if not guarded it may become a means of spreading the disease. Any attempts to do this without such surveillance will be promptly dealt with. During the past year the Board has been able to make some arrangements with the New York authorities which remove some of the former embarrassments in transporting milch cows and calves to the New York market, and also to facilitate the transfer of imported cattle to this State for convenient quarantine. Further comments on contagious diseases of animals will be found in Circular F accompanying this report, and in the report of the State Board of Agriculture for this year.

VARIOUS LAWS AS COMMITTED TO THE OVERSIGHT OF THIS BOARD.

The service of the Board in its execution of the general constituting act and in its relation to the Bureau of Vital Statistics and the law as to contagious diseases of animals, is outlined in its appropriate connection as shown by the index.

The change made in the law relating to the adulteration of milk has seemed to work well. The Board is able to commend the efficiency of the inspector. Although it has no relation to the executive administration of the law, it asks and receives a quarterly report of the work attempted. The report of the milk inspector as given with this report will embrace fuller details.

The law to prevent the adulteration of foods and drugs failed of an appropriation last year, only because of a technical defect in the act. The balance left from the former year was small, but has been used with benefit in securing examinations and reports from two of the members of the council of analysts. These will be found valuable as guarding against common adulterations. We believe that it is desirable that this work be permanently sustained by a moderate appropriation. While the State may not deem it advisable to adopt so thorough a system as that of England and of two or three of the American States, there should be a method of apprising our people of the more injurious adulterations of foods and drugs, as these lead to much ill health and impairment of labor power, especially with the families of the industrial classes, who are the greatest purchasers of falsified foods.

The law passed by the last legislature as to the sale of petroleum and its products has been executed in accord with the terms and intent thereof. Its restrictions were made fully known to dealers and to the local Boards of Health. Cases of accident have been carefully watched for and the Board has held itself in readiness to deal with any infringements. The proper apparatus was secured for testing the quality of oils. It is the opinion of dealers as well as our own observation that the law has aided in bringing into disrepute the lower grades of oils, and has protected our citizens from these dangerous impositions. While the law does not secure a paid inspector or enable the Board to sustain a uniform system of detection, it does place into the hands of local Boards of Health the power to prevent illegal sales and to punish those who, as dealers, may cause accidents by the careless vending of forbidden grades.

The law relating to the sanitary inspection of State, county or township alms-houses, asylums, prisons, jails or other public institutions, has been found to authorize an inquiry very important in the interests of the citizens of the State. A special paper on this subject, as a part of this report, will give the details as to the work which has been done. If a plan of State oversight could be devised which would secure a faithful and prudent visitation and advisement, and which would secure to all these institutions the results of more recent knowledge in dealing with the defendant and criminal classes, it would be a wise outlay of time and money. As a rule the State institutions are managed much more intelligently than those of smaller districts.

In accord with the law as passed last year, this Board has urged upon the trustees of the State Normal School the importance of definite instruction in the care of the health of teachers and pupils. Until those who are to have the care of our public schools come to know more about the actual requirements of health administration, and how to guard the physical welfare of those in the schools committed to their care, there will continue to be great lack in this important department of knowledge, among the children and future citizens of the State. Two circulars relating to the subject have been issued, and the Superintendent of Schools has aided us in securing the attention of all district schools thereto. We still hope that a system of definite training and teaching will be adopted by those who have administrative control of the higher educational institutions of the State.

The duty of making inquiry as to such statistical information as is furnished by the national census, in order to make it available for our own semi-decennial census has been performed. We have on file in this office many schedules which will thus be of value as guides to a proper examination.

Various other laws relating to public health have found a place upon our statute books; as these have become known to us we have given to them such direction and influence for good as we could. As a rule, however, laws that relate to public health duties which are passed without any provision for their enforcement, soon cease to be obeyed and so do not accomplish the objects for which they were framed.

The law of last year, (ch. CLV.), more closely defining the powers of local Boards of Health and the mode of procedure where a Board of Health notifies of a nuisance which the owner fails to abate, avoids

some of the constitutional objections which had been made to the modes of exercise of power given under former laws. It is believed that the action of local Boards under this law will be sustained in all cases where no irregularity of procedings occurs.

There is still some need of legislation as to the status of local Boards in their relations to other authorities in the same precincts, to prevent that clash of judgment as to rights of jurisdiction which sometimes occurs.

VACCINATION AND SMALL-POX.

The prevalence of small-pox throughout the United States and its occurrence in various localities in this State during the period included within this report and the previous one, have made it incumbent upon the Board to turn special attention to its prevention, and especially to re-examine all details affecting the methods of vaccination. This was all the more important because of the active discussion which has been going on as to the relative merits of the Jenner or humanized lymph, and that more recently known as the bovine lymph. The later method by which the lymph is propagated from calf to calf and so a supply secured, has led many to enter upon its production as a business. Thus, as never before, the vaccinator has found himself exposed to the risks of unskilled or careless or fraudulent supply. Many other questions have arisen which, although they do not discredit the power of real vaccine lymph to protect against small-pox, require careful statement, and should lead us, in our answers, to indicate how this most efficient and indispensable preventive can be most extensively and successfully applied. In addition to two circulars in our last report, and to many replies and directions to various local Boards, we have sought, from several competent sources, replies to a *Memorandum* of inquiry as to *Vaccination*, as contained in the Fifth Report of this Board, (p. 339), as also such other facts as are especially important to members of the medical profession and to the people at large. Some of the members of the Board have made the subject one of special study and investigation. In addition, we have sought the opinions of several acknowledged authorities, among which we have selected such as seems to us of present service to the citizens of the State.

Dr. T. F. Wood, of Wilmington, North Carolina, has been for many years a close student of the subject, and furnishes brief replies to our memorandum. Dr. E. L. Griffin was one of the earliest prop-

agators of bovine lymph, and by his careful methods, his accurate knowledge and his reliable faithfulness, has done much to test and vindicate the value of genuine bovine lymph. His answers to the memorandum are, therefore, very valuable.

A few additional notes by E. J. Marsh, President of the Paterson Board of Health, form a part of this series of opinions and answers. Answers and a summary by the Secretary also accompany these replies.

It is believed that we thus put on record facts and opinions which will be a safe guide to vaccinators and to the people in seeking the protection of this great preserver from disease, disfigurement or death. While the Board does not endorse the views of each individual, so far as preference or the ground of preference for the kinds of lymph is concerned, it believes that from the material thus presented the best information can be derived.

Information as to the sanitary condition of localities, a summary of such local reports as are of special interest, statements from the milk inspector and from the council of analysts, and other papers containing valuable directions in the interests of public health, are herewith submitted for the guidance of individuals and households, of municipalities and townships, in matters which pertain alike to the welfare of families and of the State.

PAPERS AND REPORTS.

I.—SMALL-POX AND VACCINATION.

BEING IN ANSWER TO THE FOLLOWING MEMORANDUM OF QUESTIONS IN THE FIFTH REPORT:

I. Should the use of bovine lymph supersede the use of humanized lymph?

II. What phenomena, if any, have occurred in the use of bovine lymph, as distinct from what has been heretofore noted as to the humanized Jenner lymph? Such as (*a*) time of maturity; (*b*) degree of sickness; (*c*) proportion of local to general effect; (*d*) as modified by the number of pustules; (*e*) as showing herpes or other skin irritation; (*f*) as to period of protection, etc.

III. Are we able to arrive at any law as to how frequently vaccination should be repeated?

IV. Should there be a law of compulsory vaccination?

V. How far should *revaccination* be insisted upon in attendance at public schools?

VI. How far can we determine the efficacy of the vaccination by the scar?

VII. Should we not adopt the plan of giving certificate of vaccination, so that the facts as to its proper doing may be more fully known?

VIII. In what way shall practitioners be assured of the purity and freshness of lymph?

ANSWER I.

BY THOMAS F. WOOD, M. D., SECRETARY NORTH CAROLINA BOARD OF HEALTH.

"I. Should the use of bovine lymph supersede the use of humanized lymph?"

The employment of bovine lymph at the time it was introduced by Dr. Martin (1870), solved a question which was then becoming momentous—where shall we get reliable vaccine? It averted a disastrous crisis, by returning to the fountain-head for our supply. We need not recount the history of the attempts at the establishment of the practice of animal vaccination; suffice it to say that this regenerated lymph has been sought after by the best practitioners at all times, so as thus practically to admit its validity. Even most of those who were wedded to the Jennerian plan confess the necessity for regeneration.

One of the strongest arguments in favor of animal vaccination is that if it is pursued carefully by skilled and honest propagators, it puts at rest the fear of a vaccine famine, and it keeps the lymph up to the highest attainable degree of activity and purity. It is a fair inference that the purest and most active lymph is the stock from which we must look for the highest degree of protection. It remains now to inquire, is it practically true that bovine lymph is superior to humanized lymph? My answer is in the affirmative.

1. Bovine lymph gives all the results of original vaccinations as described by Jenner, W. Willan and all the earlier writers. It runs its course in the same uniform way, with the exception that the vesicle is a little delayed in its first stage, and the resulting cicatrix corresponds to the oldest record of a typical form.

2. The percentage of successes with bovine lymph (as high as 70 in my experience) in revaccinations of persons originally vaccinated with humanized lymph, demonstrates the superior potency of the former.

3. In the experience of many reliable observers, the course of humanized vaccine through a long series of years, is to depart from its typical form, and therefore afford less and less protection. The history of the practice of vaccination affords us numerous instances of the necessity of reverting to the original stock, to accomplish which retrovaccination, variolation and the discovery of new stock have been eagerly tried. If it were a practical experience in 1836, when the Passy lymph was introduced, and if it were a practical experience during the late war, then we may reasonably look for its recurrence when we depart for a sufficiently long time from the original stock. In this view of the case, resort to bovine lymph makes us sure that we give the person vaccinated the highest degree of protection.

4. There are other practical considerations which should lead us to discard arm-to-arm vaccinations, when bovine lymph is to be obtained, viz., humanized lymph has been the medium for the transmission of syphilis,* (authority of Mr. Jonathan Hutchison); of erysipelas; of scorbutic ulcers, (authority of Dr. Jos. Jones and Dr. James Bolton, in the Confederate armies.) Bovine lymph is absolutely free from such results. Doubtless the transmission of syphilis is greatly exaggerated, but that it has been done at all, points out a danger that we should take into consideration.

5. Bovine lymph can be procured in any desired quantities, of standard uniform quality, at a reasonable notice.

The reasons in favor of arm-to-arm practice are, for many considerations, sufficiently valid. Up to an unascertained limit, which I may state to be the tenth to the twentieth remove, humanized lymph shows no deterioration. Its effects are milder. It "takes" more rapidly after the inoculation. It is a matter of convenience when bovine lymph is not at hand. It is very seldom that any bad results are detected, such as the transmission of syphilis, &c., from the use of humanized lymph or crusts. It has been almost the sole reliance of the Local Government Board of Great Britain for seventy-five years, and in a country where vaccinations are done faithfully, and show excellent results.

"II. What phenomena, if any, have occurred in the use of bovine lymph, as distinct from what has been heretofore noted as to the humanized Jenner lymph? Such as (*a*) time of maturity; (*b*) degree of sickness; (*c*) proportion of local general effect; (*d*) as modified by the number of pustules; (*e*) as showing herpes or other skin irritation; (*f*) as to period of protection, etc."

Vaccination with bovine lymph has brought to light a series of phenomenal symptoms, except to those medical men who have kept fresh in their minds the descriptions of Jenner and the early writers. Jenner described the disease caused by early removes from the cow, and he, consequently, gave a picture of only the intensest forms of it, in his "Inquiry" and "Further Observations." A glance at the colored engravings in Jenner's great work, in Woodville's, Pearson's, Bryce's, Willan's and all others, shows that the vesicle was larger, and the areola more intensely red than in the cases familiar to us up

*Also contagious porrigo. See Hebra's plates Diseases of Skin; Atlas of the Sydenham Society.

to the time of introduction of Beaugency lymph. The reader of the early vaccinographers can hardly believe there was not some exaggeration in their descriptions of the serious constitutional symptoms, and the bad ulcers which sometimes succeeded vaccination; ulcers so bad, indeed, that they had to be treated with solution of white vitriol.* Pass along until you come to the history of the cultivation of vaccination by Bousquet, (1836), and you will see that his attention was arrested by the opportunity he had of comparing vaccine vesicles cultivated from arm to arm during many successive generations, with the Passy cow-pox, then recently discovered. His pictorial comparison speaks volumes upon the natural history of cow-pox, leading us to the conclusion that vaccine, cultivated from arm to arm, after a certain limit has been obtained dwindles in size of vesicles produced and in the duration of the disease. In fact, showing conclusively that vaccinia introduced into the human subject is in a foreign soil, and will, after a limit, (still unknown), run so low as to require a return to the original seed from the native soil. This is a practical matter, having its analogy in the cultivation of seed in foreign soils. The medical men who were only familiar with this deteriorated vesicle, coming to look upon it as the typical one, very easily conclude that vesicles of bovine lymph are abnormal and unnecessary. And, furthermore, having only in mind the trivial disease caused by an attenuated lymph, they do not put their patients on their guard when vaccinating them with bovine lymph. The consequence is that the patient takes no forethought to protect himself by rest during the fever, or to protect the vesicle from harm.

(*a*) Bovine vesicles mature more slowly than old humanized lymph, dropping the scab from the twenty-fourth to twenty-eighth day. It destroys the cutis vera and leaves a well-marked cicatrix. Decanteleu's beautiful tables of cicatrices show just what we have resulting from bovine vaccinations. We are enabled to go back and examine vaccine cicatrices in the generation immediately succeeding the introduction of vaccination. The foveolation in cicatrices is no more characteristic than the ovoid cicatrix with a convex centre, radiated and with a deep non-foveolated margin. Really, the foveolation accepted by most practitioners as typical, is not a peripheral foveolation, but the depression of the hair follicles scattered over the face of the cicatrix.

* Jenner's "Inquiry."

(*b*) and (*c*) The degree of sickness is generally greater following bovine vaccination. The local effect of the active vaccination is in proportion to the constitutional effects.

(*d*) The number of pustules modifies the constitutional troubles up to a certain point.

The eruptions incident to bovine vaccination are the surest indication of the identity of the present cow-pox stock with the early Gloucestershire stock. One need no longer be surprised to see a general eruption during the course of a typical bovine vaccination, if he will consult Jenner, Willan and other early writers. The defenders of vaccination in its struggle found great difficulty in explaining away the general eruptions produced.

As to *period of protection* from bovine lymph, there is, as yet, no evidence, because a sufficient time has not elapsed to determine. This one fact has been demonstrated, that the proportion of successful revaccinations is small in persons who have received bovine vaccination as much as ten years ago; while the 70 per cent. of revaccinations is not unusual among those who had previously received the long-humanized lymph.

"III. Are we able to arrive at any law as to how frequently vaccination should be repeated?"

There is no law absolutely limiting the protective power of a vaccination. It is safe to say, with our present knowledge, that a person vaccinated in infancy with bovine lymph or a short remove from it, and revaccinated at puberty with lymph of equal value to the first, will be secure for a lifetime from small-pox, and, in most instances, from any degree of varioloid.

"IV. Should there be a law of compulsory vaccination?"

It would be well if every person could be compelled to receive vaccination. But it is next to impossible to execute a compulsory law. Our chief work in this direction should be by example, and by informing the people what vaccination really is.

"V. How far should *revaccination* be insisted upon in attendance at public schools?"

Revaccination should be resorted to in all times of public peril

from small-pox, in schools and elsewhere, except in those cases where a fresh and typical scar, together with the history of the patient, satisfies the vaccinator as to the amount of protection.

"VI. How far can we determine the efficacy of the vaccination by the scar?"

The scar, when fresh and typical, is strong evidence of the protection of the subject, although it should be received with some limitation. There are many instances in which the subject has but a faint scar and has absolute protection, as proven by exposure to small-pox. It is the best evidence we now have, and if the vaccinator will carefully study the different scars and keep them in his mind, he certainly, if he can get a true history as to previous vaccination, will seldom make a mistake. Decanteleu's rare chart of vaccine cicatrices ought to be very familiar to every vaccinator.* This was one of the earliest questions discussed. See Steinbrenner's *Traité sur la Vaccine*, p. 658.

"VIII. In what way shall practitioners be assured of the purity and freshness of lymph?"

The evidence of purity of vaccine depends very much upon the knowledge of the subject the propagator possesses and his honesty. In bovine lymph there is no way to determine its purity and freshness except by actual use. As to the estimation of the value of a humanized crust, we can speak with some certainty. A good scab is semi-transparent, mahogany colored, and, when fresh, moist, and when a little older should be brittle. It is odorless, free from blood. It should represent vesicles which have not been tapped. Any departure from the dark mahogany color, especially if the crust be light and friable, should be taken as certain evidence of impurity.

[See in full on this point accompanying note at close of this article, pp. 42–3.]

If hereafter any revulsion should seize the profession in the United States, and they were absolutely to abandon bovine vaccination, the good that has been accomplished will be felt for a quarter of a century, by reason of the excellent stock that has been

* See Dr. H. A. Martin's report on Animal Vaccination, in the volume of Am. Med. Ass'n Transactions for 1877.

distributed all over the country. In fact, if that day should come, the progressive mildness of the sores and facility with which the lymph would "take," would probably lead the American profession to conclude, as it led the English profession, that animal vaccination is "much less successful than vaccination with humanized lymph." Seaton's Hand-Book, p. 951.

A fragmentary treatise on Vaccine Cicatrices,* published in 1851, now very little known, and, at the time of its publication, but little esteemed apparently, deserves to be studied with renewed interest, as it really contains more information on vaccine cicatrices than can be found elsewhere. Decanteleu had received the appointment of Sanitary Inspector of Schools in 1845, and being perplexed by the meagreness of the current knowledge as to the typical standard of vaccine cicatrices, he set about working out the problem himself. At that time the accepted description was as follows: "The veritable cicatrix is round, depressed below the level of the skin, studded over with depressions of diverse forms, formed by irregularly disposed rays or furrows." Reason and observation demonstrated to him that vaccination could result in cicatrices of numerous and varioloid forms, and very different from those described in the medical works. In order to attain his end he performed a great number of vaccinations, studying with care the results, determining rigorously their character, and finally studying with scrupulous attention the mode of formation of the succeeding cicatrices. During seven consecutive years he pursued this investigation, watching, recording, and taking impressions of five thousand four hundred and twelve vaccine cicatrices.

In order to make his work more complete, impressions were made with pasteboard paste and glazier's putty. In this way he procured a rich and curious collection. From these moulds were engraved one hundred and twelve figures. In order to make it more complete, a second column was added to his table of figures, placing the cicatrices of ecthyma, burns, leech-bites, small-pox, furuncles, carbuncle, acne, blisters and cauteries, side by side with the vaccine cicatrices.

The first part of the work comprehends the following heads: 1, the form; 2, their dimensions; 3, the configuration of their surface,

* "Monographie des Cicatrices de la Vaccine, accompagné d'un tableau i'conographique, contenant 112 figures disposeés méthodiquement," par J. E. B. Denarp Decanteleu: Paris 1851, p. 32.

the accidents noticed, their color, their characters, their nomenclature; 4, their affinities; 5, their differential characters; 6, their classification; 7, their diverse transformation; 8, the degradation of their forms or types; 9, the degradation of type in the same subject; 10, co-existence of the different kinds in the same individual; 11, the relative frequence of divers kinds on the same subject; 12, the influence of age, constitution, weight, texture of skin, certain skin diseases, on the aspect, dimensions, accidents and color of the cicatrices.

The second part considered: 1, why some vaccine cicatrices are round, some oval; why, in the oval form, the long axis is parallel with the axis of the arm; 2, the diverse dimensions, and on the same subject; 3, the varied configuration of their surface, the punctated and the *figured** (gaufrure); 4, why the recent cicatrices are generally concave, and how they can undergo divers and numerous changes; 5, cause of the degradation of forms in different individuals and the same individuals; 6, how cicatrices of different types can exist in the same persons; 7, in what manner age, constitution, corpulency, texture of skin, skin diseases, influence the type, aspect, dimensions and color of vaccine cicatrices.

In the 5412 cicatrices examined, 3493, or 65 per cent., or nearly two-thirds, were round; 1919, or 35 per cent., little more than one-third, were oval.

It was also observed that these two forms could exist separately or together. Thus, on 1000 subjects, 47.5 per cent., nearly one-half, presented only round cicatrices; 190, or 19 per cent., had oval cicatrices only; and 335, or 33.5 per cent., a little more than a third, presented a mixture of the two forms, combined in very variable proportions.

DIMENSIONS OF VACCINE CICATRICES.

The dimensions of round cicatrices vary from 4 to 20 millimetres, ($^3/_{20}$ths to about $^{15}/_{20}$ths inch.) The greatest number (1136) measured 7 millimetres, (about $\frac{1}{4}$ inch) in diameter; and the next greatest number (795) measured 6 millimetres, (little less than $\frac{1}{4}$ inch); and the smallest number measured 20 millimetres, (more than $\frac{3}{4}$ inch.)

* Gauffrure—having irregular cellules on the surface, like the markings in a waffle. There seems to be no exact word.

REMARKS.

A critical study of Decanteleu's figures of cicatrices, leads to the conclusion that, industrious as he was, his work was incomplete. Some casts in my possession from some cicatrices found in the persons of German subjects, resulting from vaccinations of thirty years ago, show that there is a valuable number of varieties left entirely out. These are round, with clean-cut borders, $\frac{1}{3}$ inch in diameter, depressed, whiter than the surrounding skin, but distinctly foveolated. This I believe to be typical of a vigorous humanized lymph, several generations removed.

The convex cicatrices are very numerous after animal vaccinations, and many of the forms he gives are now common. They must have been rare in this country when this work was written, (1845), and their frequency can be accounted for by the discovery of several cases of cow-pox, from which their stock was drawn; the Passy case, in 1836, being the one nearest this date, just nine years before his studies were commenced.

ANSWER II.

BY EZRA M. HUNT, M. D., SECRETARY NEW JERSEY STATE BOARD OF HEALTH.

It is not the design of this article to debate the question whether small-pox has been limited and prevented, and is to continue to be limited and prevented, by vaccination. The fact that Edward Jenner discovered a system of introducing what is known as the kine or cow-pox will be taken for granted. In 1798 he published his "Inquiry into the causes and effects of variola vaccine," and about 1800 Dr. Waterhouse, of Boston, procured vaccine lymph direct from Jenner. Ever since, vaccination has been practiced in this country.

As to the power of vaccination in influencing small-pox, we quote from "The Truth about Vaccination," by Ernest Hart of London, (1880), and refer those anxious for more details to this brief treatise:

"Eighty years' use of vaccination has proved beyond doubt that, 'duly and efficiently performed,' its power of influencing small-pox is, indeed, almost absolute, that it acts, not invariably by preventing, but sometimes only by controlling that disease. The vast majority of those who have gone regularly through the vaccine

process are saved thereby from any future attack, however modified or slight, of small-pox. In the minority, who have not been rendered by it completely proof against the influence of the small-pox poison, the action of that virus is yet so modified that the small-pox, as a rule, is deprived of all danger to life, and does not leave behind it those disfiguring traces which are not the least of the terrors of unmodified variola. There is certainly no subject on which medical testimony is more unanimous than on the very large immunity from attacks of small-pox which successful vaccination will confer. A vast body of evidence which was collected by the Epidemiological Society in 1851-52, from all parts of the kingdom and from abroad, showed that vaccinated persons placed in circumstances in which no unvaccinated or otherwise unprotected person, or scarcely any such, escaped (*e. g.*, persons living in crowded and ill-ventilated dwellings in which the small-pox infection existed, occupying the same rooms, and sleeping in the same bed with small-pox cases, mothers nursing their babies who were suffering from the disease,) yet remained themselves entirely unscathed."

Taking it, therefore, for granted that there is such a thing as protection from small-pox, by the process known as *vaccination*, our first practical inquiry is, *from whence is the material for the operation to be secured?*

To this three answers have been given, each of them so correct, that probably the preference must turn upon relative points and questions of expediency.

The lymph used by Jenner, and which was the means of introducing the art of vaccination to the world, was derived from an eruptive disorder found on the udder of the cow, which, after painstaking research, he learned to distinguish from other eruptive diseases also sometimes found on the udder. He found by actual experiment that when the lymph was introduced into a child, it was preventive of small-pox.

He also found that it was not necessary always to procure the lymph direct from the cow, but that in passing through human subjects it did not lose its power. Hence came the use of "humanized vaccine lymph," which, it is abundantly proved, in the course of eighty years or more has protected tens of thousands of persons from the small-pox.

The second source from which effective vaccine lymph has been derived, is such as has resulted from the introduction of the virus of variola or small-pox into animals and then using the modified lymph of the vesicles so produced for human vaccination. No doubt the fact that Jenner himself regarded the kine or cow-pox ("variolæ vaccinæ") as a modified small-pox, first led to this class of experiments. It is true that this source of supply has been doubted, because of many negative experiments, but the evidence of Gassner, Sonderland (1830), Thiele (1836), Robert Ceeley, of Aylesbury, Mr. Badcock, of Brighton, and their acceptance by such authorities as Simon, Seaton, Buchanan,

etc., the successful repetition of Ceeley's experiments in this country, in 1840, by Dr. Horatio Adams, of Waltham, Mass., by Dr. S. Knight and Dr. Wm. C. Van Bibber, of Baltimore, (1852), and the fact of the continuously successful use of vaccine derived from such sources for a long time afterward, seems to leave no reasonable doubt that, if need be, a fresh vaccine lymph can be thus secured. As, however, there could be no advantage from an attempt to secure vaccine lymph from such a source at this time, and as some risks similar to the former risks of inoculation might attend it, it only seems interesting to us as starting the question whether, after all, the alleged cases of spontaneous kine or cow-pox had not a human origin.

The third source from which effective vaccine lymph has been derived, is from a case of spontaneous cow-pox known as the Beaugency stock (1866), lymph from which, propagated from calf to calf, was introduced into this country in 1870, as also possibly from some other stocks of spontaneous cow-pox which have been authenticated. (We do not include in our enumeration a vaccinating lymph which was procured by introducing humanized vaccine lymph into calves, and so an attempt made to refresh by this culture, and which was known as Lænoix's lymph, and for a time used with some success.)

Practically, as we now have to deal with vaccination, the only question to be determined is, shall we insist upon using lymph known as the Jenner lymph, transmitted by successive human vaccinations, or shall we use the lymph from more recent cases of spontaneous cow-pox, cultivated or preserved by being transmitted from calf to calf, instead of from person to person? (After having compared these two, a subsidiary question also arises, viz., whether we shall in all cases use this more recent lymph transmitted from calf to calf, or whether, having this supply, we shall not select our best results in children, and so use also humanized lymph of this more recent stock.)

1st. As to the Jenner lymph.

The criticisms made upon its use relate chiefly to these three points:

(*a*) Its enfeeblement of protective power by reason of its long use and so distant remove from the original supply.

(*b*) The possibility of conveying thereby some disease which has existed in persons from whom the lymph has been taken.

(*c*) The difficulty of obtaining enough to meet the emergencies of epidemics.

Under the first point (*a*) the statement of the case is this: It is alleged by some that you may take the lymph from a normal vesicle,

at the proper time and in the right way, and insert it into the flesh of unvaccinated persons and have an apparently good vesicle therefrom, but that of one hundred or more so vaccinated, more than in the early years of vaccination will contract genuine or modified small-pox not very long after, and still more will be protected for a shorter period than formerly.

The strongest statement made in confirmation of this view is probably that furnished by Dr. Cameron, of Dublin, and to be found in the Fortnightly Review, May, 1881.

In all such examinations it is to be borne in mind that even if the fact seems to be established, we are first to inquire whether it is not owing to some incidental or accidental modification of effect, and are not to assume that it is owing to any inherent deterioration of "vesicle" power. If so, and if we are able to eliminate these restricting or disturbing results, it does not at all affect the integrity or usefulness of the original methods. The errors made in the adoption of a system do not at all affect its real value, if only these errors are capable of identification and removal. The art of the physician is to recognize the errors and their sources, and to secure that precision of procurement and insertion which shall insure success.

After some careful examination of the subject, we are unable to collect any series of facts which show that in the oft-repeated removes from the first vaccinations in Jenner's time, or in that of his immediate successors, there was apparent any change in the character of the vesicle, so far as concerns its efficiency. Even oftener than now, the test was made by the direct exposure of vaccinated persons to the contagion of small-pox. Ever since, physicians and nurses without number have relied upon this protection without any consideration of the number of removes from the original stock, and have had the proof which such a test furnishes, that this vaccination is fully protective against small-pox.

With so much evidence as there is on which to postulate a law that genuine vaccination of this kind is protective from small-pox, where a case of apparent exception has occurred, such questions as these are in order:

Was the vesicle from which the lymph was taken a genuine vaccine vesicle, and the lymph in a proper state for transfer?

Were all the usual phenomena of a perfect vaccination realized in the case of the person under observation?

Was the vaccination that of a single vesicle and without any apparent constitutional impression, so as to raise the point of defective quantity rather than of deteriorated quality?

Have such cases been so rare as to make it legitimate to class this as an idiosyncrasy, since we recognize that to many laws there are occasional inexplicable exceptions which do not invalidate the general law?

These questions are started here not with the intent of their full answer, but as a caution that when careful and continuous observation and testimony seem to have authenticated a law, we are not to give such force to a few phenomenal or apparent limitations as to lead us to doubt its existence. Imperfections in details do not mar the primal fact. It generally occurs that these failures or variations are capable of explanation, and that there is no need to discredit the written judgment of those who have formulated the law, and by the fullest observation established it.

The fact that some persons have contracted small-pox after having had it once before, does not at all affect the general statement that one attack of small-pox is protective against a second. With the many possibilities that arise as to the genuineness and extent of a vaccinating effect, it is not surprising that some persons who have been vaccinated have an after-attack of small-pox or varioloid, yet the fact remains that, as a rule, the Jenner vaccination is fully protective against small-pox. Such is the belief of a very large majority of vaccinators.

PERMANENCY OF EFFECT.

Our second inquiry has reference to the question whether there has been any diminution in the time in which genuine vaccination affords protection.

If vaccinia is a modified variola, or even if not, and if any of the analogies, as measles, scarlatina and others of the class of diseases to which small-pox seems to belong, apply to it, it would be proper to entertain, as a working hypothesis, the idea that a vaccination which, at the time, exhibits its full effect, would continue to be operative throughout the whole of the subsequent life. The fact that in very many persons it has been and is so operative, can scarcely be gainsaid, and adds to the probability that the protection is usually lifelong.

If sufficient exceptions multiply upon us, we are not at once to conclude that the law must be set aside, but are to start and settle such inquiries as these:

Is there full and sufficient evidence that the original vaccination was such, in all particulars, as would have satisfied Mr. Jenner and the earlier disciples of vaccination?

Was it at all tested at the time by what was formerly so much the crucial method of immediate revaccination, to know whether the system failed to respond to a repetition?

Is it certain that when we get what seems to be a true vesicle from a repetition with bovine lymph, that the person was not protected or that what you may choose to assume was a feeble protection, would not have prevented his taking of the small-pox?

Is it certain that the sore produced is a genuine vaccine vesicle, and uninfluenced by anything that has preceded it? Or, if undoubtedly genuine, can we not ascertain a law of change in the individual or in his climate or surroundings, that accounts for the effect and recognizes him rather as an explicable exception than as a breach of the law and a reason for its denial?

Such inquiries behoove the accurate students of the subject who are seeking to be exact, and who form judgment upon sufficient testimony rather than upon the bias of their own few cases.

For, when we come to turn back to old authorities and see the precisions and tests of original vaccination, and the sources of error that we may need to eliminate, we must not too hastily conclude that there is *usually* a limitation of effect, or that revaccination under the same conditions as those of its early performance is required at briefer intervals than in the time of Jenner. There is a strange lack of such evidence as would commend itself to a medical judge and jury, if all of us were called upon to submit our cases to such a decision, and to give a reason for our views with meekness and fear.

We believe that Jenner was right when he said of vaccination: "Duly and efficiently performed, it will protect the constitution from subsequent attacks of small-pox as much as that disease itself will. I never expected it would do more, and it will not, I believe, do less." Seaton's Hand-Book, p. 178.

II. The second point of possible objection is the possibility of transmitting by or through vaccination any disease which has existed in persons from whom the lymph has been taken.

That by some condition of the person vaccinated some form of irritation may occur, or that eczema or other skin disease may be developed has always been granted. But results have been in thousands of instances so benign, and the protection from small-pox so complete,

that there are but two diseases as to which impression enough has been made to take the form of serious objection.

These are erysipelas and syphilis. The occurrence of erysipelas has never been claimed as peculiar to vaccination. Any scratch upon the body may be the occasion of an erysipelatous disease, or the introduction of parts of a crust or of some irritating foreign matter, distinct from lymph, may produce it. The probabilities or possibilities arising from this disease have been very carefully studied, and a full analysis of cases has never authenticated this disease as a valid reason for neglecting this protection from small-pox. It is a very rare result.

Most physicians do not believe it possible to communicate hereditary syphilis by genuine lymph. The grounds for suspicion in this direction have been so doubtful that a large majority of vaccinators still doubt if cases of alleged syphilis have not been the result of the accidental introduction of syphilitic poison, by the direct application of the virus to the puncture or abrasion, or afterward by rubbing or scratching. The general view has led to this form of statement:

1st. While syphilis is an inoculable disease, it is probably only inoculable by its own primary infection, which the child could not have, except as the syphilitic virus was introduced directly from the parent or some other source by direct contact.

2d. It is not known that inherited syphilis can be communicated through vaccination. If it could be, inasmuch as inherited syphilis is a disease, the existence of which is declared within six months after birth, this remote possibility could be vacated by choosing a supply from children of an age beyond that time.

"In foreign countries attempts have again and again been made to decide by experiments whether vaccination, from persons obviously ill from constitutional syphilis, will communicate syphilis to the recipient: and it is, to say the least, a very remarkable fact that in not one of these experiments has anything like syphilis resulted. With the well-attested experiments which now stand on record we are obliged to doubt whether vaccination, *i. e., genuine and simple inoculation with vaccine lymph*, from however syphilitic a subject, can possibly communicate syphilis, or, at the very least, whether some stage of the vaccine vesicle more advanced than vaccination rules allow to be proper for lymph supply, or some admixture of blood with vaccine lymph such as careful vaccination never permits, must not be a condition for such possibility." See Hart, p. 291. "During the twenty years in which there has been systematic inspection of public vaccination in England,

some millions of vaccinations have been performed. But in no single instance have the government inspectors of vaccination been able, after the most rigid inquiry, to find one single case of syphilis after vaccination." Hart, p. 27. Is not Dr. Seaton correct in saying *that the danger*, if indeed there be any at all, of communicating through vaccine lymph, as in an ordinary well-performed vaccination, any other infection than its own must be so infinitesimally small, that for all practical purposes we may regard it as non-existent?

Our third query relates to the difficulty of obtaining enough Jenner lymph to meet the emergencies of recurring cases of small-pox. This certainly has become a serious inconvenience. With the exception of the supply from Dr. C. H. Leonard, of Providence, Rhode Island, which Dr. E. M. Snow of that city has been so careful to perpetuate, it is now quite difficult in this country to be sure of a supply from the Jenner stock. While we cannot accept many of the objections made to the Jenner lymph, and believe by perfect care and propagation it would continue to protect, even if we never had discerned the method of perpetuating calf or bovine lymph, yet when we come to examine still further we shall hope to show some reasons why, at the present day, it is as practicable as it is safe for us to trust chiefly to the bovine supply, and to concentrate our efforts in preserving it from those unskilled and commercial embarrassments to which it is exposed.

We therefore next pass to inquire whether the lymph now especially known as bovine lymph, is reliable, as carrying out the intent and accomplishing the purpose of the Jenner system of vaccination, and how its completest effectiveness is to be secured.

While it must be admitted at the start that the use of the recent animal lymph has not yet been very long or been subjected to the accuracy of experiment which has been exercised as to the Jenner lymph, there is no reason to doubt its great value as an addition to our sources of supply. It vacates any cavil as to the possibility of the transmission of human diseases, which has been alleged as to the humanized lymph, and enables us to secure a larger amount of supply, fresh and ready for use. On the other hand, the very fact of large demand and active production sometimes begets carelessness as to methods, or passes its production and sale into the hands of those who have no expert relation to those nice experimental questions which greatly concern the physician and his patients. While we do not admit the necessity of its use by reason of the loss of any original power in the Jenner lymph, we regard it as an addition to our stock

of such advantage as now to be regarded as our most important supply.

We have thus answered the first inquiry in the memorandum of this Board, as found on page 339 of its fifth report.

In answer to the second inquiry of the memorandum, as to the phenomena which have occurred in the use of bovine lymph, as distinct from what has been heretofore noted as to the humanized Jenner lymph, we note as follows:

(*a*) The time of maturity is less uniform and generally more prolonged. Dr. Wenning, for instance, of the Cincinnati Academy of Medicine, (see Cincinnati Lancet and Clinic, 1882, p. 113,) vaccinated on the same day in the same school, about forty children with bovine and eight with humanized lymph. Some of the bovine lymph did not produce its effect until the fourteenth day, while the human took in the usual time. Dr. Hewitt, of Minnesota, informs me that during an epidemic in his state the contrast was so marked that in the cases of those who had been exposed to contagion he uniformly used the humanized lymph, in order to anticipate the prodromal stage of small-pox. In the Privy Council report of 1854, under a page headed "Signs of Successful Vaccination and of Successful Revaccination," being the description of Gregory, as revised by Ceeley and Marson, it is said "when lymph is employed which has recently been derived from the cow, the resulting phenomena, as compared with the previous description, are somewhat retarded in their course; and the areola is apt to be much more diffuse. There is, also, more feverishness but eruption is less frequently seen." P. 12.

(*b*) The degree of sickness is, as a rule, greater in a genuine bovine than in a humanized vaccination, and quite corresponds to Jenner's statement, made as to his own cases. This, when arising from perfect lymph, is regarded by many as a proof that the constitutional effect is more pronounced. If it were possible always to know that this sickness results from the pure lymph alone, and was not modified by the condition of the system or from other causes, the amount of sickness would be a test of the constitutional effect. As it is, the experience or judgment of the vaccinator must be relied upon to determine its exact significance.

(*c*) *The proportion of local to general effect.* It is not probable that recent bovine lymph has anything peculiar to itself as distinct from the Jenner lymph, so far as the relations of local to general effect are

concerned. The local effect, as well as the constitutional, is regarded as likely to be more pronounced in the use of the bovine lymph, but this probably depends somewhat on the amount of lymph introduced, as we shall see under another heading.

(*d*) "*As modified by the number of pustules.*" We are still in need of statistics on this point sufficiently accurate to be comparable with those already on record as to humanized or Jenner lymph. (See English Reports for 1861, by Drs. Seaton, Stevens, Sanderson and Buchanan.)

As a sample of the importance attached to this, we find that under the English vaccination method, the registrars kept record of the number of marks. Thus Dr. Seaton, in his report for a half year, (June to December, 1860,) has the following in his return:

With typical marks, 2882,	3 or more,	1036.
	2 " "	1219.
	1 " "	627.
With possible marks, 3485,	3 " "	1262.
	2 " "	1447.
	1 " "	776.
With bad marks, 1889,	3 " "	606.
	1 " 2	1283.

In the next report (1861), after an additional examination of over 19,000 cicatrices, he says: "The conclusion that 29 per cent. of children nominally vaccinated were very imperfectly protected against small-pox, and that another 37 per cent. had only a comparatively moderate degree of protection, is a very serious one, and would be still more serious if it had appeared to depend upon causes beyond control." Having only one or two marks was called by some the "half-vaccinating" custom. Care was formerly taken to have the insertions about three-quarters of an inch apart, so as to distinguish the vesicles from each other.

There can be no question that in the use of the Jenner vaccine it was important to produce more than one pustule, and that both the degree and permanency of the effect had some relation to the number of vesicles or pustules which filled with lymph. Often punctures used to be made sufficiently apart from each other to give opportunity to trace the development of each one. It was and still is the general judgment of the medical profession that a number of pustules is desirable, because more fully assuring the degree and permanency of protection. It is objected by some in respect to bovine lymph, inasmuch as its effect is more active than that of Jenner lymph, that the introduction of a larger quantity makes the operation itself more hazardous. It is a question of much importance whether we ought not to adopt what used to be known as the Bryce method, from the plan of Mr. Bryce, who, soon after Jenner's discovery, introduced vaccination into Scotland. So soon as the activity of a single insertion or puncture had been manifested, he revaccinated at another point. If, in due time, this showed some effect, he repeated it again, and so on until no effect was apparent. It was a fact that when the second or third vaccinations produced an effect, the latter insertions, which came to anything, matured nearly "consentaneously" with the first that had taken.

Dr. E. Warlomont, Director of the State Vaccinal Institution at Brussels, and perhaps the most successful practitioner of animal vaccination, says: "When a child is brought back at the expiration of the first seven days, if it be revaccinated on the spot, even with its own vaccine lymph, it may be that there will be a fresh eruption, feeble for the most part, but occasionally showing all the signs of classic vaccinal pustule. What conclusion is to be drawn, if not that the first inoculation, insufficient to protect the subject against a second vaccinal impregnation, was *a fortiori* insufficient to guard it against variola? Hence the necessity of fresh insertions until the complete exhaustion of vaccinal receptivity. This is what I term *vaccinization*. Thus every child brought back at the end of eight days should be revaccinated on the spot, even with its own vaccine, if it be in proper condition. If this second vaccination answer well, a third should be performed, and so on, till the patient be completely *vaccinized*. I have a decided conviction that if this practice were followed, if all children were *vaccinized*, the immunity from small-pox would be much greater than at the present time; and it is, perhaps, from my having constantly put it into practice that my successes have been so constant, and the result of my vaccinations so thoroughly satisfactory."

Because it is not always easy to determine the genuineness of a bovine vaccination, because we do not perfectly know how far a local effect indicates a complete constitutional effect, we think it would be a valuable addition to present methods of practice if it were usual to repeat vaccination in a few days, even where what seems an adequate effect has been produced. Nevertheless, there is little doubt that a single vaccination, properly performed with bovine lymph, does, with

rare exceptions, protect the person who has been vaccinated from small-pox.

(*e*) *As showing herpes or other skin irritation.* It is not generally claimed or admitted that bovine lymph of the more recent stocks and transmitted from calf to calf, is any more likely to produce dangerous irritation than is the Jenner lymph. Like the original cow lymph, as used by Jenner, it is more active in its effects, and therefore is more liable to excite local irritation, and to be the occasion for the appearance of some eruptive disorders, to which the person may be inclined. Whatever danger there may be of the conveyance of any human disease from one human system to another, is avoided in the use of bovine lymph. It has never been alleged that any serious disease has been transmitted from the bovine to the human species. Although from the fact that some dermatologists believe that a mild form of herpes has been thus transmitted, students of bovine vaccination should be on the watch against the remote possibility. In reference to the "nævus-like" looking proliferation which sometimes is formed, Dr. J. B. Taylor, Inspector of Vaccination for the New York City Board of Health, speaks thus, (see Med. Rec., April 8th, 1882, p. 389): "It is virus beginning to deteriorate that produces the 'raspberry,' or, as they are more commonly called, fungus or abortive vesicles. The latter are cellular in structure, closely resembling a vaccine vesicle in all appearances, except as to color. This is a dark or dirty red, like a nævus. They appear a little later than a true vaccination and remain unchanged for from two to four weeks, when they dry up, forming a brown scab, which eventually falls off, *leaving no scar.*" We cannot say with the author that they cause no inconvenience. We think they are keloid in their character and need further investigation as to their cause. While they never have been found harmful, they are unpleasant, and of no value as a protection; from the fact that one observer has reported a large number of cases as occurring from the use of one stock of lymph, it seems to be not at all connected with any individual condition, but with some condition of the lymph used.

(*f*) *As to period of protection.* We see no reason to doubt the statement of Ernest Hart, that "by vaccination in infancy, if thoroughly well performed and successful, most people are completely insured for their whole lifetime against an attack of small-pox; and in the proportionately few cases where the protection is less complete, small-pox, if it be caught, will generally be, in consequence of the vaccination, so

mild a disease as not to threaten death or disfigurement. * * * In consequence of the large amount of *imperfect* vaccination which has until very recent years existed, the population contains very many persons who, though nominally vaccinated and believing themselves to be protected against small-pox, are really liable to infection." * *

We believe that a summary of evidence as to the Jenner vaccination goes to show that, as a rule, where persons were properly vaccinated with the genuine lymph, and to a degree that showed constitutional effect, as tested by repeated vaccination before the first vaccination had separated its crust, such persons were permanently protected from small-pox. Also, so far as present evidence goes as to bovine lymph, it is equally strong, or, as some would claim, much stronger. This prepares us to pass to the answer of the third query of the memorandum—"III. Are we able to arrive at any law as to how frequently vaccination should be repeated?" Our answer to this is, if we were able to know that the first vaccination was performed by a skillful person, and found satisfactory by him, and especially if tested by revaccination at the time, we believe, in the vast majority of cases, the protection is permanent. Jenner, in his day, gave a case to show that some perceptible effect from lymph inserted long after does not prove that the person would have contracted small-pox. Arriving at the age of puberty, or change of climate or of constitution, does not again subject a child who has had measles or scarlet fever to a new attack.

We believe that Jenner was correct in his claim that a child fully and properly vaccinated was for life protected from small-pox as perfectly as if he had once had the disease, and that the same is as fully true of genuine bovine lymph as procured by transmission from calf to calf.

But the *practical question as to the necessity of revaccination is quite different from the theoretical one.*

Whether from imperfect vaccination at the time, imperfection of lymph, imperfection of skill in the vaccinator, or of care in observation, the neglect or impracticability of repetition at the time, or from some other possible cause, it must be admitted that the common judgment and consent of the medical profession at present is that revaccination should be had at or about the age of manhood or womanhood, and that in the presence of an epidemic or special exposure, it is the part of proper precaution to repeat it. Personally we base this view only on the judgment that since we do not, in most cases, know all

the details as to protection, it is not worth while to run even a minimum of risk of so serious a disease as small-pox. But we are not able to arrive at any "law" as to how frequently vaccination should be repeated.

IV. We do not at present favor a general law of compulsory vaccination, because we believe the object sought can in this state be attained better in other ways, taking it for granted that a primary vaccination is always insisted upon. As children are those of the most susceptible age, and in their mode of aggregation at school, furnish the most hazardous materials for epidemics, and as the privileges of the school are the gift of the state, it is wise and proper to require of teachers and scholars vaccination as a condition of attendance.

V. How far should revaccination be insisted upon in attendance at public schools? is the fifth question of our memorandum. This depends largely upon the period which has elapsed since the first vaccination, the evidence of its genuineness, and the intensity of the epidemic, or the degree of exposure in particular cases. Where the vaccinator or the source of the lymph are unknown, or there is want of evidence as to degree of protection, revaccination is generally to be advised as safer. But whether a child who has not been or will not be revaccinated, shall be excluded from the school, must be left to the judgment of physicians and to the action of local boards of education or school trustees.

Revaccination is to be urged chiefly on the ground that the first vaccination may not have been exhaustive, and that in the presence of an epidemic it is not worth while to run any risk.

VI. How far can we determine the efficacy of the vaccination by the scar?

In general this may be answered by saying that the efficacy of a vaccination largely depends upon its quantity and quality, and that the scar as examined by an accurate observer informs much as to these.

When we review the large amount of evidence furnished by Jenner and his contemporaries, and examine the records of the English Blue Books and the consentient views of such observers as Marson, Ceely, Seaton, Sanderson, Simon, Stevens and Buchanan, it is surprising how far attention to these items has ceased to be exact.

In 1863 Dr. Seaton begins his report by saying: "We begin by assuming, as now proved beyond shadow of doubt, that the number

and typical quality of vaccine scars are the elements which denote efficiency of protection against small-pox. Without waiting for the new evidence of this relation that will presently appear, we assume that every vaccination should be performed according to the rule of the council which directs at least four good-sized vesicles, or an equal amount of local effect to be produced. From the above tables it is seen that not more than one hundred and eighty children in one thousand had the high degree of protection that would be given by an obedience to this rule. Even if we admit their good cicatrices as constituting evidence of efficient protection, we find that scarcely more than a third part of the whole number of vaccinated children have received this degree of protection.

It is to be remembered that in all the earlier methods of vaccination, separate and successive punctures were made, and there was great accuracy of observation as to both the extent and quality of the result. The principles of test were well enunciated, after observations of tens of thousands of cases by various observers who found themselves in full agreement as to what did and what did not, both as to quantity and quality, constitutes the sign of proper vaccination. The opinions were formed by examination of the cases about the eighth day, as well as by examination of the cicatrices. Thus in the first instructions of the first report of the medical officer of the Privy Council, (1858), instruction third is, "vaccinate by four or five separate punctures, so as to produce four or five separate good-sized vesicles; or, if you vaccinate otherwise than by separate punctures, take care to produce local effects equal to those just mentioned." It was then largely the custom to have the child from whom the lymph was taken present, for immediate transfer, in the spirit of a letter of Jenner's written to a friend whose children he was asked to vaccinate, where he says, "Our arrangements must be carefully made, as the children must be met here by proper subjects for transferring the lymph, for on the accuracy of this part of the process much depends.'

The facts presented by Mr. Marson, in his report of 1856, after having been in charge of the London Small-pox Hospital for nearly twenty-five years, and the views of Mr. Ceely, of Aylesbury, both pointed to the necessity of close distinction between perfect and incomplete vaccination. Dr. Simon, emphasizing the importance of both (p. 54) the amount and the character of the mark, says: "The amount of vaccination scar or scars on the arm or arms of a successfully-vaccinated person ought decidedly not to be less than half, and is proba-

bly the better for reaching three-quarters of a square inch. It does not practically matter whether the quantity is got by the existence of one very large scar or by the existence of several smaller ones—a difference which depends on inessential differences in the mode of vaccinating." Mr. Marson's method is to make, about three-quarters of an inch apart, five punctures, not very superficial, each of which gives a vesicle, and eventually a cicatrix of circular form and of diameter varying from three-eighths to five-eighths of an inch. Mr. Ceely, using Weir's vaccinator, at four different spots, about three-quarters of an inch asunder, raises on each spot a compound vesicle or group of vesicles; and the result at each spot is a cicatrix of oval or elliptical shape, and on average about one-half of an inch long, by one-third of an inch broad.

"The quality of vaccination scar, to which too much importance cannot be attached, is that it shall be slightly depressed, and in its whole extent be dotted over with minute pittings." We do not agree with Martin in depreciating the import of these. One cannot read the description of the sizes of a successful vaccination as given by Gregory, and revised by Ceely and Marson, without seeing that in it they expressed that accurate knowledge which came from the closest observation of thousands of cases. Still, more, the four inquiries of the medical officers of the Privy Council, made by eminent men and including actual examination of cicatrices by the hundred thousand, as detailed in these reports, show that the number and quality of the "marks" is, to the skilled observer, quite accurately indicative of the value of the protection.

It is hard to rid one's self of the persuasion that the need of revaccination of the present day is mostly to be attributed to the uncertain character of some of the lymph, to the want of thoroughness in primary vaccinations, to the want of skill in judging of the requisite quantity and quality of the "sore," and "the vaccinator's low standard of what he ought to deem a satisfactory result of vaccination."

As the present habit of vaccination is not by distinct punctures, we need to judge more by the area of the cicatrix and by its indentation, (foveolation.)

Dr. Russell, the health officer of Glasgow, says: "The number of vaccine marks can have no meaning, excepting so far as they indicate, in a general way, the quantity of lymph introduced into the system. * * * I am inclined to think that the local and permanent phenomena which would best indicate the quantity of lymph introduced,

and, consequently, show even more striking relations to the mortality, would be the superficial area of good vaccine cicatrices."

An area of half a square inch is the size specified in the official report of Dr. Bridges.

It must be admitted that in dealing with bovine lymph we have not, as yet, determined, with the accuracy with which observers of the Jenner lymph thought they had determined, the significance of the cicatrix.

The small annular elevation of the lymph cells and the friable character of the crust, often perplex those who have, over and over again, seen so as to be sure that they know what has constituted a good Jenner vaccination.

From the variable depth and circumference of the vaccinal lesion even when uncomplicated, and its variation from local inflammation, both the area and the "foveolation" or pittings are obscured as to their significance. The graphic and accurate descriptions of the Jenner vaccination by Gregory, Ceely, Marson and Wilson, deserve to be recalled. (See English report, 1858, p. 30.)

It is true Dr. Martin is both positive and descriptive in his identification, but this perhaps, because of our mixed supply, is too accurate to correspond with the testimony of most observers.

While greatly hopeful over the evidence to be secured by more extended comparisons, and while not denying to the cicatrix some significancy, we must, at present, say that it is doubtful whether, from the cicatrix of a bovine vaccination, we can certify the perfection of the protection. Vaccinators should be studying cicatrices.

VII. *Certificate of vaccination.* We think the plan of a certificate of vaccination important. It identifies the time of the operation and the person performing it as can be done in no other way. This would often determine the question of protection or the need of repetition. It secures greater carefulness on the part of many vaccinators. England now has government medical inspectors, and certain of the medical licensing bodies require evidence of tuition by one of the government teachers of vaccination.

A certificate of vaccination should state the number of vesicles produced. At present there is no definition of what is a successful bovine vaccination, too often any sort of vaccinal effect on the arm being regarded as a success. The certificate should give the time and place of its performance and by whom, and should state whether the lymph used was that of the Jenner stock, that from the calf direct or that

which is one or more removes therefrom; as also whether a crust or points have been used. All the better if the source of supply is also stated.

VIII. Our next question is: "In what way shall practitioners be assured of the purity and freshness of the lymph?"

The importance of being thus assured cannot be overestimated.

If the lymph is simply inert, repetition is required, and a want of confidence engendered. If small-pox is prevalent the first failure may expose the person and so the community to an attack of small-pox, which good lymph would have prevented.

If, besides the lymph, you have blood, serum or other foreign matter, or any organic substance in a process of decomposition or decay, there is the possibility of producing much unnecessary local irritation, and of introducing into a human system material which may excite disease. Also if a dirty lancet is used.

The possibility of obtaining unprotective or absolutely spurious and injurious lymph, does not weaken the argument for *vaccination, since there is such a thing as thoroughly protective vaccination*, since the material for it can be procured, since *what it protects from is one of the severest* scourges of humanity, a fearful tax on human life and on social and national progress.

But the fact of possible inertness or spuriousness does make it intensely incumbent upon the general government and the State to secure for its citizens right vaccination, to protect them from imperfect or spurious vaccination, and upon the members of the medical profession to see to it that in offering themselves as vaccinators, they be able to assure their patrons that they have a lymph which is both safe and effectual, in a timely and protective sense. For on these two conditions, one of which relates to the State and the other to the vaccinator, depend a very great public and personal interest to citizens, to families and to individuals. And it also behooves the vaccinator to know that both as to quality and quantity of effect, he has given to his patient the full benefit of the *completest* and longest possible protection.

It thus becomes a practical question, both to physicians and the people generally, how we shall have assured protection. Many physicians, feeling the importance and responsibility of the question, think that the general government should have a system which should insure against imperfect lymph. Others, that the State should in some way provide a lymph supply.

It has not been deemed advisable by this Board for it to enter upon any system of lymph production. It acquaints itself with and advises as to sources. Then also it sees to it that vaccination is promoted throughout the State, and that it is promptly resorted to when small-pox occurs. It has been able to aid much in this way.

In the case of the only vaccine farm in this State, it was found to be conducted by a city Board not in the limits of the State, and we could only make examination and pass judgment and give advice. It had objections and has now ceased to exist. In order to have a more assured certainty of lymph we have encouraged physicians to use that which has taken satisfactorily to themselves and is thus approved by their own selection.

We have also introduced into the State certain approved stocks of lymph, and placed them for propagation in the hands of responsible and capable physicians, as thus starting local centres of purity, to which we could refer and which we could authenticate.

When asked as to how the people shall know that the lymph is pure, we can only answer by saying that their confidence must rest upon the vaccinator, and is the same they exercise when they send for a physician and trust him that he will use the proper medicine and not make a mistake as to it. To assure its purity or to give the right remedy may cost him far more inquiry in the one case than in the other. But so long as there is the genuine article; so long as it is an indispensable requisite to protect us from a sad and disfiguring and often fatal disease, and so long as a skilled profession have both motive and competency to secure the protection, the reliance must be here. If finding a lack of ability to secure the needed protection, they must, through the people and in their behalf, appeal to the State.

For this we do not apprehend any present need. The two past years have witnessed a prevalence of small-pox, and an epidemic intensity very general in its character. No State has been more exposed thereto than our own. While it has broken out in fifty or more localities, it has in only three instances obtained much headway. In these its progress was mostly owing to neglect of adequate powers in local Boards, but was readily met when such powers were conferred.

The enormous demands for vaccine lymph throughout the country found the reputable producers of bovine lymph unable to meet the demand. Hence we have been exposed to the evils of an over-demand, which, in such an instance, could not but lead to unskillful or fraudulent production. With this experience, with increased knowledge and

with the great awakening of the medical mind, it is probable that the true and reliable sources of vaccine lymph will be more closely defined than ever before. Questions of preference as to methods and of the significance of lesions or changes wrought by the lymph, and of the conditions which limit or secure permanency of protection, will be examined with eager skill. If for the sake of brevity we may commend to others what we would say to ourselves, it is thus:

Do not forsake the Jenner lymph, on the ground that it has lost protective power.

Do not discredit bovine lymph because there has been occasional over-production and fraud.

In our zeal for the old or the new, let us not create a public feeling of distrust in this protection. Remember that there are enough reliable producers to make it competent for you to assure yourself of the reliability of your lymph. Do not let its supply take the form of a mercantile drug, since it is a commodity so special in its character as to need to be supplied more directly.

Watch closely the course of your vaccinations, and, to some extent, *depend upon yourself for supply by using lymph* that you procure after having obtained your original lymph from a reliable source, inserting it in a healthy child and having been satisfied with its mode of action.

Do not use crusts, except in a most pressing emergency.

During an epidemic, with persons who have been directly exposed to small-pox, use, if you can, at first Jenner lymph, on the ground of its greater rapidity of action, even if soon after, at some other point, you introduce the bovine lymph in order to test or intensify the effect.

Let us not allow the mere incidents or accidents connected with the use of either Jenner or bovine lymph to obscure the indispensable importance of vaccination or of protection from small-pox, the hazard from which is actually so great, while that from vaccination is infinitesimally small.

As a summary of the views submitted as a whole in this paper, we may add as follows:

SUMMARY AS TO SMALL-POX AND VACCINATION.

I. Small-pox, after complete vaccination, is as rare a disease as is a second attack of small-pox in the same person.

II. Where a vaccination has not afforded protection it may be owing

(*a*) to the lymph being spurious, or (*b*) deteriorated in quality, or (*c*) insufficient in the degree of saturation of the system, or (*d*) owing to some idiosyncrasy in the person. If owing to any of these causes, these cannot be said to establish any rule that limits the effects of proper and complete vaccination, since such causes admit of elimination or limitation to a minimum.

III. The protection afforded by vaccination depends much upon the fact that at the time of its performance it has been done so exhaustively as that weekly or bi-weekly repetitions with genuine lymph would not produce any effect.

IV. Revaccination at adult life is often but the supplementing of partial or inadequate vaccination in youth. The chief argument for it is the fact that present methods of first vaccination do not encourage repetition at the time. Revaccination is a wise precaution.

V. So long as there is no compulsory law of vaccination, and no system of certificate as to the perfection of primary vaccinations, revaccination is all the more important.

VI. Lymph from spontaneous cow-pox is, probably, not deteriorated from the mere fact of human transmission, and, therefore, that usually known as the Jenner lymph is still valuable.

VII. Lymph from more recent spontaneous cow-pox, transmitted through successive calves instead of through successive infants, is also a valuable source of supply. This may be used after transmission through persons who have not been previously vaccinated.

VIII. The risk of transmitting other diseases through vaccination is excessively small—is even considered impossible by many of the best authorities. Yet the time will never come when dirty methods of collecting or inserting lymph, or when the careless introduction of other material into the original sore may not transmit septic or irritating material, or when any scratch may not, in a very small fraction of exceptional cases, cause inflammatory or septic results. Such rare and avoidable accidents or neglect furnish no reason for neglect of a process which, for every risk it has occasioned, has saved tens of thousands of lives. The expectation of life to each individual is therefore increased by vaccination.

IX. The security against small-pox consists in the exact knowledge and care of medical men, in the performance of the operation only by competent persons, and in such general laws as favor or secure the purity of lymph and the prevalence of vaccination among children.

X. The only reason why small-pox ever becomes an endemic or an epidemic, is the neglect of complete vaccination.

ANSWER III.

E. L. GRIFFIN, M. D., PRESIDENT OF WISCONSIN BOARD OF HEALTH.

I. "Should the use of bovine lymph supersede the use of humanized lymph?"

Not necessarily so; perhaps not wisely so. Both are protective, indispensable, and, with wise safeguards in their selection and use, safe.

We would urgently recommend the use of humanized lymph of only a few removes from the heifer, when that form is used. When such a selection is made, the relative merits of animal and humanized lymph cannot be fully determined by any data we have at command.

We regard bovine lymph as possessing all the qualities of safety and protection which could be desired. The essential requisite in the use of either is a conscientious and intelligent care in their selection and use.

II. "What phenomena, if any, have occurred in the use of bovine lymph, as distinct from what has been heretofore noted as to the humanized Jenner lymph?"

(*a*) *As to variation in time of evolutions and maturity.* The period of incubation is from one to three days, generally, longer in the use of bovine lymph than where humanized lymph is used.

A relatively long period is generally observed before the vesicle reaches its several stages of development and maturity.

Retardation in the course of the vaccination is a matter of common observation. This peculiarity is generally thought to be caused by the insoluble quality of bovine albumen in the serum of the blood, and hence the slow action of the absorbents on the vaccinal granule. This delay is so marked in some cases as to cause great surprise, but I have never known any untoward results to follow. The same phenomena and from the same cause are sometimes observed where humanized crust is used. Generally, in the end the vesicle matures fairly, and we may reasonably infer that a protective influence has been secured.

The phenomena of successful vaccinations will present marked deviations in degree when observed in different individuals. The cause of this is to be looked for in the variations in the quality and vigor of the lymph used; in the varying conditions of health in the persons vaccinated; in their unsanitary surroundings and in mechanical interference with the normal development of the vesicle.

(*b*) *Degree of sickness.* The constitutional symptoms following the use of pure bovine lymph, and those induced by lymph humanized by a few removes from the heifer, are generally of a like character and degree. In the case of both, these symptoms are sometimes quite severe. The cause is quite often found in the condition of the patient himself. It must be admitted that during the past year an unusual amount of severe constitutional symptoms and local complications have followed the use of bovine lymph. Undoubtedly several causes have combined to produce these results—

1. A marked susceptibility, during a portion of the year, in the human subject, to the vaccinal disease, as well as to the variolous poison.

2. The use of bovine lymph of questionable purity.

3. The use of points which were packed and sent out for use, possibly before they were thoroughly dried. In such cases, some vital degenerative change might take place in the albuminous coating of the point, so that when such lymph was planted in the human arm a degree of septic action might be set up. Where orders were in advance of the crop, and impatiently waited for, such an accident is by no means impossible. All these evils are *accidental* and almost inseparable from a great pressure, such as was brought to bear upon all vaccine establishments during the winter of '81 and '82.

4. Faulty and unskillful methods of vaccinating, especially the one of scarifying too deep.

Simple as is the operation of vaccination, yet it requires a degree of technical skill rarely appreciated in or out of the profession. It is to be deplored that an operation so inseparably connected with the safety of human life should be entrusted to any but skilled hands.

(*c*) *As showing abnormal results.* The frequency of vaccinal erythema following the use of bovine lymph is a noticeable phenomenon. This constitutional manifestation of the vaccinal disease is seldom observed in the use of humanized lymph of distant removes from the heifer. It is a harmless affair, and only indicates a thorough saturation of the system with the vaccinal disease.

The phenomena of so-called spurious vaccinations are sometimes very annoying. The prevalent notion that these irregularities appear only after the use of bovine lymph is incorrect, for they were observed years before the introduction of animal vaccination.

While an apparently large number of spurious vaccinations were observed during the winter of '81 and '82, it must be remembered that the ratio was small, since the number vaccinated was simply immense, and this without regard to physical condition or sanitary surroundings, and that the service was rendered in many cases without skill or intelligence such as the importance of the operation demands.

A recent writer* has grouped together what may be called the *accidents* sometimes noticed to follow the use of bovine lymph, having their cause, as we have before stated, sometimes in the patient and his surroundings, and sometimes in the bad quality of the lymph used.

1. Red tubercles, the size of peas, appear at the seat of vaccination. These tubercles sometimes suppurate.

2. The vesicle commences with much itching and irritation. It is not umbilicated, but acuminated or conoidal, and contains straw-colored or opaque, instead of clear lymph. The areola is completed by the fifth or sixth day, and begins to decline on the eighth day, the scab falling off by the tenth day.

3. Instead of the usual papule or vesicle, a bulla containing a transparent fluid, and having a reddened margin, may develop. Troublesome ulceration sometimes arises beneath the crust, which is formed after the rupture of the blebs.

4. A crop of herpetic vesicles, preceded by shivering, may appear about the third day after vaccination. These soon burst, and the exuded fluid gives rise to an eczematous eruption, the skin becoming hard and œdematous. Intolerable itching accompanies the vesicle, and the axillary glands become enlarged.

5. Occasionally vesicles which have apparently run a normal course up to the eighth or tenth day, suddenly rupture, and ulcers, that spread both superficially and deeply, make their appearance. They cause pain or itching, and are accompanied by much constitutional disturbance.

These manifestations are always benign in character, and always end in complete recovery.

(*d*) *As to period of protection.* This cannot be definitely settled by

* Hardaway on Vaccination and Small-pox.

our present *data*. The history of animal vaccination is too brief to furnish opportunity for strict comparison. The evidence is strongly in favor of bovine lymph over that of humanized, *i. e.*, the long-used human lymph.

III. "Are we able to arrive at any law as to how frequently vaccination should be repeated?"

No. That must always, from the very nature of the case, be a matter of experiment. So much must be allowed in a given case for the varying vigor of the lymph used, for the possible imperfection of the operation, for the accidents interrupting the normal development of the vesicle, and for the varying degree of resusceptibility to the vaccinal disease, that nothing but repeated trials can test the safety of any person.

The test of revaccination should be applied at the age of ten or twelve years, and before that age under imminent danger. The trouble and cost of such a revaccination is so insignificant in comparison with the security gained, that it is one of the marvels of the age that so many neglect this duty.

IV. "Should there be a law of compulsory vaccination?"

We are not prepared to advocate such a law, although there are potential arguments in its favor. The partial application of such a law as applied to schools and public institutions is wise. In the present state of the public mind with regard to compulsory measures, it is very doubtful whether a more general law of a compulsory nature would be sustained. Educate the people as to personal duty and public obligation, and leave the burden of responsibility on the individual.

V. "How far should revaccination be insisted upon in attendance upon public schools?"

Undoubtedly to the extent of full protection for all the pupils. It could not be considered an unwise or objectionable rule to revaccinate all pupils when arriving at the age of twelve years. It might be found necessary to revaccinate younger pupils during a wide diffusion of small-pox in the community.

All doubtful primary vaccinations should be revaccinated. The genuineness of a primary vaccination must be determined by its history; by the appearance of the scar as to its typical or deficient character; by its quantity.

VI. "How far can we determine the efficacy of the vaccination by the scar?"

Only approximately. We need another factor to aid us, namely, the history of the primary vaccination. While much reliance can be placed upon a truly typical scar, together with a reliable history, giving a typical primary vaccination, we are obliged, in the final analysis, to fall back upon the test of revaccination to establish and assure our judgment.

VII. "Should we not adopt the plan of giving certificates of vaccination, so that the facts as to its proper doing may be fully known?"

Yes.

VIII. "In what way shall practitioners be assured of the freshness and purity of the lymph?"

If humanized lymph is desired, the physician must make his own selection and be his own judge. It is a wise way to procure a package of points of bovine lymph from some reliable propagator, and on carefully-selected children produce vesicles from which, on the seventh or eighth day, lymph may be taken of perfect purity and great activity.

In the matter of bovine lymph, great responsibility must always rest upon the propagator. No man should be allowed to propagate animal lymph for public use who is not a well-educated physician, of accredited and unimpeached integrity of character, and who conscientiously devotes himself to this service.

The perfect quality of animal lymph is a matter of so much importance to the public that its production should not be degraded to the level of a common trade, but be exalted to a sacred position in skilled labor. All vaccine establishments should be under the State or national supervision, thus giving, in a measure, a guaranty to the public.

No one can positively determine the purity and vigor of animal lymph by its physical properties. Some of the finest quality of bovine lymph is *amber*-colored. Some has a tint as if stained with blood. If such points are very heavily charged they have a suspicious look.

We make the following suggestions:

1. Purchase your lymph from some well-known, accredited and experienced propagator.

2. Order direct from the producer.

3. Order only in such quantities as will probably be used early.

4. Use dry-stored lymph upon ivory points or quill slips. Animal crusts are too unreliable and too liable to contain impurities to be recommended.

5. Vaccinate but one person with one point.

6. Do not carry the points about in the vest pocket. Body heat soon lowers the vitality of the lymph.

7. Reject such points as have evidence of containing impurity.

8. Study carefully your *methods* of vaccinating and seek to become skillful in the operation. Take time. Be patient. It pays.

Recognizing the infinite blessing of animal vaccine, it should be the constant effort of every physician to seek to reform such evils as are incidental to it and extend its practical usefulness to the human family.

ANSWER IV.

BY E. J. MARSH, M. D., PRESIDENT OF THE BOARD OF HEALTH OF PATERSON.

In compliance with your request, I will give you my opinion and the results of my experience on the various questions propounded on page 339 of the report of the Board for 1881, concerning vaccine lymph and vaccination. The first two questions can best be discussed in the reverse order, as the answer to the former will follow from the answers to the latter.

I. From the beginning of my practice up to 1873, I had used the humanized vaccine lymph exclusively. I had employed the arm-to-arm method, the fluid lymph in capillary tubes, the quills and the dried crusts—the last in a very large majority of the cases. The lymph was obtained either by myself or some professional friend, or from some institution of known character, as the New York Dispensary. I had seen two or three epidemics of small-pox. During these small-pox epidemics I was perfectly satisfied with the protective power afforded by this vaccine, (I mean in cases of recent vaccination), and I felt perfect confidence in my ability to protect any individual who might be exposed to the disease. I had seen no serious bad effects from vaccination; there had been a few sore arms—small, indolent ulcers, slow in cicatrizing, a few cases of subsequent eczema, and a few of convulsions in teething children. Moreover, the success of the operation had been good, failures in primary cases were very rare, and more than half the secondary vaccinations were successful. Since 1873 I have used almost entirely the bovine lymph, and this has been

obtained from Dr. F. P. Foster, Dr. H. A. Martin, or the New York City Board of Health. I began and have continued the use of this lymph for various reasons; the danger of conveying syphilis by vaccination had been much written about—a possible degeneration of the Jennerian stock and consequent diminution of the length of the protection conferred by it had been asserted, and it became a fashion to use the animal lymph and patients asked for it. In my use of bovine lymph it was observed that the vaccine vesicle resulting was much larger, the areola and inflammatory induration were more extensive, the crust large, flat and thin, generally ruptured, and came away before the sore was cicatrized. In two instances the inflammatory action was so high that the vesicle sloughed out *en masse*, leaving a deep ulcer. The constitutional symptoms were not more severe than formerly. There was a little more frequent delay in the maturity of the vesicle, but this was not generally marked. There was no more tendency to subsequent eruptions or irritations of the skin, but yet the only case of post-vaccinal erysipelas I have ever seen came after the use of bovine lymph; but this, in my opinion, is in no way attributable to the character of the lymph, but solely the result of the traumatism.

The operative success was not nearly so good as with the use of humanized lymph, and at one time failures even in primary cases seemed to be the rule and successes the exception. So much so, that I often felt and expressed a dread of dealing with another epidemic of small-pox. I felt I could not anticipate or promise my patients the same certainty of success and immediate protection as formerly. I desire to say, however, that recently my success has been much greater on account of adopting a rule of vaccinating with two points in every case, and now I have obtained very excellent results, one of the two abrasions almost always producing the vesicle. This unequal success is due, in my opinion, to the dilution of the vaccine lymph; the humanized lymph used is generally the pure lymph from the vesicle, or the same, dried in the crust; the substance on the quills or points of bovine lymph consists mainly of blood serum, with a very small quantity of vaccine lymph. As to which kind of lymph will protect the individual for the longer time, must be left for the future to decide. The time that has elapsed since the introduction of the animal lymph has been too short to allow of any decision in its favor, or to determine whether a single vaccination, in infancy, with this lymph will protect for a lifetime. For myself, I certainly would not take the responsibility of not advising a revaccination on reaching

adult age. As bearing on this subject, I will report that I recently revaccinated a child of seven and a half years whom I had previously successfully vaccinated in early infancy with animal lymph, and this revaccination was successful.

In accordance with my own experience given above, I find no reason why the bovine lymph should supersede the humanized, and I find many reasons why both should be retained.

Bovine lymph should certainly be retained; the protection it affords is certain, the absence of syphilitic contagion is certain, and on this account it can be used in some cases where prejudice would interfere with the use of the best humanized lymph. The most decided advantage it affords, however, is the ease with which the supply can be forced equal to any possible demands. With the sudden appearance of small-pox there is at once an enormous demand for vaccination, and the supply of vaccine is strained to the utmost and often falls short. By cultivating the lymph on cows and heifers, however, a supply can be obtained at a week's notice equal to any possible demand.

Humanized lymph should be retained, because it is protective from small-pox, because, with care, it can be guaranteed as equally safe as regards danger of syphilis, because it can be propagated by the physician himself, and because of its *comparative cheapness*. The last may seem an insignificant point, but it is not so. In some parts of the State the fee for vaccination is ridiculously low, and a physician who receives only fifty cents can scarcely afford to pay from ten to thirty cents for his material.

As to the way in which practitioners can be assured of the purity or freshness of the lymph: In the case of humanized lymph, it had best be propagated by themselves or obtained from physicians on whom they can rely. Bovine lymph cannot be thus obtained, but the supply can only be kept up by organized work. The procuring at all times an abundant and reliable supply of vaccine is of sufficient importance to be taken charge of by the State. This can be done either directly or indirectly. A vaccine farm can be carried on by the State Board of Health, or the same Board can officially inspect and certify to the character of the lymph supplied by individuals. This must not be all, however. This would provide good material, but it would not keep out the bad. No other lymph ought to be allowed to be sold or used in the State, except such as might be authorized by this Board.

We may not be able to arrive at any absolute law as to how frequently vaccination should be repeated, but we can, at any rate, establish a reasonable rule of practice. In ordinary periods it is neither necessary nor advisable to revaccinate before the period of adult life—about twenty years—but the operation should then be performed, and such vaccination and revaccination will almost certainly protect during the whole period of life. In times of small-pox epidemics, the revaccination should not be postponed beyond the age of ten years, and adults, who may have been revaccinated once successfully, should be advised, though not urged, to a second revaccination, partly to provide for the few exceptional cases and partly to redouble their own assurance of protection. Therefore I do not believe that *revaccination* should be insisted upon in attendance upon public schools. In ordinary cases the children are too young to be proper subjects for revaccination, and in times of small-pox epidemic, the local Boards of Health can enforce the necessary rules as to such attendance. Possibly it might be advisable to require successful revaccination as a necessary qualification for graduation.

Nor do I believe that there should be a law of compulsory vaccination. The enforcement of such a law would be very difficult in this country, on account of the slight police surveillance and the migratory habits of the people. Very few persons object to vaccination, and an equal amount of labor in offering vaccination would bring equally good results. Under the two systems, London suffers more from small-pox than New York. As a means of preventing small-pox, it would be totally inadequate unless it provided for thorough revaccination. I see no benefit to be derived from the giving of certificates of vaccination. The possible value of such a certificate would depend upon the ability and character of the physician signing it, and, in too many instances, would be worthless. In all instances of primary vaccinations (with very few exceptions), it would be of no more value than that certificate which is always given—I mean the scar. This may not be of positive value as to the protection afforded after a period of years, but it is of as much value as any written certificate could be. Certificates of revaccination might be of value in certain exceptional cases, where the resulting scar was small or indistinct.

DISPOSAL OF SEWAGE IN CITIES.

BY JULIUS W. ADAMS, C. E.

Having been honored by the request to furnish a paper upon the subject of the disposal of sewage in cities, I am led to confine myself to a review of the several schemes or systems which have been proposed to that end, as any attempt to illustrate the practical details of sewer construction would be somewhat unprofitable, unless given in connection with the systems in localities to which they severally related. This would carry us further than our limited space will permit. I have accordingly confined myself to an exposition of the several systems of sewering towns, in which, of course, there will be much which to engineers will lack the flavor of novelty—but I trust that the cause in which we are all interested, will not suffer by any attempt to bring the principles of the several systems clearly before the citizens of this state.

In the diversity of opinions which prevail as to the value of the several systems, the circumstances under which they grew up have an important bearing, and their history, going back a long way, for many centuries in some cases, is not uninteresting, and I had attempted to relieve the dryness of the subject by a rehearsal of some of these matters, which, after all, have but little practical value, and are inconsistent with my main purpose of *condensation*. I shall therefore omit their recital, and confine myself rather to what *is*, as of more practical importance than how it came about.

The end and object of works of sewerage are to remove the liquid and semi-liquid waste products of life from the vicinity of dwellings, before decomposition sets in, and in such manner that there cannot possibly be any harmful pollution arising therefrom, either to earth, air or water, and that the operation of removal shall give no offence to either sight or smell, and no methods be asked of the people, which

are likely to be neglected by the most refined, or by the lowest or most improvident of the population. Such is the ideal sewerage to which we aim to approximate; and that system or method which will, all things considered, promises the nearest approximation to this standard, in a given locality, is the proper scheme to be recommended.

The above standard presents the primary sanitary needs, which admit of the least possible compromise. The secondary and economical considerations, the value of which each community must judge for itself, are, theoretically, that the organic wastes present in sewage should be returned to the earth from whence they came, to be remoulded into vegetable life for future animal use. Science points unmistakably to the need of this economy, the neglect of which has heretofore impoverished large districts.

While science indicates that these organic wastes should be utilized to enrich the soil, it by no means follows that each and every locality should strive to this end. It may be that its accomplishment would cost more than its return money value, in which case the waste of these fertilizing elements, (when effected without endangering any sanitary principle), may be considered as so much expended to insure the public health. *Salus populi suprema lex.*

It must be borne in mind, however, that while we speak of the sewering of a district, the proper disposal of the rainfall on its surface, as well as the subsoil water, is no less important in a sanitary point of view. The surface water which scours the gutters and cleanses the streets of paved cities, except in the event of long-continued storms, is shown by analysis to differ in no essential from sewage, and requires equal facilities for its prompt removal. Stagnant water is the enemy of human life, and a water-logged soil is found to be one of the most potent causes of phthisis, as shown by the result of subsoil drainage in some English towns; hence the consideration of its proper disposal, as well as the removal of surface water and filth, cannot with safety be neglected when considering the sanitary needs of populous districts.

It will appear that there are *three* systems for the collection and removal of sewage from the neighborhood of dwellings. Each system comprises several methods:

First, the dry system. This divides itself into the general method, whereby the human fæces, without other liquid than that peculiar to the material itself, is alone dealt with. *Second*, the pneumatic system, where the house sewage alone is moved in hermetically-sealed iron

pipes to the outfall, by the method of a vacuum in the pipes or by compressed air, as the case may be. *Third*, the water-carriage system, where, by one method, the house sewage alone is conveyed to the outfall; and by another method, sewage of all kinds, from whatever source, including storm waters, are led to the outfall by the action of running water.

The methods under the first system comprise the midden-heap, privy vault, ash closet, dry earth closet and the equally barbarous or semi-barbarous method of pails, tubs, etc., or any plan, indeed by which the material is left for any length of time on the premises, and when removed is finally disposed of by hand or the horse and cart. The emptying of cesspools as ordinarily practiced, though not exactly a dry method, may yet be classed with the above.

Some of the methods of this system are still largely in use, even in large cities in Europe, and are not unknown in our own country, but are suitable only for isolated dwellings, farm-houses or small settlements, where the open air of the surroundings reduces the nuisance inseparable from their use, to a minimum. Removal by "pails" can scarcely be called a system, as not reducible to rules, but as one of the methods very much spoken of at present, it may possibly claim recognition as such.

The advocates of the pail method will urge its economy, and state in evidence its large and growing use in England, where the need of better sanitary conditions have forced themselves upon the attention of the authorities to a greater extent than elsewhere. In the towns of Rochdale, England, with a population of over seventy thousand, Manchester, with six hundred thousand, and Birmingham, with four hundred thousand, four-fifths of the people use the pail method, and it is on the increase in the crowded manufacturing districts of the north of England. The State Board of Health of New York, (second annual report, 1882,) have recommended its use for villages and towns without sewerage works, in our own country, as entirely inoffensive in its operation, and shows the economy of its use by stating "that the yearly expense of removing human sewage in Rochdale was but ten cents per head of the population," &c.

To this it might be answered that the recommendations of the New York State Board of Health, if carefully examined, will be found to be confined *exclusively* to such small settlements "as are without a public water supply or system of sewerage." But the citing of the method of Manchester, Rochdale and large cities among a wealthy, highly

refined and cultivated people, in such commendatory terms as "*inoffensive* and economical," and the urging its adoption as a sanitary measure has tended to fortify the belief in many minds that irrespective of the local circumstances which have forced the pail method into use elsewhere, (and which circumstances do not obtain in this country,) the fact of its use for many years in such crowded cities with satisfactory results, may be considered as evidence that it could not fail to be a desirable and safe method for *any* town or city in this country to adopt, whatever the character or extent of the population. Such views, though based upon an entire misapprehension, are prevailing to such an extent that in the interest of true sanitation I feel constrained to devote more space to a consideration of this pail method than at first sight, before this audience perhaps, would appear necessary.

In Manchester alone, with a population on both sides of the river of six hundred thousand, we are told there are no less than sixty thousand of these closets; in Birminghan nearly as many, three hundred thousand of the population in the latter city being furnished with them. They consist usually of a closet in the back of the premises, abutting upon, and accessible from a back alley, which alley serves for two rows of houses, one on either side. An iron pail of a capacity of about ten or twelve gallons is placed under the seat of the closet, provided with a cinder-sifter, through which the fine ash falls below, and the cinders into a recess, for further use in the household. The pails are removed by the town authorities at least weekly, and the pails emptied in extensive yards. The pails are cleansed and returned, and the excreta, together with refuse from slaughter-houses and other sources, and from the streets, are by mechanical and chemical expedients converted into manure, which under the most favorable circumstances costs considerably in excess of the sales; thus, at Rochdale, Mr. Thos. Hewsin, the engineer, reports as follows, for 1879: "The cost of the pail system with the disposal of the excreta in its crude state, is much more expensive than was the old privy system. The income from sales being no more, whilst the cost of collection will be from ten to twenty times as much."

The deep, large drains found near all the old Roman remains in England and on the continent, were built as conduits for drainage long before their use as sewers was thought of, and indeed it was penal in England before the year 1815 to cast human sewage into

them until a commission was appointed in England to inquire into the health of towns, the intolerable nuisance resulting from surface disposal of human excreta, was considered as the inevitable result of dense population growing out of the increase of great manufacturing interests crowded within limited areas.

Public attention was first called to the enormity of the nuisance then and there existing, by this Health of Towns Commission in 1844, less than forty years since, and in 1847 it was first made compulsory in London to use these drains for house sewage. It is difficult for us in this country, at this date, to realize the extent to which both the soil and the air were polluted, and the ravages of disease induced by the utter indifference to the exposure of human excreta in and around the residences, not only of the working and middle classes but of well-to-do residents as well. Decency will not permit more than a mere reference to the condition of things made public by the report of this commission; one or two extracts will suffice.

In Manchester the inspector reported in one locality in the city six hundred and forty-five houses, with a population of seven thousand and ninety-five persons, as having but thirty-three conveniences of any kind for the disposal of the house filth, and in another locality of the same city *three* or *four* entire streets were reported as without any accommodation whatever for that purpose, and in the report of the medical officers of the Privy Council, near twenty years later (1861), it was stated that in many cases in the centre of the towns no accommodation of any kind was provided.

We need not dwell upon the horrible condition of things which abounded in the crowded districts of England, nor wonder that as truer ideas of the dangers to health of this neglect began to prevail, residents in the districts should accept the pail system, operated, as was proposed, under strict official supervision, and at short intervals, (and notwithstanding what we should regard as, more or less, still a disgusting exhibition,) hail it as a most blessed improvement! It *is* unmistakably a vast improvement upon the reeking cesspools, open vaults and public manure-heaps, and the nameless abominations which previously abounded—a disgrace to civilization; but an intelligent native population have never tolerated these things, and if properly advised will reject the alternative which a lower grade of intelligence accepts with thanks. It cannot be denied, however, that we *have* a class of population very well disposed to revert to original habits, upon the principle probably of "persistency of type."

We naturally inquire why the existence of the larger underground drains should not have been availed of for the more ready disposal of this filth. To this it may be said that aside from the cost to the poorer classes, the use of the pail method, it was claimed, would keep out of the water-courses polluting elements which would otherwise render them unfit for domestic use, and at the same time give the agriculturists a more valuable manure, undiluted by water carriage, both of which purposes it very imperfectly performs. Setting aside the nuisance growing out of the careless misuse of this closet, the street filth washed by the rain, into the gutters, the baths, laundries and kitchen slops still require sewers for their disposal. Such sewers, where not previously existing, have been provided on a large scale even in towns where the use of the pail method was universal; and analysis shows that not only is the sewage therefrom equally polluting to the streams into which it is cast as is the discharge from water-closet towns, but that the bulk of the resulting sewage discharged from the sewers is in no essential lessened by the use of the pails. As to the sewage collected by the pail method the resulting manure has no such value as has been assigned to it, losing as it does so largely the chief fertilizing ingredient—the ammonia; for while the fæces, weight for weight, are more valuable than the urine, the value of the total amount of the latter is *six times* as much as the former, and the resulting ammonia is mainly lost in the preparation of the manure. A visiting engineer (Rawlinson) says of this manure at Rochdale, "I saw thousands of tons which the farmers would not take away." If this be true for the crowded areas and wasted lands of England, how much more in this country of unlimited virgin soil.

To show the emergency under which the pail method was advocated in England, the Irwill river basin (branch of the Mersey,) in which Manchester, Rochdale, Bolton, Bury, Oldham and other manufacturing towns are situated, has an area of three hundred and twelve square miles, and in 1871 a population of one and one-fourth millions, or near four thousand to the square mile, and increasing at the rate of two per cent. yearly, with eleven thousand and fifty factories of all kinds. The consequences have been that the streams are utterly unfit for domestic use, and notwithstanding the efforts to keep human sewage out of the streams, the waters are so polluted that the towns all seek their supply by means of storage reservoirs many miles off among the hills, and of very limited amount.

The Borough Engineers of England, in charge of sewage works,

formed an association some years since, whose proceedings are published from year to year, and from the papers contributed by engineers of prominence, members of the association, we can quote to almost any extent in entire condemnation of the pail method. Some of them, with a special experience of its working, can scarcely find terms sufficiently strong to express their disapprobation, amounting to *disgust*, of the pail method, even when operated under the best of circumstances; and the evidence is overwhelming that no community will tolerate the pail method if they could be *allowed* the water-closet, which in many places they are denied. In Manchester, with a public water supply, no houses below two hundred and fifty dollars rental are allowed the water-closet, and with varying rates of rental this is the principle established in the manufacturing cities in the north of England; a principle of classification is of questionable applicability in this country.

When, in 1880, Robert Rawlinson, Chief Inspector of the Local Government Board in England, was a royal commissioner to inquire into the sewerage and drainage of Dublin, great efforts having been made in that city to secure the adoption of the pail method by an official recognition of its advantages, after referring to Rochdale in Lancashire "as the locality where this method is best carried out, but at a yearly loss of £10,000 to the tax-payers," he concludes his report as follows:

"In our opinion, the cleanest and cheapest mode of removing excreta will be by water, through closets, drains and sewers to a common outlet. Houses must be drained, streets must be sewered so as to remove waste water, and if these drains and sewers are well and properly constructed *no additional expense need be incurred to transmit the entire volume of excreta from the houses and city*, if it is suspended in the waste water removed from the city through the drains and intercepting sewers to some outlet. The collection of the city excreta by means of movable pans or by the process of (so called) dry conservancy will cause more nuisance and be more costly than water carriage. The nuisance will be greater, because there will be retention of the excreta for a time on the premises, and the cost will be greater by the amount of labor necessary to collect the excreta, and also because there is no practicable mode of converting the excreta into a portable manure which will pay the incidental charges."

We trust enough has been said to show the fallacy of adopting the "pail method" of removing excreta in *cities* or populous districts in

this country, because local circumstances elsewhere may have rendered its adoption a preferable alternative. The characteristics of the locality should always govern the application of *any* system or method, however perfect in the abstract it might appear. The chief argument, that of economy or utilization, utterly fails as applied to our American cities.

EARTH CLOSETS, ETC.

The remaining methods of this system, such as the *ash closet* or the *dry earth closet*, require but a passing notice. The first, which consists in partially deodorizing the contents of the closet by ashes thrown into it whenever convenient, (but the contents not removed until the nuisance created compelled it,) was the intermediate stage between the dung-heap, open privy or midden, (so called,) and its successor, the pail or tub method. It was open to greater objection than the latter, as not admitting of official supervision to the same extent. The neglect of the lower classes to carry out any requirements essential to its inoffensiveness, if, indeed, any such there were, rendered the use of the ash closet offensive beyond expression. The resulting material was worthless for manufacturing into manure, and to cart it in its crude state direct to the land was attended by a cost, and other obvious objections, beyond its value.

The dry earth closet method might properly be as summarily despatched, but as illustrating the tendency of some individuals to seize on new methods of sanitation, and offer highly-wrought specious arguments in their support, unsustained by sufficiently extended experience, we cite the following as a warning to the ambitious sanitarian:

Some twelve or fourteen years since, a young American, now well known by his happy style of writing, adopted this dry earth closet from some English examples of its use, and endorsed it. I quote from his pamphlet, now before me, as follows: "I believe that these advantages, embracing the utilizating of a manure, *worth*, including kitchen and laundry waters, at least $10 per annum for each member of the family, old and young, and the removal of the most fertile source of typhoid fever and dysentery, and the prevention of cholera infection, together with the question of cost, will revolutionize the sewage question; and that public sewers will in future be restricted to the removal of liquid drainage alone." Testimonials, most emphatic and eulogistic in its favor, were obtained and published. The Earth Closet Co. was formed, local offices established, contracts for their

manufacture were entered into with the Colt Manufacturing Co., of Hartford, and agencies for their sale and introduction were established throughout the principal cities of the United States, as a preferable mode to that of the water carriage system for dealing with human excreta in cities, towns, &c.

Setting aside the enormous amount of fresh earth required, (a ton to an individual yearly,) even upon the assumption that it could be used over and over again without endangering health or comfort, and the consequent cost in cities, and the nuisance arising from improper use of the machine, not to say the danger to health thereby resulting, the manurial value of the earth after use proved no better than ordinary garden soil, and so far from a value of $10 per head, its use entailed a cost beyond any value which could be realized by its sale as manure, and it proved a total failure as an economical sanitary measure. It was suited only to isolated dwellings of a class where strict attention to its needs could be enforced, and we hear no more of it as a successful rival to water carriage. The details of this method need not detain us.

Second, a pneumatic system. The first method under this system is Lineur's, as applied in Amsterdam and some few localities in Holland, and is applicable to a dead-flat country, where sewage could not be moved by gravity. It is confined to the movement solely of the contents of water-closets, (without any flushing by water,) by means of their connection direct into iron pipes of small dimensions. A number of such pipes connect with a street main, which in its turn leads to a central reservoir, wherein, by means of the connection of the latter by a pipe with a grand central station, where a vacuum can be had by pump, the material, through the intervention of stops and valves, is sucked, as it were, to the station, where it must be removed by mechanical means, usually for manufacture into manure. Certain barometrical syphon traps between the house pipes and the street mains insure a uniform movement of the contents of closets whatever may be the amount of the material, whether much or little. The method has nothing to do with drainage of any kind, but is confined to the transport of human excreta alone, and is essentially limited in its range, and is attended, in first cost and maintenance, with an increased expense over simpler methods. The same is true of

Shone's method of the pneumatic system, which, in addition to the vacuum in the pipes, adds also a plenum process, by means of what are called "self-acting ejectors," operated by compressed air, supplied

by pumps at a central station, by which their contents are forced to the outfall. The advantages of Shone's method consists in lifting the sewage, at frequent intervals if needs be, to insure better grades in a flat country, or to overcome impediments, to a uniform grade, without thereby increasing the expense of motive power. This method is yet in the experimental stage in one or two towns in England, but has capabilities that it is thought may show to advantage in certain localities. The cost of the maintenance of this method under the severe frosts of our winters, will be a bar to its use on a large scale in northern localities; while elsewhere, the necessity of economy in first cost of works of sewerage will operate against its introduction. Its claim to a saving in the cost of excavation is of but little value, as this is but a small item in most localities. Neither method of the pneumatic system has as yet commended itself to our consideration by economical results attained, and in view of their increased cost we may safely await their more complete development under the fostering care of their designers.

We come now to the mixed system—that of water carriage—which divides itself into two methods, known as the "separate" and the "combined." Each has its merits, and each in the locality suited to its capabilities promises the best results attainable (so far as our present knowledge extends) by the modern system of sewerage. Then it only remains to determine which of these methods, combined or separate, best serves the need of the locality. As the question of sewering and draining a town refers generally to the selection of one of the two methods of this system or to their combination in the same locality, we shall examine them more in detail. The "separate" method, as its name implies, after receiving the house sewage in a pipe sewer (a line of small pipe for this purpose being laid on each side of the street) carries it by gravity to the outfall. The drainage of the yard and roof, as also the subsoil, are conveyed by a separate branch, either to the existing sewers under the centre of the street, or to a line of pipe laid purposely, but distinct from the pipes carrying the house sewage, the complete exclusion of rain water from the house sewage being considered as essential. The rainfall on the street is conveyed by open or covered gutters, connected at proper intervals with the main drain. Thus in a city, where drainage and the removal of the storm water are recognized as a desirable feature, no less than *five* lines of conduit are to be maintained in operation. This in connection with a flushing tank at the head of all the branch sewers, in order to a periodical cleansing of

the dead ends, which are without natural flow, constitutes the complete separate method. When in thinly-settled districts, or when from any cause it is not considered necessary to provide for the surface water on the street, this latter must find its way, after being collected in the gutters, to the drainage outfall of the district, or wait absorption by the soil or air, but the drainage of the roofs and paved yards, even in this case, must be provided for by a line of piping of some kind, and one for each side of the street, unless the streets are narrower than modern practice calls for, in which case a central line of pipe is made to answer the other needs. This method *separates* the sewerage entirely from the drainage of a town.

Some good examples of this method may be seen in some English towns, and it is frequently used in the suburbs of towns for limited areas. The most extended example of this method for an entire city, is shown in Memphis, Tenn., a city of some thirty-five thousand inhabitants, where, after the yellow fever epidemic of 1879, it was considered imperative to introduce some system of sewerage, and abolish the existing shallow privy vaults and cesspools, which rivaled, almost, in their extent and foulness, some foreign examples to which we have referred. These were considered to have contributed to the spread of the disease in that year, and it was but one of over a half dozen similar visitations in former years.

It is stated that the estimates for sewering the city by the combined method, that is to say, sewering and draining the entire territory tributary to the same outfall, was from $800,000 to over $2,000,000, but upon what basis we cannot say, as the smaller sum would have been a liberal estimate for the work required to be done. The estimate under the separate method for sewering alone, was but $225,000, neglecting any provision for surface draining. The funds of the citizens being inadequate to the larger outlay, they very properly, under the emergency upon them, adopted the separate method, which we are told has thus far proved entirely satisfactory. There has been no further outbreak of epidemic, but if the death rate is taken as an evidence of healthfulness, it has not realized the expectations of those who were interested in the work—a death rate as low as twenty per one thousand annually being estimated as the probable result of their labors, (see National Board of Health Bulletin Supplement No. 3, 1880,) whereas the death rate has scarcely been lower than double that amount, or near forty per one thousand (see Sanitarian for November, 1882), a high death rate for this country. The city of Brooklyn, for

the same time, shows but twenty-one per one thousand. With reference to the matter of cost, which will be examined further on, we would remark that notwithstanding the alleged economy in adopting the separate method of extremely small pipes, the expediency of doing so, in view of the complications which may arise in the future growth of towns, now say of ten or twelve thousand population, must be a question, and one which the local sanitarian must seriously consider before deciding in its favor. He must by no means permit his judgment to be influenced by the idea that this use of small pipes, confined to the conveyance of house sewage alone, is a modern invention. In reality it has been largely in use in suburbs in England and on the continent for the last thirty years, but is giving place to the combined method in populous districts, as the cheaper and more efficient. So far from its being "a new departure in engineering to maintain that a six-inch pipe with an inclination of $^1/_{150}$, was large enough to drain two hundred dwellings," as is stated in a late official document emanating from one of the engineers who was engaged in the Memphis sewer location, a very slight acquaintance with the literature of the subject will show that as long ago as 1852, at a time when the ordinary size of even house drains was two feet in width, and no sewer was built less than two or three feet in diameter, avowedly to enable workmen with spade and shovel to enter them as the only method of cleansing them, the general Board of Health reported to Parliament on this subject, wherein it was shown that a pipe of five-inch diameter, with an inclination of $^1/_{153}$, would suffice to drain the house sewage alone from twelve hundred houses.

The use of small pipes was then introduced, and though more efficient than the large brick drains previously in use, their advocacy was carried too far, as most innovations are, but it resulted in the almost universal introduction of small pipes in lieu of large brick sewers, and they now constitute the larger portion of every system of sewerage.

The *combined* method of the water carriage system consists, as we have seen, in simply providing one channel, and but one, for the discharge of the proportion of the storm water which is permitted to enter the basins placed at the street corners to receive it, together with the house sewage, and also the roof and yard water. As all water which enters the house leaves it as sewage, the measure of the latter is, in volume, the water supply. While this method is more costly to construct than is the separate, when the latter is

modified in its outlines to meet cases of emergency, or temporary expediency, as at Memphis, it is not more costly, when the two methods are compared in their entirety, and each developed to the extent of its capabilities, as claimed by their respective advocates.

The separate method has the advantage in this country of a godfather, whereas the "combined" method, being without protecting patents or fatherly interest of any kind from any one, can be cut and carved with impunity by any one calling himself an engineer. Any failures of absolute success in the method are very naturally attributed to the defect inherent in the system itself, whereas, imperfectly designed, it may be, in the first instance, it is very frequently built of inferior material and in disregard of true economy. Under the mismanagement peculiar to our changing city governments it is rather a wonder that the combined method has proved so rarely a failure. It is a *combined* method in more senses than one, as combining in many cases old and antiquated dimensions, as peculiar to the method, while they are not. As an instance, the Fleet street sewer, London, drained four thousand four hundred acres of city area; its outfall was twelve feet by eighteen, with a fall of one in four hundred and eighty. A modern combined sewer would fulfill its purpose in a circle of nine feet diameter.

We have seen that whatever may have been the personal uncleanliness of the common people in past times, and their disregard of ordinary decency in their disposal of domestic sewage, the danger of living on or near undrained land was fully recognized at all times, and the removal of surface water, not only in built-up cities, but even in the temporary camps of the period was dwelt upon by writers as old as the age of Augustus. The drains established for this pupose, some of them of extraordinary dimensions, became, in later days, the natural, even if unauthorized, receptacles for any refuse to be disposed of, including house sewage. What is, in many cases, now called the "combined method" of sewering, was not the result of original designs to that end, but within the days of some of us here, grew out of the application of old and existing works to a new purpose. Hence the failure of some of these hybrid structures when applied to more modern uses should not be taken as a standard by which to judge the system itself, when designed *ab initio* to serve the double purpose of surface drains and sewers, which is its function. Its growing use is an evidence that its double purpose is recognized as a sanitary need.

To properly examine the rival claims of the two methods would

consume much time and require extended illustrations in detail, and I am constrained to confine myself to a brief statement of the salient points of the two methods.

First. The separate method assumes that the removal of the house sewage alone is the first requisite, to which the drainage is secondary and comparatively unimportant.

To this it may be said that it is a common mistake to regard fæcal matter as containing the only foul elements in the composition of town sewage. That it is not even the preponderating source of such impurity is shown in the fact that, as we have previously stated, the chemical analysis of the discharge from the sewers of towns, where the water-closet discharge was *entirely excluded* from the sewers, differs in no essential, in its polluting elements, from the house sewage delivered by the small pipes of the town sewers entirely by the separate method, the collection of stable dung, amounting to one load daily for each quarter of a mile of Regent street, London. And sanitarians, in accordance with the belief which we have hinted at, as having obtained long centuries before any system of sewerage, as such, was thought of, agree in the danger to be feared from a damp soil, whether arising from undrained surface water or stagnant subsoil water, and regard the danger, though possibly less in degree, and less easily traced to its source, as no less *real*, and calling for equally efficient methods of removal.

Second. The sewers of the combined method, it is urged, are so largely in excess in point of area of section or capacity over those of the separate method, that the use of the former as conduits for the flow of the house sewage alone, or what may be called the dry-weather flow, is materially impaired, the depth of flow and consequent velocity being thereby sensibly diminished.

To this it may be said that with the flow reduced to the house sewage, in either case the same volume of liquid, will, in the smaller pipes of the separate system, (under the same inclination,) give a greater depth and velocity than it would have in the larger channels of the combined method, and so obstruction would be more likely to occur in the latter than in the former. But the difference in practice is much less marked than is commonly supposed, for in any modern example of the combined method a large percentage of the sewers are pipes, and in the branches, where the flow is limited in volume, pipes of small diameter, (differing but little, in their hydraulic radius, from the pipes of the separate method,) are invariably used. Thus in

Chicago, with three hundred and sixty-two miles of sewers, which are on the combined method, forty-four per cent., or one hundred and fifty-eight miles, are of vitrified pipes, and seventy per cent., or two hundred and fifty-two miles, are two feet or less in diameter; and in Brooklyn, of three hundred miles of sewers, eighty per cent., or two hundred and forty miles, are of pipes of eighteen inches or less in diameter. The obvious and inexpensive modes of clearing the sewers, either by temporary dams, city water supply, movable wagon tanks or other means of producing a temporary increase in velocity, above an obstruction, leave nothing to be desired on the score of efficiency or economy. The last year's report in Chicago shows the expense of preserving their entire system free of obstructions, to have been but one and eight-tenths cents per lineal foot. If the authorities are so disposed, the pipes of the combined method could be flushed *daily* by the flushing tank method, which is said to work so well in Memphis, and the combined flush from all the branches would give ample volume of water to sweep the main brick sewers.

Then there is the method of cleansing sewers by means of what is called a "pill," being a ball say two inches less in diameter than that of the sewer, which is put in at a manhole, and being driven along by the force of the water until an obstruction is met, when the ball becomes a dam, and the water escaping under and around the ball rapidly loosens up the material and sweeps it along the sewers followed by the ball. This method, according to Mr. Fowler, the engineer of New Haven, is completely satisfactory in that city, and the cost of preserving the entire system of sewers free of deposit is a little over one cent (1.08) per lineal foot yearly. Again, there is no difficulty whatever in furnishing a channel in the larger sewers which will concentrate the low flow into a section of precisely the same area and boundary as obtain in the pipes of the separate method. This is known as the *cuvette* or *cunette*, (either word is used,) and resembles the lower half of a pipe built into the brickwork, which, while furnishing no impediment to the storm water flow, concentrates the ordinary dry flow into a narrow channel. While its uses have been satisfactory the necessity for it has not been considered sufficient to justify even the slightly additional labor expended in its construction.

Third. The small sewers of the separate method are claimed to be more easily cleaned than the larger dimensions of the combined, by the process of flushing, which consists in the sudden application of a large volume of water with a velocity which sweeps away any obstacles.

It is scarcely credible to state the nature of the substances which no possible supervision is found adequate to keep out of the sewers. The fact must be recognized that nothing which can, by any device, get into them, and many things which it would be supposed were impossible, do find a lodgment at times in city sewers and form the nucleus of obstruction. As obstructions are found mostly on the branch sewers, from the limited amount of liquid there furnished, what are called flushing tanks are built at Memphis, holding each about a hundred gallons, at the end of all the branch sewers, which automatically empty themselves daily, and sometimes oftener, and passing into the small six-inch pipes fill the lower half and assist very materially the flow of the house sewage; and if need be, the city water supply may be readily turned into these tanks, thus tending to remove anything movable by water. If, instead of these small pipes, larger ones for rain had been built on the same grade, and with their bottom shaped like those of the small pipe, (cunette,) the same quantity of water, applied in the same manner, would produce a precisely similar effect. As the upper branches of the combined method are, as we have stated elsewhere, now universally of twelve-inch pipe, neither of the methods possesses any advantages one over the other in the ability to remove obstructions by flushing. Nor must the value of the rainfall be lost sight of in the combined method as a powerful means at times for sweeping away and thoroughly cleansing the entire system of pipes and sewers in a manner unapproachable by anything which the separate method has to offer.

Where the obstruction resists the flushing process, the combined method by its dimensions, offers great facilities of access, whereas, in the separate, (if built without manholes, as at Memphis,) the street must be ripped up and the sewer broken into.

Fourth. It is alleged that the large sewers generate and contain a greater quantity of noxious gas than do smaller ones, and are not so easily ventilated.

We know but little of the method of generation of the gases or vapors of sewers. It might be supposed that the greater area of the larger sewers would favor the generation of more gas, but it might be remembered also that the cubical contents of sewers increase faster than do their areas. The surface in a four-foot sewer is to be four times as great as is that of twelve inches diameter, but its area is sixteen times as great; from this we might infer that with any circulation of air in the sewer, the larger one would be nearer the condition of the external air, and experience seems to confirm this fact. With respect, however, to the effect of this in dwellings, the quantity of gas in a sewer is of no consequence; it is the degree of concentration which is important. And in this respect large sewers have, it would appear, the advantage over smaller ones. Experience has not verified the claim that the smaller sewers are easier ventilated than the larger. With the main house drain untrapped, (and open to the roof,) as is entirely admissible in good workmanship, it would be easy to ventilate efficiently sewers of any size through the house pipes, since the combined area of the latter is many times greater than that of the sewer. But if it be considered more important that the house pipes be properly ventilated, as is the prevailing opinion, then with a water trap on the main drain it would be independent of the method which might prevail in the dimensions of the sewers themselves, whether small or great.

Fifth. The relative expense of the two methods is claimed as largely in favor of the separate method, as applicable to localities which would otherwise be debarred from the benefits of the water carriage system.

This to a certain extent is the fact, but it must be taken with some qualifications.

The first cost of a method of sewering, if confined to the bare purpose of removing the house sewage, will, if modified to suit exceptionable conditions, as we have previously stated, cost less than a method which at the same time aims to drain a portion of the storm waters from the streets, with the droppings of animals and other street refuse, together with all the water of back yards and roofs. That is to say, if a single pipe of six inches be laid in the centre of the street for the sewage of both sides (as at Memphis), otherwise, not.

The first twenty miles of the sewers laid in Memphis, it is said, cost $1.30 per foot, but at least thirty cents per foot were saved by omitting any manholes in the street, a saving as it has since appeared of questionable expediency, as we learn that it has since been found necessary to introduce them. Hence, an estimate of at least $1.50 per foot would be within the actual cost. There being very few cellars in Memphis, or structures below the level of the street, which ordinarily would be required, the drainage from the yards and roofs, which this method imperatively forbids, into the sewage pipes, must be otherwise provided for, and could not be had at less than $1 per foot. This makes the separate method without any street drainage whatever, to cost at least $2.50 per foot, or one-sixth less than the cost of the

combined method in Chicago, which was $3 per foot, including fixtures and every attendant expense, the sizes of sewers ranging from one foot in diameter to nine feet. The extension in Chicago the last year shows the cost of twelve-inch pipe as $1.14 per foot, the fifteen-inch, $1.33 per foot, the eighteen-inch, $1.88 and the two-foot, $2.08 per foot. These three sizes would probably be ordinarily used in a separate method but with a larger proportion of small pipe.

The cause for no greater saving being shown in the separate method grows out of the fact that there are many items of cost in sewer construction which do not decrease with the size of the pipe used, such as superintendent, office expenses, sheeting, trench excavation, pumping from foundations, repairs to roadway, &c., and as the cost of excavation increases owing to quicksand or other material difficult to manage, this disproportion in price may become insignificant. Thus sewering alone might prove as expensive in first cost by the separate method as would sewering and draining by the combined, and in addition, the maintenance of the separate method would be more costly than the combined in a northern climate.

Sixth. Rain water in excess is claimed by the advocates of the separate method to be seldom more than inconvenient, and at most places can properly be allowed to flow off over the surface of the ground as it did before the introduction of sewers.

While we considert his argument to have been met by hinting at the well-known injurious effects of stagnant water upon human health and life, we can add that precisely the same sort of reasoning would apply to the sewage itself before the introduction of sewerage works.

Seventh. Where it is absolutely necessary to remove rain water, as well as sewage, by underground conduits, it still may be effected more efficiently, it is claimed, by having separate channels of discharge, and a superior efficiency had by a slightly increased cost.

To effect precisely the same purpose as the combined method, the separate will cost nearly one-half more, and their superior efficiency is not apparent, while there are many objections in the maintenance of so many lines in working order. The liability of misuse of the several pipes by wrong connections designedly effected to save cost, has often taken place in England and would be still more likely to occur here. As to maintaining that nothing can get into these small pipes which they are unable to discharge, the fact remains that they do become choked through ignorance or carelessness, to an extent sufficient to give constant employment to special workmen.

Eighth. Increased facility is claimed for the separate method where pumping, or a treatment of the crude sewage for manufacture of manure becomes necessary.

Where cellars are of necessity below the level of the street sewers, and pumping must be resorted to in order to drain them; the less the volume to be pumped the cheaper will be the process, without doubt. But as to the further utilization of the sewage, it is to be presumed that the capacity for rain water, which the large conduits of the combined method possess, need not be availed of throughout their entire extent, as by a system of penstocks and storm overflows heavy storms may be diverted to the water-courses, and little more than the ordinary flow of the town sewers at such times need be led to the manufacturing works to be dealt with for manure.

I have thus briefly sketched the salient points of the two methods of the water carriage system, with the claims made by the advocates of the separate method for universal applicability, and the counter arguments in support of the combined method. It could be wished that a more complete analysis of the respective methods had been presented. But the subject more in detail has been well treated by Mr. Elliot C. Clarke, engineer of the Boston sewer department, in the second annual report of the Massachusetts State Board of Health, Lunacy and Charity, Supplement, 1880, to which I would respectfully refer you as a most exhaustive article on the water carriage system, which shows very satisfactorily, as I think, the benefits to be derived from the combined method for populous districts, with the exception, however, that he allows a greater dimension and consequent cost for storm water sewers, than modern practice would probably call for. Justice requires me to add, that to this paper of Mr. Clarke's a reply has been made by Col. Geo. E. Waring, who projected the Memphis sewer system, and published in the March and April Nos. of the American Architect for 1882. For the rest, permit me to call your attention to the report of Mr. Rudolph Hering (who occupies the first rank as a sanitary engineer in this country), made to, and published by the National Board of Health, December, 1881, Bulletin, Supplement No. 16, wherein after a clear and concise review of the works of sewerage in European cities, he so illustrates the working of each as to enable us to sum up the conditions under which each of the methods which we have considered of the water carriage system, is properly applicable; and they may be condensed as follows:

The *combined* is suitable—

First. When rain water must be carried off underground from extensive districts, especially when they are closely built up as in large cities, and where new sewers must be built for this purpose.

Second. Where purification is not required, or is not difficult, and storm water overflows are not objectionable in polluting the streams.

Third. When a sufficient amount of water or sewage is available for flushing the larger sewers.

The *separate* method is suitable—

First. Where rain water does not require extensive underground removal, and can be concentrated in a few channels slightly below the surface, or where it can safely be made to flow off entirely on the surface. Such conditions are found in rural districts where the population is scattered, or small, or at least in short drainage areas, and on steep slopes or side hills.

Second. Where an existing system of old sewers which cannot be made available for the proper conveyance of sewage can yet be used for storm water removal.

Third. Where purification is expensive, and where the river or creek is so small that even diluted sewage from storm water overflows would become objectionable, especially when the water is to be used for domestic purposes at no great distance below the town.

Fourth. Where pumping the sewage is found too expensive to admit of the increased quantity from intercepting sewers during rains, which can occur in very low and flat districts.

Fifth. Where it is necessary to build a system of sewers for house drainage with the least possible cost and delay, and the underground rain water removal, if at all necessary, can be postponed.

In selecting a system or method, in addition to the first cost, there must arise the usually embarrassing question, Where shall the outfall of the public sewers be located? In answering this question neighboring towns as well as individuals must be consulted, or an item for damages might otherwise arise. This question of the disposal of sewage, in which health and comfort are balanced against cost, is before many of our towns to-day. When we recollect that there are some six hundred towns in our country provided with public water supply, and at least *four*-fifths of them as yet without any system of sewerage or drainage, it will be seen that the final disposal of town sewage, in a manner, so as to avoid the pollution of the watercourses or sources from whence the domestic water supply is derived, is becoming a matter for grave consideration on the part of sanitarians. The vexed "sewage question" we have read and heard much of, while its solution was of but general interest, but the rapid improvements in our own country are bringing it home to our doors as a question of individual as of national importance. We thus need to consider

The treatment of sewage called utilization.

Before examining this, we would remark that the average amount of human excreta may be stated as 120 gallons, or 16 cubic feet yearly —.044 cubic feet daily, and estimated to weigh 2.8 pounds. If the water supply be 20 gallons per head—2.66 cubic feet daily—this is sixty times the bulk of the human sewage, or combined, may be stated as 2.7 cubic feet. The excreta alone from an individual has been variously estimated, as in a manurial point of view, worth from $1.25 to $2.60 yearly of the population. As the water which enters a house leaves it as sewage, our greater water supply, (as well as rainfall,) renders our domestic sewage in bulk about one-half as valuable as that of English towns, six-sevenths of which is in solution, or about one cent per ton, (Seventh Annual Report Mass. State Board of Health, 1876.) It is estimated that it takes two thousand four hundred tons to equal analytically one ton of guano.

Where sewage can be cast into the sea or tidal river without the danger of returning upon the shores, or attended with any other unsanitary condition, experience fully indicates that this is the best possible disposal of it; though simple as it appears, it is sometimes attended with difficulties, which add very greatly to the expense. But no presumed theoretical value in the elements which go to form sewage should induce a town or city thus circumstanced to attempt as a commercial undertaking its utilization, either by putting it crude upon farm lands in the neighborhood, or manufacturing it into dry manure for transportation. But where the district is situated upon inland waters, and the summer or low flow of the stream is less daily than twenty times the daily volume of the sewage, the latter estimated as not less than the artificial water supply during the same interval, or where periodical impediments exist to the uninterrupted flow of the stream into which the sewage is cast, such as dams, ponds, &c., and the sewage is retained for a time on its shores to breed pestilence; or when the district is wholly inland without living streams of any magnitude in its vicinity, the ultimate disposal of the sewage without endangering the health of the people, becomes a matter of grave consideration. Some process must be resorted to by which it

may be rendered harmless, called utilization, not in hopes of a profit to the town, but to be effected at the least possible additional expense to the tax-payers. This is the best result to be hoped for, (in our present knowledge of the subject,) and to this end several methods are in use.

These methods are precipitation, irrigation and filtration.

Precipitation. This consists in receiving the crude sewage at the outfall into tanks, and by adding some chemical ingredients, the solids held in suspension are precipitated, and the effluent liquid, more or less clarified and deodorized, is allowed to escape into the streams. What is called the "sludge," of the consistency of thick mud, remaining at the bottom of the tanks, is raised by various methods, and either by the application of heat or machinery is dried and disposed of as manure, but is ordinarily not so valuable as to command any ready sale. This sludge sometimes accumulates in such quantities as to necessitate the purchase of land with a view to its *burial.* In Birmingham, with a discharge from the town of twelve million gallons of sewage daily, and the use of thirteen tons of lime, the daily amount of sludge on their hands is not less than four hundred tons. Neither is the effluent water in all cases more than clarified, without being purified, and soon becomes more or less offensive. Under favorable conditions as to subsequent dilution in running streams, the process has in individual cases been moderately successful in a sanitary point of view, and at no great cost. The hope thus held out of final success, has resulted in innumerable patents being taken out for treatment of sewage by precipitation, among which the following may be named:

The A. B. C. process, so called from the initials of the ingredients used in the precipitation, alum, blood and clay; the phosphate sewage process consists in the use of alumina and lime; Bird's process uses what is called sulphated clay; Stethart's process, lime, sulphate of alumina, sulphate of zinc and charcoal; Hille's process, lime, tar and salts of magnesium; Marsdens & Collin's process, lime, carbon from the manufacture of prussiate of potash, ashes, soda and perchloride of iron; Holden's process, lime, sulphate of iron and coal dust used under certain modifications, in deodorizing the sewage of one of our extensive summer hotels on the coast of Long Island; Fulda's process, of lime and suphate of soda; Blythe's process, superphosphate of lime with magnesia and lime; Whitehead's process, dicalcic and monocalcic phosphate and milk of lime; Campbell's process, phosphate of lime and lime added; Hansen's process, lime, black ash and red hematite, treated with sulphuric acid; Goodall's process, lime, animal charcoal, ashes and sesqui-persulphate of iron. The lime process alone has been in use forty years or more. It offers economy in first cost, but it cannot be considered as successful, the resulting sludge accumulating in such quantities for lack of a demand by the farmers that its disposal adds much to the expense. Scott's process, by which this sludge is manufactured into cement, is well spoken of; other processes, such as Higgs', Dale's, Demsdale, Leuk, all *promise* success enough on a small scale, to encourage the patentees, but invariably, when extended, have resulted alike in failure. All these precipitation processes do, to a certain extent, purify the sewage or clarify it, chiefly by removing the suspended matter from the sewage; but they all leave a very large amount of putrescible matter in the effluent water. At least all the ammonia contained in the sewage is carried off in the effluent fluid, and sometimes the quantity is increased. The resulting manure that they produce from the sludge is in every case very inferior, as the valuable constituent of sewage consists mainly in the ammonia, which is lost to the solid manure, showing the futility of the attempts to utilize sewage by precipitation alone.

Irrigation. This, it is stated, has produced good results. In Edinburgh, some two hundred years since, the simple process of irrigating the meadows of Craigentinny by crude sewage was undertaken. It still continues there after a long interval during which it was disused, without much change in the process, and with no more favorable results to the city treasury.

The average results from a large number of towns show that owing to the necessity of leaving the land to recover itself after being drenched with sewage, (but the flow of sewage meanwhile being unintermittent,) some three hundred and sixty acres are needed for every million of gallons daily of sewage. The cost of the operation is largely increased by the high value of land in England, and hence, scarcely a guide for us on the score of expense. The process now consists in preparing the land by disposing the surface at short intervals into ridges and furrows, with such precautions as regards levels that the sewage being led by the main conduit and branches (sometimes open trenches,) over the surface, will nourish the roots of the plants, then drain off to the outfall discharging into some stream. Even dry sand beaches have returned good crops by this treatment; and though bad smells

are reported as rife, thus far it does not appear to be attended with any danger to health. Below Paris, at Gennevilliers, where the irrigation by means of some ten or twelve million gallons of Paris sewage daily over some twelve hundred acres is now carried on, a village, acccording to Mr. Hering's report, has sprung up in the midst of the irrigation field, the death rate showing as low as 19.5 per one thousand of the population. Additional land is being taken in yearly and the works extending, not without remonstrance, however, from residents in the neighborhood, who declare it a nuisance every way.

Filtration alone has in all cases been abandoned, but more recently what is known as *intermittent downward filtration* is claiming attention, which consists in preparing the ground, which in the first place must be of suitable character and favorably situated, by deep underdraining, say not *less* than six feet, and passing the sewage both over and *through* the land intermittently, that is, allowing certain areas time to aërate and recover themselves before a renewal of the operation. The claim is that by this process a much less extent of ground, say twenty to twenty-five acres per million gallons of sewage daily, will suffice for purifying the sewage. The precise benefit over the method of broad irrigation is not yet determined, and except under favorable circumstances its advantage over the other has been seriously questioned. It has been proposed to use this method in connection with broad irrigation.

The value of these several processes is reported upon by "the Executive Committee of the Society of Arts [England,] conference," as follows:

"With regard to the various processes based upon subsidences, precipitation or filtration, it is evident that by some of them a sufficiently purified effluent can be produced for discharges without injurious result, into water-courses and rivers of sufficient magnitude for its considerable dilution; and that for many towns, where land is not readily obtainable at a moderate price, these particular processes afford the most suitable means of disposing of water-carried sewage. It appears further that the sludge, in a manurial point of view, is of low and uncertain commercial value; that the cost of its conversion into a soluble manure will preclude the attainment of any adequate return on the outlay and working expenses connected therewith, and that means must therefore be used for getting rid of it without reference to possible profit," and fnrther: "In certain localities where land at a reasonable price can be procured, with favorable gradients, with soil of a suitable quality and in sufficient quantity, a sewage farm, if properly conducted, is apparently the best method of disposing of water carriage sewage. It is essential, however, to bear in mind that *a profit should not be looked for by the locality establishing the sewage farm, and only a very moderate one to the farmer.*"

In addition to the above method of sewage disposal, we may add a word as to the effect of casting it into the sea; regarding this as an obvious method on the long eastern coast of this state, but one which may ultimately prove embarrassing to some of the fashionable resorts there growing up, unless the proprietors are willing to put their hands into their pockets and pay for the cleanliness that is akin to godliness. This coast, open to the full sweep of winds from the ocean, and the absence, save in a restricted sense, of any literal off-shore current, will render the final disposal of crude sewage a matter of some difficulty, as being sure of being thrown back upon the shore. With the open sea before them, and apparently exempt from the consideration of sewage as requiring purification before throwing it away, the evidence of this necessity will be likely to be received with great unwillingness at first. Yet it may be considered *certain* that this evidence of the necessity of such a measure will accumulate to such an extent that some means for the classification of the sewage, at least to the degree of rendering its subsequent dilution by sea water a sufficiently sanitary measure, will undoubtedly prevail earlier or later. Some form of precipitation will be resorted to, the effluent water temporarily deodorized, but undoubtedly putrescible, being discharged periodically at a distance from the shore and at certain states of the tide, and the sludge removed by boats, or otherwise disposed of as it best may be.

The same or similar methods may be resorted to on rivers whose waters serve at the same time for domestic use further down stream: but the process of purification must be carried further than that indicated above, to the extent of purifying and deodorizing the effluent water before discharging it into the river; this may be effected by some of the processes of irrigation or intermittent downward filtration, which have been shown to be efficient to that end in a sanitary point of view, *but at a cost.* This cost is dependent upon the circumstances of the case, and we have as yet in this country too little experience of our own to determine beforehand. We may confidently expect, however, that the volume of our rivers, our less crowded

areas, the consequent reduced value of land for sewage farms, the comparative freedom from fogs, and long-continued dampness of atmosphere, retarding evaporation, and the greater prevalence of bright sunshine, all the favorable attendant circumstances, indeed, except the one of greater severity in our winter climate, are calculated to reduce the expense attendant upon the final disposal of sewage from our inland towns, in comparison with the experience in England; the average cost there, by irrigation, being stated at about $39 for every million of gallons of sewage treated daily, that is, over and above any receipts for sale of manure or the sale of resulting crops.

Brooklyn, December, 1882.

THE DISPOSAL OF TOWN SEWAGE.

BY PROF. CHARLES McMILLAN, C. E., PRINCETON.

Projects for the disposal of sewage belong to one of two general classes, viz.:

First. Schemes for wasting the sewage, and

Second. Schemes for purifying it and utilizing its fertilizing ingredients, in whole or in part.

It is to the former class that your attention is particularly invited. Schemes for wasting sewage, especially when executed on a large scale and under suitable conditions, are, unquestionably, the least expensive. They are usually adopted because of the nearness of a very large body of moving water, which may serve at once as a diluent of the foul matters discharged into it, and as a natural vehicle for their speedy removal beyond the limits of the town or other settlement where they originate. The easy access to such a body of water is, of course, an essential condition for the successful prosecution of such a scheme.

Towns thus situated are particularly fortunate in having at hand so inexpensive a mode of getting rid of their wastes; and even small settlements, if not too straggling, may find it profitable to consider whether systematic sewerage, under such circumstances, would not be more satisfactory, in every way, than the usual expedients adopted in such places. But, on the other hand, it should be remembered that while the pecuniary advantages of wasting sewage into streams are often very great, a corresponding degree of caution must be observed in resorting to this mode of sewage disposal, and proper attention should be given to the sanitary questions which are involved, whose satisfactory solution should, in every case, precede the adoption of such a scheme. These questions relate to the degree of pollution which the sewage will produce in the stream, especially during periods of low

water, and to the consequent possible invasion of the rights of communities or individuals dwelling below the points of sewage discharge.

It must be acknowledged, however, that this general inquiry does not usually admit of a satisfactory answer. The degree to which it is safe to pollute fresh-water streams is as yet little understood. Neither our own practice nor the experience of European engineers, nor yet the important work already accomplished by the Rivers Pollution Commissions of Great Britain throws sufficient light on the subject to raise it above a tentative level. This should not be a cause of surprise when the intricacy of the problem is considered, the variableness of its elements, and the meagreness of our information regarding those very facts which would naturally constitute the known or given quantities of such investigations. Some eminent authorities, after inquiries conducted under circumstances especially favorable as regards the means and talent at command, have declared it to be their opinion that water that has been once contaminated by sewage or manure matter is henceforth unsuitable for domestic use. Many practitioners, however, while acknowledging the great danger lying in the presence of even very minute quantities of *crude sewage* in potable water, lay more stress than the authorities whose opinion has been quoted on the self-purification of streams, especially through the destructive agency of free oxygen and of aquatic plants, and are therefore disposed to regard the above sweeping condemnation of sewage-tainted waters as too broad an inference from a limited range of observations.

It is true that a scheme for discharging sewage into a river whose volume, even at low stages, is vastly in excess of that of the impure liquid that it receives, is not burdened with much perplexity.

But such cases, as we all know, are the exceptions. Their freedom from complications of a sanitary nature, so far as sewage disposal is concerned, usually renders them, in that one feature, neither objects of concern to sanitarians nor, I may add, the most fruitful sources of the incentives to an active investigation of the important questions relating to the conservancy of streams. It is generally the smaller streams of the more densely populated portions of a country which, when made the receptacles of filth, compel attention to the necessity of greater cleanliness in this respect, through their assaults on the senses and on human interests to the extent even of affecting life itself.

It is unnecessary to enter into an enumeration of the reasons for the protection of fresh-water streams from pollution. They are so generally recognized as to need no repetition here. The time which

might thus be occupied will, therefore, be devoted to the more important purpose of endeavoring to reach a proper understanding as to the manner in which the expediency of temporarily using any stream as a receptacle for sewage may be approximately determined. I say *temporarily*, because an increase of population must sooner or later disturb the basis on which every such project is founded and necessitate, in some measure, the diversion of the sewage to filter beds or other means of purification as a preliminary to admitting the sewage effluents to natural watercourses.

The British enactments for preventing the pollution of rivers prohibit the discharge into streams of all sewage that has not previously been raised to a given degree of purity. The standard required by them is an arbitrary one, and is applied to all fresh-water streams alike, without regard to their natural purity, size or any other varying conditions. Moreover, a strict compliance with the requirements "appears to be construed into its being necessary to deal with the sewage on land, so that those towns which are so situated as to be unable to dispose of their sewage on land have no means of attaining certificates that they were dealing with their sewage efficiently."* These reasons and others, prominent among which is the friction caused by a failure to apply the law uniformly and simultaneously to all the settlements of a given drainage district instead of to isolated towns, seem to have caused the decree of the Rivers Pollution Commission, especially in their earlier applications, to fall short of securing even a moderate share of the advantages which were expected from their promulgation.

Some of the difficulties are set forth by Dr. Wallace in a lecture before the town authorities of Glasgow. He says: "In the case of a number of towns, such as Birmingham, Bradford and Leeds, the purified sewage is incomparably purer than the grossly-polluted streams into which it flows. These and many other towns are subjected to the manifest injustice of being compelled, under heavy penalties, to render their sewage clear, inodorous and almost perfectly colorless before discharging it into rivers or streams, which are often, as in the case of the Bradford Beek, literally common sewers of the foulest description. The inhabitants of these towns complain, and with good reason, that in the upper reaches of the rivers wholesale pollution is permitted, while they have been put to great expense in order to accom-

* "Sewage Disposal," by Henry Robinson, C. E., London, 1880.

plish a purification, the effects of which are swallowed up in the filth of other towns over which they have no control." This was uttered only three years ago.

Now, while I have no kind of doubt that the strict rule adopted by the English will ultimately be found, from a sanitary point of view, to have been a great blessing to the entire kingdom; and while it may be, although I am inclined to doubt it, that uniformity of standard is calculated to furnish sanitary authorities with the most practical basis of control of these matters in a country whose population is as dense as that of England, and many of whose rivers have been so long and so greatly befouled, I cannot help viewing the total exclusion of crude sewage from the streams of Great Britain by the proposed enforcement, under every variety of circumstances, of a fixed and high standard of purity for sewage effluents, as a somewhat hasty and oppressive expedient for accomplishing a beneficent end. The opinions of those who have recommended this measure are very properly esteemed of great weight, and yet it may be fairly questioned whether a plan quite as efficient and less burdensome to the public than that adopted might not have been reached by endeavoring to provide for a more gradual restoration of the purity of the streams, by beginning the cleansing process near the sources of the streams instead of at points nearer tide water, and by solving each case of pollution by the sewage of a settlement in the light of its particular surroundings, and its bearings on the welfare of lower neighborhoods, instead of regulating all cases by a fixed rule and standard. The framers of the Rivers Pollution Prevention Act of 1876, seem to have realized the hardships with which the total exclusion of crude sewage from streams would bear on communities already provided with extensive sewer systems delivering into streams, and have drawn a very marked distinction between old works and new ones, and in favor of the former, by a clause which, singularly enough, as Mr. Robinson says, has caused the act to be practically inoperative.

But even should the present mode of dealing with this question in England be admitted to be the best for that country, it does not necessarily follow that it is equally as suitable for others. The limited area of England, the denseness of her population and the long neglect of her rivers, which has made some of them literally open sewers, are, unquestionably, the important causes that have made the conservancy of British streams a vital question. And it may be that the accumulated evils arising from these causes call for immediate and

heroic remedies. But in a larger country less densely inhabited than England, and possessing a different climate, the conservancy of its streams may readily become, under such different conditions, a problem of much less gravity, wherein considerations of economy might be allowed a reasonable weight without endangering human life, and whose solution, therefore, would admit of a more liberal and comprehensive treatment with regard to *all* the interests involved.

In our own country all the conditions are so very different from those existing in England that the purity of our streams has not yet become, except in a few localities, a matter of great concern. It is, nevertheless, a very important and a growing question, which year by year, as one stream after another becomes tainted, will force itself more pressingly on our attention. There is no escape from it. And it were therefore wise in our authorities to institute, through the agency of properly constituted commissions, early and systematic inquiries into the whole subject, with the view of being prepared to regulate the admission of impurities into streams. It is believed that the conclusions from such inquiries in this country will differ very materially from those reached by the British commissioners, especially in regard to the necessity in the immediate future of excluding crude sewage from streams.

But now the question may be asked, How is a reasonable degree of purity to be maintained in our streams if the exclusion of crude sewage from them is not to be regarded, as it is in England, as the very key to the solution of the problem? The answer is: By regulating the discharge of crude sewage, in every case, to suit the capacity of the receiving stream in such wise as not to raise the impurity of the latter, at a stated distance below the outfalls of the sewers, beyond a limit to be determined by the nearness of settlements, by the natural condition of the stream and its powers of self-purification. It is believed that a careful observance of this rule will in almost every case lead to a practical and not unfair solution of the question. Thus, it may be found that in one case it is unsafe to cast any crude sewage into the stream, and therefore that resort must be had to cleansing processes; in another, that a partial delivery of crude sewage is admissible; or, as in the case of our large rivers, that it is perfectly expedient for a considerable period of time to resort to the stream for sewage disposal. However, the investigation of any particular case should be a guarded one, for reasons given further on; and it should also be remembered that the tendency to practice economy at th

expense of our neighbors operates, unfortunately, with especial force in problems of this kind, and that the menace to other neighborhoods arising from a selfish economy or from errors of judgment, may be a very grave one.

On the other hand, I believe that while such investigations need not and cannot be pressed to the point of absolute certainty, they will have been conscientiously carried out when the possibility of injuriously defiling the waters used by neighboring settlements shall have been reduced to a very remote contingency.

The rule which I have advanced is based on the assumed power of self-purification of running water. We have, unfortunately, but little specific information on this point, but that which has been gathered indicates, unmistakably, that all streams have, in a greater or lesser degree, the power of converting organic impurities into harmless compounds. The Rivers Pollution Commission gives a *résumé* of their observations on the point in question in their report of 1874, the practical deduction from which is that, while the destruction of organic matter does go on in sewage-laden streams, the process is nevertheless a very slow one. Their observations of this phenomenon in natural streams are not recorded in a form which would be available for use in this paper; but the general conclusion from a laboratory experiment of the commission* is that, at a mean temperature of 68° Fahr., a given volume of sewage diluted with twenty times its bulk of fresh water would lose at the utmost about two-thirds of its organic impurities in a run of one hundred and sixty-eight miles at the rate of one mile per hour, or in about a week. These experiments have been deemed important because they were purposely restricted to a given mixture of sewage and clean water, in order to remove all uncertainty from the "variability of the composition of the river waters at different times of the day," and also because of their results which have been so widely quoted. The agitation of the mixture while conducting the test was more favorable to its thorough aeration than that which would usually arise from the natural movement of streams;

*"Water and Water Supply," by Professor W. H. Carfield—Van Nostrand's Science Series, 1875.

A mixture of London sewage and clean water having, after mixing, .267 parts of organic carbon and .081 of organic nitrogen in one hundred thousand parts of the mixture, was thoroughly exposed to the atmosphere and agitated by being syphoned from one vessel to another, falling each time through three feet of air. At the end of ninety-six hours the mixture was found to contain .250 parts of organic carbon and .058 of organic nitrogen; and after one hundred and ninety-two hours, .2 of organic carbon and .054 of organic nitrogen.

and this advantage may possibly have compensated for the lack of any cleansing agency akin to that of aquatic plants, which are believed to play no inconsiderable part in the destruction of the organic constituents of water. Whether there was any such compensation is very uncertain and, therefore, in deducing a general inference from the experiments, our conclusions may be somewhat in error from being based solely on the effects of the reducing agencies employed, viz., the free oxygen held in solution by the water and the atmosphere.

The thoroughness and rate of oxidation of a given quantity of organic matter in liquid form will very probably be in a direct proportion to the volume of fresh water used for its dilution; that is to say, if the amount of fresh water be doubled, the rate of cleansing a given bulk of sewage will probably be twice as great as it was before, and so on.

It is natural to suppose that the oxidation of the sewage will progress more rapidly as the time of its exposure to the effects of the clean water increases, for, the amount of organic matter will be constantly diminishing while the volume of the stream remains constant, and its store of free oxygen is all the time being replenished from the atmosphere. A theoretical consideration of the actual conditions seems to indicate that the average rate of oxidation, in different times, varies according to a law which is rather too unwieldy for use in a computation which is only after all a rough approximation. I have, therefore, assumed the rate to vary in the simpler ratio of the squares of the times. This will lead to some error, but inasmuch as our computation will have to progress from small degrees of dilution to higher ones, the errors will be on the safe side, as they should be.

The results are shown in the first two columns of the following table. The third column will be explained further on. (See page 108.)

TABLE NO. 1.

Degree of dilution of sewage.	Times required for cleansing.	
1 part of sewage to 30 parts of water.	168 hours.	[168]
1 " " 40 " "	145 "	[139]
1 " " 50 " "	130 "	[119]
1 " " 100 " "	92 "	[75]
1 " " 200 " "	65 "	[48]
1 " " 300 " "	53 "	[36]
1 " " 400 " "	46 "	[30]
1 " " 500 " "	41 "	[26]
1 " " 1000 " "	29 "	[16]

If this table is at all a fair inference from the data referred to, it would indicate that a stream flowing at the rate of one mile per hour, which received $^1/_{1000}$ part of its own volume of sewage, would have to run twenty-nine miles before it would regain its normal purity.

An example bearing on the same point is derived from the condition of the Seine below Paris. The total discharge of the sewers of that city is about one hundred cubic feet per second. About one-sixth of this is diverted to the sewage farm at Gennevilliers, leaving about eighty-three cubic feet per second to be discharged into the river. The volume of the river is reported by D'Aubuisson as being about four thousand six hundred cubic feet per second; hence the sewage is diluted with about fifty-five times its own bulk. Now at a point about fifty miles below Paris the river is stated to be perfectly clear and in a normal state of purity, or, to use the words of my authority, chemically pure. If this be true—and there seems to be no reason to doubt it—it would seem that for a dilution of fifty-five, or, inverting the terms, for a degree of pollution of $^1/_{55}$, a thorough cleansing is accomplished in a run of about fifty miles at the rate of a little over two miles an hour, or in about twenty-five hours.

Using these data as we did those of the experiment already considered we have the following table:

TABLE NO. 2.

Degree of dilution of sewage.	Cleansing run at the rate of two miles per hour.	Time required for cleansing.
1.30	68 miles.	34 hours.
1.40	59 "	29½ "
1.50	52 "	26 "
1.100	37 "	18½ "
1.200	26 "	13 "
1.300	22 "	11 "
1.400	18½ "	9¼ "
1.500	16½ "	8¼ "
1.1000	12 "	6 "

A particular feature in the case of the Seine, which very probably contributes considerably to the purification of that river, is that both the banks and bottom of the middle ground of the polluted reach of the stream are occupied by a very luxuriant vegetation. Now, when the efficacy of aquatic plants in preserving the purity of water in

aquaria is remembered, it should not be surprising to find a marked difference in the results of the two cases quoted; although we would scarcely be prepared to look for so great a divergence as that indicated by corresponding numbers in the tables.

The contrast between these tables and between the data on which they are based illustrates very strikingly the extremest variation of results which may arise from a difference of circumstances in problems of this kind.

In the absence of other information this contrast would be very discouraging were we not in some degree warranted in viewing the case of the Seine as illustrative, in a general way, of the self-purifying power of rivers, and possibly also, (with a large allowance, however,) of average streams in the alluvial districts of warm countries, while the experiment referred to might be taken as an extreme indication of what might transpire in the case of a polluted brook flowing through rocky defiles and uncleansed by any other than atmospheric agency, or in the case of rivers in the northernmost portions of our land. In either case, however, the tabular conclusions presented before you must be accepted with great caution, perhaps with considerable dilution, especially where they exhibit the probable times of cleansing waters which are but very slightly debased by organic impurities, for—Firstly, variations of temperature have a marked influence in accelerating or retarding the distruction of organic matter. In what degree this occurs it is impossible, in the light of our present knowledge, to say. Secondly, sewage, as usually delivered, requires a run ranging, in ordinary cases, from a few hundred yards to a mile or two before becoming well mixed with the stream which carries it. This distance is of great importance when we are considering short runs, and an allowance must be made for it in each case, depending on the location of the outfall and the width and degree of disturbance of the stream. The most practical way of applying this correction would be to make the extreme allowance for every ordinary case. Thirdly, the assumption that an increase of fresh water, (other conditions remaining the same,) will correspondingly increase the rate at which a given amount of sewage will be cleansed by it, may be an error of practical importance. The assumption is a plausible one, and yet it is possible that a finer distribution of a given amount of putrescible matter throughout a larger mass of the oxidizing agent may, by the excess of the latter, cause a more intense oxidation than with smaller quantities. But it should be remembered that if the latter is the true

state of the case, then are my tables safer than I have supposed them to be. Fourthly, the average rate of purification at given times is very uncertain. So far as I know no attempt has been made to determine it—at least, I have not met with any reference to it. I have taken it as varying with the square of the times in order to err on the safe side in the cases of the shorter runs. Judging from the experiment on which the first table is based I should think it probable that the average lies somewhere between a ratio of the squares of the times and the square roots of the cubes of the times. A third column is appended to Table No. 1, whose numbers (in brackets) are derived from the latter ratio. Lastly, the chemical constitution and the flow of sewage vary greatly in different localities, and in the same place during different seasons and at different periods of the day. This variation, especially in regard to the composition of the sewage, will necessarily be a source of great perplexity in any attempt to forecast the polluting effect which a proposed system of sewers will have on a given stream. In what is known as the "combined system" of sewerage the greatest pollution will probably be produced by short and violent rain storms during the dry seasons, by the casting of large quantities of street washings into a stream before its own volume has been materially increased. It would seem, therefore, that in such a system the storm capacity of the sewers and the average flow of the stream at dry seasons, and the chemical composition of their contents at such times, would be the proper gauges of the relative volume, of sewage and stream, and of the degree of dilution of the former. It must be evident, however, that the topographical features of the town and of the country bordering on the stream may sometimes modify the above general conclusion very materially.

In the so-called "separate system" the maximum discharge of the sewers and the minimum flow of the stream, together with a higher degree of pollution of the sewage itself than in the former case, should always constitute the basis for computing the probable dilution of the sewage.

Notwithstanding what I have said in regard to the defects of these general tables, I still believe that they may be of some service as guides for the approximate solution of problems relating to the expediency of casting crude sewage into streams of potable water, at least until we have more information in regard to the exact effects of that practice under a great variety of circumstances—provided always that due regard is paid in each case to the nature of the climate and the other

important features already alluded to. In the southern latitudes, for example, where the winters are very mild and aquatic vegetation is luxuriant wherever it finds suitable nutriment, I should be inclined to expect that the deductions from the case of the Seine, with the addition of a moderate margin for safety, would find a safe application. In the colder regions of the north a closer approximation to the figures of the first table would be more suitable, while for the middle latitudes I would be inclined to approach a mean between the two.

A means of estimating the time, or the run, needed for the purification of a stream of sewage of average quality by a given volume of water being once established, it will then be, comparatively, an easy matter to determine whether any particular water-course will afford the necessary quantity of pure water for cleansing the sewage of one of its towns before it reaches a lower one, where the water might be used for domestic purposes; or, should the minimum flow of the fresh-water current be given, and the distance in which it is required to accomplish the cleansing, then the average, or preferably, the maximum amount of sewage which would be admissible to the stream may be found by a very simple computation.

Whenever the question related to the restoration of the purity of potable waters great nicety of calculation would be unnecessary, for, as I have already intimated, a large margin of safety must be employed in dealing with problems involving danger to human life. This is especially true in the light of our present lack of specific knowledge regarding the restorative powers of fresh-water streams.

Wherever the water of the stream, in its natural state, is clearly unfit for domestic use, much of the gravity of the question will disappear. Yet even here it must be remembered that such water may be applicable, as it often is, to a great many industries, some of which might be injuriously affected by the organic impurities brought by the stream to their doors. The adjustment of such cases to the interests of all concerned would usually be more easily compassed in the case of potable waters.

Time will not permit me to enter at present into the consideration of the effects of the precipitation of the solids of sewage matters in the neighborhood of the localities where these matters originate. It is an interesting field of inquiry, covered as yet, so far as I know, by mere conjecture as to the sanitary effects of such precipitations on their immediate neighborhoods, except in extreme cases, where the accumulations of sewage matters have in the course of very many years

become sources of rank offence to the senses, and, doubtless, also breeders of disease.

The following are the points which I have endeavored to lay before you:

Firstly. That fresh-water streams have, undoubtedly, the power of destroying organic impurities which are mixed with them, and therefore that it is not, necessarily, unsafe to cast crude sewage into streams of potable water.

Secondly. That the capacity of any particular stream to effect such destruction depends on the degree of dilution of the foul matters, on the original purity of the stream and the degree of disturbance of its current, as bearing on its oxidizing powers; that it also depends on the climate and season, the character of the soil on the bed of the stream, and on the presence of aquatic plants; and finally, on the time of exposure of the putrescible matters to these reducing agencies.

Thirdly. That even the very limited number of facts which we possess in regard to these matters admit of a rough formulation, whereby questions as to the expediency of using any particular water-course as a receptacle for crude sewage may be raised out of the field of mere conjecture to a more scientific and practical plane of discussion. And in this connection I have endeavored to show how the only examples which were availabe for my purpose may be interpreted in the light of certain general principles and adapted to practical use.

In conclusion I desire to express the hope most earnestly that the institution of the National and State Boards of Health will speedily be followed by an enlargement of their powers and the placing of ample means at their disposal for the prosecution of thorough inquiries into the important, but as yet obscure matters which I have endeavored in a preliminary way to consider.

ENTERIC FEVER AND CESSPOOL DANGERS,

As Illustrated by Local Outbreaks on the Mountains, near the Sea, and in a Public Institution.

The State Board of Health, ever since its formation, has had occasion to watch with care the different forms of fevers which from time to time prevail, in order to detect their causes and the best methods to secure avoidance. It may be said of the State as a whole, that its freedom from specific fevers has been fully equal to that of most of the States.

Typhus fever, which prevails so often in the crowded cities of the old world, and which has had occasional outbreaks in this country sometimes occurred at Perth Amboy, when, more than now, it was a place for the arrival of emigrants. The outbreak of last year at Camden county alms-house was an unusual experience. It has always been recognized as a disease of personal uncleanliness and overcrowding and has oftenest had its origin in jails, in close hospitals, or in times of famine.

Typhoid fever has some points of resemblance, so much so that it was long known by the name of abdominal typhus. It has always seemed more directly traceable to the accumulation of foul animal secretions and has seemed to increase with the use of foul cesspools and sewers. Long ago it was not infrequent in New England, amid the valley towns, and in private houses was attributed to the fact that the location of outbuildings was often higher than the house and so as to contaminate wells. There is much ground for the conclusion that it arises in many cases from the dejections of diarrheal patients, or from the mingling of excretal matter with water or air. It is not usually claimed that it arises from vegetable decay, but is always associated with some abnormal animal condition.

There is often occasion to inquire whether we do not now see still another form of fever not always having the special lesion of typhoid fever, but which has many of its symptoms. This view has been so

much entertained as to lead some high medical authorities to speak of what they call a cesspool or sewer fever, seeming to arise spontaneously from breathing air or drinking water contaminated by the stored filth of human and household accumulations. We have had a class of these cases in this state and believe such a view to have some support.

The various forms of Intermittent and Remittent fevers which prevail from time to time, are not different from those familiar both to English and American practitioners, and will continue to vary in frequency and intensity accordingly as the population is subjected to the influences of heat, moisture, imperfect drainage and abnormal vegetable decay on the one hand, and accordingly as human systems by deterioration or exposure are made more susceptible on the other.

We are here to speak of enteric fever, or of that varying form known as cesspool fever, which has been illustrated the last year.

Our attention was first called to an outbreak which occurred in the Centenary Institute at Hackettstown, beginning early last January.

The buildings are finely located on a height, amid beautiful mountains and with good natural surface drainage. The care of the institution was excellent, and the general health of the pupils, until awhile before the outburst, had always been good. So soon as a few cases occurred it was thought best to adjourn the school, both that new cases might be prevented and that the causes might be diligently sought out and remedied. There were in all about thirty cases and four deaths.

The Secretary of the Board made a thorough examination into all conditions which might have seemed to excite the disease. It could not be traced to any person who had come from elsewhere and entered the school, unless it could be connected with a case of so-called malarial fever in Brooklyn. The first case had been exposed to this and was called by the same name, but afterwards seemed to be a possible nucleus of the other cases. The milk supply was chemically examined and found unobjectionable. The water was derived from the mountain and supplied the entire village, in which no cases had occurred.

The inside water-closets and other water-pipes for the removal of soiled water were not all of the best construction, and defects were found which showed that foul gases could find entrance if such were anywhere produced. The outside privies were near and had not been cleansed for several years, reliance being had on natural soil drainage. The cesspool also had been constructed so as to allow all liquid matter passing into it to pass off into the ground, and had not

been cleansed for several years. It was believed that the strata of ground would incline all flow away from the buildings, and so it was thought that the pool would be self-cleansing. Examination showed not only a cleft in the limestone bottom, but also that such a flow away from the buildings could not be depended upon. No doubt was left on the minds of those examining it, that a condition of things was found which would account for the sickness which had occurred. Various details might be recited, but they would only be a repetition of conditions before noted in the Jamesburg and Princeton epidemics. Hot-water pipes that discharged heated water into the sewer pipes may have had something to do with increasing the temperature of the sewage. The trustees delayed the opening of the institute until thorough structural alterations had been made. Many of the indoor fixtures and pipes were altered and replaced by those of more recent approval. The outer privies were rebuilt and fitted up after the trough-closet method, which, with proper cleansing, airing and oversight, is much of an improvement upon the usual school out-house. Two cesspools at a distance were substituted for the one near by, and made so to communicate with each other as to cause constant draughts of atmospheric air, and admit such examination and outflow as will prevent foulness. Although there are those who object to any form of cesspools, good authorities claim that by such an arrangement there is full protection against risk. The officers and trustees of the institute have spared no pains to correct all defects. Yet it furnishes new evidence not only of the need of vigilance, but that everything connected with large institutions, so far as the removal of all *débris* is concerned, needs to be fully known, and that structural arrangements must be such as to secure pure soil and pure air.

Soil saturation with liquid or solid refuse is never safe in the vicinage of large buildings in which many persons live. Foul air is often in winter driven therefrom by the furnace heat and dispersed through the rooms. Headaches and general *malaisé* often occur where there is no specific disease. It is only in flagrant cases or where some sickness has been introduced from without that we have these severer cases.

The other special outbreak occurred along the shore instead of amid the mountains. The following is a brief outline of it:

A fine hotel stands on a narrow strip of land, with a sea-front about five hundred feet before it and a river one hundred and fifty feet to the rear. The building was

erected about five years since, in a bed of sand, free from organic decay and with but little excavation. The water-supply was derived from Long Branch, the main pipe being extended thereto. The water itself seems to have been good. The only defect here is that, because of insufficient pressure as turned on to the water-closets, it cannot always be relied upon for flush, and so may leave the closets without full traps, or, at least, without a supply sufficient for prompt and adequate flush.

The main point was to trace what became of all the liquid and water-closet wash from the closets, the kitchen, etc. It was found that this was carried to two general soil-pipes, which emptied into two separate cesspools outside the main inclosure of the building. The soil-pipes were open on the roof, but were hermetically sealed at their exit and in their course to the cesspools. Between the cesspools and the building there was no trap and no outside ventilation. The cesspools themselves were within a few feet of the closets and one of them in an area of the inclosure. They were miserably constructed of plank and filled to the top. The planks over the top were covered with ground. When opened, we found a heavy mass at the top of mere solid filth. That near the kitchen was a mixture of grease, fecal matter, etc., quite solid and over eighteen inches in thickness. It was in a state of nauseous decomposition. Each of these cesspools had an overflow near the top, so that what did not soak into the ground might be carried into the river, adjacent. One of these was stopped up, so as to allow no outflow except such as took place from the loose tile under the ground. Any foul air from these cesspools must at times have found its way into the soil-pipes of the building, and so could flow out wherever the bath, or closet, or other connections would permit.

Fortunately there were but four or five cases of the fever, and of these none died. We had no doubt of the local character of the disease.

In both of these cases neither the mountains nor the sea are to be held responsible.

The time will never come when either on mountain or at sea, mistakes in dealing with filth will not be dangerous. It is even yet claimed by some good authorities that yellow fever had its inception in the holds of foul ships in mid-ocean.

The third instance is that of a fever epidemic which commenced in December, 1881, in the Hudson county alms-house, located high on Snake Hill. It continued for about five months. The physicians in charge of the institution regarded the cases as being of a mongrel character. We have the same testimony so often given in an outbreak of fever, dependent upon foul air generated on the premises or in the buildings. It was this that led some good authorities to designate between this and the typical typhoid fever, by calling it cesspool fever. One of the attending physicians endeavored to classify the cases as follows: typho-malarial fever, one hundred and fifty-six cases, twenty-seven deaths; remittent fever, ninety-four cases, six deaths; intermittent fever, one hundred and five cases, eight deaths.

The ground on which it was not pronounced distinctly typhoid, was that there was often absence of abdominal symptoms and that a malarial influence was manifest. Yet occurring as it did in winter, it is difficult to regard the malarial symptoms as anything more than a complication. There were many other deaths, which were attributed to age or feebleness, which no doubt were hastened by or depended upon the bad local conditions. The attention of this Board was not drawn to the institution during this epidemic, but an after-inquiry into symptoms and details, left no doubt as to its pythogenic character. The crowded condition of the building, which had over eight hundred inmates, and other complicating evils, must have exposed its entire population to foul-air influences. A general condition of *malaisé* was recognized even by those who were not susceptible enough to have any severe attack. Over one hundred deaths occurred, most of them incident to this outbreak. Besides the ill adaptation of parts of the building for its purpose, its ventilation and sewerage systems are very defective. A letter addressed by the Secretary of this Board to the Clerk of the Board of Freeholders refers to it thus: "The sewage system of the alms-house is strongly to be condemned. On the inside the trough-closets and other appliances are in poor condition. The soil-pipe runs out into a great privy cesspool. Into the two privies come both this and the asylum sewage. They are too near the building, and the whole arrangement is practically wrong. All the ventilation there is opens toward the building by means of gutters, save the one soil-pipe which is ventilated on the roof but not outside the building. There is no need of any outer cessspools, as attachments to the direct sewer properly trapped and ventilated by an outer shaft would give all conveniences. Some attention needs also to be given to the general drainage of the ground here. Although elevated it is naturally wet and suffers from dampness by its relative position." Besides other sources of bad air sufficiently pronounced, the fecal and cesspool emanations could not but have permeated the building.

Thus we have had the last year three endemics of fever in very diverse circumstances as to locality, yet all in districts and positions chosen for their salubrity. They are alike in having been the victims of cesspool befoulment. If we insist upon storing the varied offalings of animal and vegetable decay, instead of removing or utilizing it, as nature has indicated, there is no mountain or hill so high and no sea air so pure that man's device may not concentrate pollution. True, the penalty does not always follow quick upon the mistake.

Nature is so grandly conservative, that she herself utilizes and amends many of our errors. Then again it often takes a union of forces to develop the result. Stored filth may not stir into disease at all if neither heat nor moisture is applied. Sometimes the depth of covering protects; sometimes its thickness and undisturbed coating makes a hermetical seal; sometimes fermentation occurs instead of putrefaction, or the mode or time of breaking up is propitious. We cannot always tell why one real case of scarlet fever is benign and another malignant, or why an epidemic of the same disease, as diphtheria, is managed easily in one house and in the other carries off a whole family group. But we do know enough to know that any system which stores filth or manufactures sewer gas, and holds these in readiness for thermal or atmospheric or personal conditions that may exist, is *extra-hazardous*. We know it is not the fault of many a household, and especially of many a crowded hotel, that they have not received any sickness adequate to their arrangements therefor. But let not the warnings we have had repeated year after year in the State be lost upon us. This variety of fever is of household origin and must have its correction or prevention by the application of well-known sanitary principles, to the cleansing or removal of all things connected with life and indwelling which are not promotive of health. While we shall never cease to make some errors, with the application of principles and methods now well understood there is no reason why typhoid fever and its allied types of disease should not forever cease to occur.

SANITARY INQUIRIES INTO THE CONDITION OF CHARITABLE AND PENAL INSTITUTIONS.

As early as 1866, in the appointment of a State Sanitary Commission, it was made a part of its duty to look after the dependent classes of various grades. In the general law of 1877, as a part of investigation and inquiry in respect to the influence of conditions and circumstances upon the public health, this Board recognized these classes as somewhat included in its inquiries. Accordingly, in the fourth report will be found a detailed account of the condition of jails in Warren, Morris, Middlesex, Essex, Union and Somerset counties. Also the record of examinations made of the Warren county alms-house, Morris county alms-house, and of the Newark city and Elizabeth city alms-houses, and a few of the township alms-houses of Essex county. Special visits had also been made by the Secretary to the county alms-house and asylum of Camden county, to the jail of Camden county and to the State Reform School, in the sanitary interests of the State. The last Legislature, by a special act, empowered the Board to inquire more fully into any State, county and township alms-house, asylum, prison, jail or other public institution, and to report upon the sanitary condition of the same. Circulars and correspondence soon revealed the fact that very different systems as to these prevail in different sections of the State. Our public institutions, viz., the state prison, the two reform schools and the two asylums are under well-known and well-organized supervision.

Essex county has a penitentiary near Caldwell, having a farm of forty acres. Work is done by the convicts—they average about one hundred and thirty in number. The institution is well conducteed and in most of its sanitary arrangements is a model.

Hudson county has a penitentiary at Snake Hill, averaging about three hundred convicts of terms of one year or less. Stone quarrying and other industries are pursued and the system is well managed. All of the counties have county jails. Most of these are connected with

the court-house and are under the supervision of the Sheriff. Those in Essex, Hudson, Passaic and Union are under the charge of wardens, and two of them are separate from the court-house buildings.

The State prison and the jails of Camden, Cumberland, Salem, Essex and Hudson counties have been visited by the Secretary of the Board and carefully inspected. Either by direct personal meeting with officers or by official letter any defects have been carefully noted and recommendations given. Letters which are on file will show how important has been this work, and how many of these needed this kind of inspection. It is known that already some important changes have been made. It may be said once for all, as to all visits to the various institutions of a penal or charitable kind, that there has been manifested the most earnest desire to know sanitary defects and the assurance that requisite changes would either be made or fully considered.

The city alms-house of Paterson, the county jail, and some of the pauper insane were visited and examined by Wm. K. Newton, M. D., and a careful report made to this Board as to them is on file.

ASYLUMS.

Full reports were received from both of the State asylums in reply to a schedule of questions and such additional particulars given as were needed. With these full reports and the knowledge already had of the structural arrangements and sanitary administration of these institutions by the Board, it was not deemed necessary to make a more special inquiry this year. Besides a few insane or demented persons to be found in various alms-houses, there are in the State eight county asylums, in which are to be found inmates of all grades of derangement, and of all varieties of skilled and unskilled oversight.

The counties which have these asylums are thus enumerated, the number of inmates being given as by the last State tax allowance. Those which are either in a building with or adjoining the county alms-house are marked with a star.

Burlington county,* sixty-four (Pemberton); Camden county,* seventy-nine (Blackwoodtown); Cumberland county,* ten (Woodstown); Essex county, three hundred and twenty-eight (Newark); Gloucester county, three (Clarksboro); Hudson county, two hundred and twenty-two (Snake Hill); Passaic county, thirty-six (Paterson); Salem county, seven (Salem.)

These, with the average of about five hundred and fifty in the State asylum at Trenton, (thirty-seven being convicts), and five hundred and thirty-five in that at Morris Plains, give an aggregate of one thousand eight hundred and thirty-one, of which a little over two-fifths are in county asylums. As the State not only pays an allowance for these, but also needs to recognize all as related to the social and industrial interests of the people, it has need to exercise over them some form of intelligent oversight. With the demented still in alms-houses or in private families we find an aggregate that may well attract attention in our study of the causes which improve or deteriorate population. The statesman and the citizen not less than the professional man, need to study the best methods of care and the possibilities of preventing this increasing element in our modern civilization.

In Burlington county the asylum forms a part of the alms-house with its three hundred and twenty inmates. The general care is under the special superintendence of a matron, and a physician visits the institution as often as is necessary. The cells, with the exception of three or four, are properly located.

Camden county has its asylum on the same grounds as the alms-house, but in a separate building. It, too, is under the superintendence of a matron, and has the same visiting physician as the alms-house.

Cumberland county has its asylum under the same superintendence as the alms-house, but is not as well attended to. The asylum building is adjacent to the alms-house, but because of the small number of inmates (ten), lacks that expert care which larger institutions can command. Three epileptics are kept in the other building in rooms not well adapted for them.

The asylum in Essex county is so large as to command all the advantages of skilled administration, and of those skilled in dealing with this special ailment. Although the present buildings are in some respects well suited to their purpose, as the property belongs to the city and not to the county, new buildings are being erected, which will probably be completed in about three years. There is no reason why this institution should not illustrate the best methods of alienistic care.

Gloucester county has a small brick building on the same grounds as the alms-house, fitted for nine persons, but containing only three. All bad cases are sent to the State asylum.

Hudson county has an asylum adjoining other county institutions on Snake Hill. It has a number sufficient to secure the services of a

resident physician and is in many respects managed according to the most approved methods. The new part of the building is admirably adapted for its purposes as to its halls, its rooms, its heating and ventilation and its change from sitting to sleeping corridors. In those rooms where close confinement was necessary, the contrast with some similar rooms in smaller asylums was very great. Those who in the latter always slept on the floor because of their destructiveness of beds and clothing, were here provided with a form of elevated bed which is used, so as to secure greater comfort and cleanliness. It was in marked contrast with similar cells seen at two other places.

Passaic county provides for between thirty and forty inmates.

Salem county. The asylum building is here adjacent to the alms-house. Although the asylum has but few inmates, like other small asylums it suffers for want of classification and administration. Both it and the alms-house were found so defective in many particulars, that the Secretary felt it to be necessary to meet members of the Board in person so as to complain of its condition and suggest changes. No one could thus visit the various asylums of our State without recognizing that the care of this portion of the population, either in a charitable, social or economical view, is a responsibility needing careful management. The time has come when it will not do to trust to routine methods or to look upon such institutions as only local or ndividual in their character. Two thousand such dependents as these need study as to causes, as to treatment, as to classification, as to system of provision—often quite different for the acute and chronic insane—as to possibilities of employment and amusement, and as to the relation which county or city asylums should bear to the State. While great ability of management is discernible in some of these, it s not so always. There is want of unity of system and oversight. The system of freeholder care needs somehow to be kept free from political changes. In two or three instances changes of administration have simply been the result of party changes, and all institutions of harity are imperiled by such methods. In others there is no attempt at expert management. Both charity and social economy require a more comprehensive oversight. Asylums for less than one hundred are sure to suffer for want of administrative care and of that skill which has familiarized itself with insanity in all its forms.

ALMS-HOUSES.

Great difference of method exists in the State as to the care of the indigent. Most of the larger cities have city alms-houses, whose officers derive their authority from the Mayor and Common Council. Several of the counties have county alms-houses. In other cases some of the townships combine in a common alms-house. Many townships have alms-houses of their own. Some have a system of outdoor relief, and a few still cling to the old method of farming out the paupers.

The following counties have county or township alms-houses:

Atlantic county; Bergen county, one for eight townships and one for three; Burlington county, Pemberton; Camden county, Blackwoodtown; Cape May county, Cape May C. H.; Cumberland county, Bridgeton; Essex county, city and township houses; Gloucester county, Clarksboro; Hudson county, Snake Hill; Hunterdon county, township houses, etc.; Mercer county, city and township houses; Middlesex county, city and township houses, etc.; Monmouth county, township houses; Morris county, county house, Boonton; Ocean county, mostly township houses, but some townships reserved a right in the Monmouth county house; Passaic county, county house and city alms-house, Paterson; Salem county, county house, Woodstown; Somerset county, township houses; Sussex county, township houses; Union county, city and township houses; Warren county, county house, Townsbury.

Of these, that of Hudson county is the largest, numbering between eight and nine hundred inmates. Nearly all of the county alms-houses have been visited. It has been our habit to make direct report as to all these institutions to the Board of Freeholders or persons in charge. Various matters needing attention were referred to and such suggestions were made as sanitary defects required. It was not deemed necessary to make any public criticism or even to give copies of communications in this report. This is all the less needful because in many instances prompt response has been made to these communications by structural and administrative improvements.

From various city and township alms-houses returns in answer to sanitary inquiries are on file in this office.

It is impossible to calculate with absolute accuracy the number of the pauper class as indicated by these returns. It cannot, however, fall short of from six to seven thousand. This, with a prison and penitentiary population of sixteen hundred, and a jail population of

one thousand, and reform schools three hundred and fifty, and asylums two thousand, makes an aggregate of dependent population of about twelve thousand.

Of all questions relating to methods of dealing with dependency, none are more important than those which relate to sanitary conditions. While this Board cannot with present provisions attempt a close examination of the smaller institutions, it has thus been able to extend to most State and county institutions a sanitary inquiry which, it is hoped, will be found to have been of advantage to these institutions and will help to awaken the attention of citizens in the various counties to the importance of attention to those influences which may limit dependency and crime. Not only the influence of intemperance but that of various other evils needs to be closely studied. Much is to be done not only in improving the condition of these and in diminishing their number, but in overcoming that thriftless tendency which is so apt to adhere to families or to communities.

HINTS WITH REFERENCE TO THE REGULATION OF MOISTURE IN ROOMS.

BY PROF. C. F. BRACKETT, PRES. OF STATE BOARD OF HEALTH.

I have been requested to discuss briefly the question of moisture in the air of our living-rooms, with reference to its regulation. The object which it is desirable to secure is the maintenance of such a rate of evaporation from the surfaces of our bodies and respiratory organs, as shall be requisite to keep them in proper condition for the discharge of their normal functions. Common experience teaches that very important relations exist between the temperature, moisture and other conditions of the air, and our feelings of comfort or discomfort.

The bodies of living beings, while in some respects self-regulating, are yet subject to the same laws which control the actions of matter in general. The unceasing molecular and atomic changes on which life is conditioned are productive of heat in the body, as they would be if they took place without it. How this heat is expended so as to maintain the normal temperature, which is in all climates found to range between 98° F. and 100° F., will be obvious by considering a few facts which have been ascertained by careful observation.

Under conditions ordinarily favorable to health it is found that 72.9 per cent. of the heat given off by the body escapes by radiation, 14.5 by evaporation from the skin, 7.2 by evaporation from the lungs, 2.5 by heating the air from breathing and 1.8 by the solid and liquid excreta. It is thus seen that about 22 per cent. of all the heat which leaves the body passes off by evaporation. If, now, such conditions supervene as shall tend to increase or diminish this evaporation, corresponding disturbances in the system result, and though it possesses powers of compensation which are called into action by such disturbances, their exercise may greatly interfere with our vocations, comfort and health.

Now the quantity of water which is required to completely saturate a given space with vapor is dependent upon the temperature of the space alone, it being exactly the same whether air be present or not. Moreover, the amount is, for every given degree of temperature, definite, so that having once been reached, no more can be taken up. Suppose that we are in a room whose temperature is, say, 99° F., and that the room has been supplied with all the vapor of water which can be taken up at that temperature, plainly, although the surface of our bodies as well as that of our lungs may be completely bathed with moisture, no relief from evaporation can be had. If, however, less moisture is present than is required to saturate the space, the process of evaporation will be set up with corresponding abatement of heat and relief of discomfort.

If, again, we suppose the air of the room to be perfectly dry, a condition not met with in nature but one which may be produced by artificial means, we shall experience equally disagreeable and injurious effects.

Now the atmosphere in which we live may for our present purpose be regarded as composed of two perfectly distinct gaseous bodies in a state of mechanical mixture, viz., air and watery vapor. These, like all gaseous bodies, are subject to the laws of diffusion, so that they become uniformly mixed throughout. And we may, without error, speak of the air as saturated when the space occupied by both contains all the vapor it can contain at the given temperature. Now the capacity of air, in this sense, rapidly increases with increase of temperature. Thus if one pound of air at 32° F. were saturated with moisture it would contain .00379 pounds of water. If, now, the whole were heated to 42° F., it would no longer be saturated, since at this temperature a pound of air would be capable of holding .00561 pounds. Merely heating the pound of air together with the vapor contained in it has changed its hygrometric state from complete saturation to one which is only 68 per cent. saturated. In like manner, if the temperature were successively raised to 52°, 62° and 72° F., the corresponding degrees of saturation would be 46, 32 and 23 per cent. If we assume that the temperature of our living rooms is to be maintained at, say, 72° F., our sense of comfort will depend on two factors, jointly, the warmth of the air and its condition as regards dryness. If we rely on open fires, which radiate their heat without warming the air directly, but do so by first warming the walls of the

room, which afterwards warm the air moderately, we shall be obliged to admit so much moist air from without that there will be little danger of too much dryness. But if we employ stoves the case is altered. Their more advantageous positions and dull radiations enable them to sufficiently raise the temperature without the expenditure of large amounts of fuel, and therefore with little necessity for admitting large amounts of fresh air, and it hence results that on the temperature being raised the degree of saturation with moisture falls very low and most uncomfortable dryness results. This is obviated by placing a vessel of water on the stove in such a position that it may be heated and give off vapor more or less copiously. In order to present the principles involved clearly, let us suppose we have a stove in which we have to burn 40 pounds of coal in the course of ten hours, in order to maintain a temperature of 62° F. when the outside air is at 32° F. Now 4 pounds of coal per hour will require 1200 feet of air for its combustion. This will weigh about 91.3 pounds and will contain, at 32° F., 0.346 pounds of vapor. This would be intolerably dry, for the degree of saturation would be only .23. Let a vessel of one foot area contain water and be so placed on the stove *that it will be kept at a temperature of 122° F.* This vessel will yield 0.538 pounds of vapor. We shall have then, altogether, 0.884 pounds of vapor brought into the room every hour. But 91.3 pounds of air at 62° would require for complete saturation 1.0764 pounds of water. We thus have an atmosphere too damp—about 82 per cent. saturation. If we reduce the size of the evaporating vessel one-half we shall add, other things being constant, about 0.269 pounds of vapor to that brought in from without; and secure a degree of saturation of about 57 per cent. This may be called a dry atmosphere, since it could sustain much more vapor; accordingly, every article that is exposed to it will continually give off such moisture as it may contain. The same will be more emphatically true of less degrees of saturation.

It appears, then, that with the conditions supposed we may if we would secure a moderately dry and healthy atmosphere, so place an evaporating vessel as to secure the evaporation of somewhat less than a half a pound of water in an hour, (between 0.269 and 0.5381 pounds).

This may form a basis for regulating the amount of water that is to be evaporated on stoves. If we are to consider the case of furnaces where a large amount of fresh air is to be heated and thrown into the dwelling, the case is complicated with the numerous details of con-

struction, the rate at which the air is admitted to the heating chamber, etc. No doubt the most satisfactory plan is to have recourse to observation of the wet and dry bulb thermometers, and by their indications regulate the exposed surface as to extent and proximity to the fire-pot till the proper amount of evaporation is secured.

NOTE BY THE SECRETARY.—We draw special attention to this brief statement of the vexed question as to whether water on stoves, or for furnaces, is desirable. A proper degree of artificial moisture is often needed for our comfort and health, in a stove or furnace-heated atmosphere. By an accurate statement of the problem itself, and the influence of relative conditions, we are brought to see that there is a method of quite accurate determination. In the absence of this, our only plan is to have a vessel of water such as is named; to note its temperature and the amount evaporated in any given time, and so form an estimate of the degree of evaporation most generally acceptable or desirable. This approximate indication with our feelings and sensations will often aid us in adjusting the heat and moisture of a room atmosphere to health and comfort.

LOCAL SANITARY INSPECTIONS

Of Sea-side Resorts, Etc.

BY EZRA M. HUNT, M. D., SECRETARY.

The State Board of Health has for more than a year past been making sanitary inquiry and investigation as to some of our most growing towns, with a view of informing itself of the exact sanitary conditions, and of suggesting changes to the local Boards of Health. It was thought best at first to direct more special attention to seaside resorts, because their rapid growth and the summer crowding of population especially inclines them to insanitary conditions.

It is the object of this paper to give an outline which will indicate the present sanitary status of the most important of these and a few other localities, and to point out desirable improvements. We shall not need to attempt to conceal any real defects, because the spirit of inquiry we have found indicates a desire to secure the best sanitary conditions, and because many of the suggestions made will no doubt be acted upon by the time this report is in print. The record will be all the more serviceable because by it we shall be able to point out evils and their remedies, such as are equally needed to be known by many other cities. Thus we shall hope to aid in giving direction to sanitary improvements throughout the State.

Having noted two of the most prominent seaside resorts on our more southern coast, and one of the growing inland resorts recommended for invalids, we will then turn to some of the growing villages and cities along the shore of eastern New Jersey.

As the chief design of our inspection was, first of all, to find out what city, borough or township provisions are made for drainage, water-supply, sewerage and the removal of all garbage, etc., we have first of all inquired into them. In addition, inquiry was had and examination made of various hotels, not for the purpose of speaking of them individually, but that we might know the general condition of large

buildings to which the people are invited to resort, not less in the interests of health than of general recreation. The New York Tribune, in a recent notice of healthy summer resorts, speaks thus:

"The New Jersey Board of Health has begun the examination of the sanitary condition of the seaside resorts along its coast. It is a necessary work for New Jersey, both humanely and financially. The summer boarder is now a more profitable crop in that State than sweet potatoes or whortleberries. It is a harvest which has only grown up within the last ten years, and which yields millions of capital to the Jerseyman; and it is a harvest which will as rapidly disappear if these very measures of precaution which are now inaugurated by the Board of Health are not carried out.

"From Sandy Hook to Cape May mushroom cities have sprung up, many of them under the patronage of some religious body. An enormous amount of capital has been invested all along the coast. Land which ten years ago would not sell at $5 per acre now is eagerly bought up at thousands. Even during the winter months the hotels at some of the resorts are crowded, physicians having discovered that the air of this coast is as mild and curative as that of Nice and Mentone. There is no reason why these resorts should not succeed, and the New Jersey coast prove a convenient and close sanitarium for this city and Philadelphia, but one, and that is the problem of drainage. The soil, being sandy, is porous as a sponge, and absorbs all the poisonous matter from the surface, transmitting it to the wells. The problem of proper drainage is rendered more difficult by the tidal streams which return all decomposed and noxious matter to the shores. It is a difficulty easily overcome, however, if taken promptly and energetically in hand, as the State is beginning now to do. The native population along the coast are the purely conservative kind who hold on inexorably to the pig-pens, open drains, foul smells, decaying fish and other abominations of their ancestors as to precious heirlooms. A few stringent laws will be necessary to teach them that their pure sea air is their only valuable capital, out of which they can make a comfortable living if they will keep it pure."

The rapid popularity of the coast, tempts to the derangement of its natural advantages to a degree which the hasty devices of speculation have already begun to illustrate. Here are the stipulated conditions on which some of them have already proceeded. Pay no attention to natural drainage. Make no provision for artificial drainage to compensate for structural changes. Grade and upheave, so as to ignore all natural laws. Instead of draining a pond, make of it an artificial lake. Hide the salt meadows, or the more organic deposits of higher vegetation, by sea-sand or river-mud. Build rapid cities, and notwithstanding the rapid pollution of ground, with no vegetable growth to utilize it, assume that the water will be good, because the oldest inhabitant says it always has been good. Rush in an unsettled population, which has far more complicating conditions than the sudden occupancy of a city by a great army, and gather the solid and liquid

tonnage of all excretions and offalings into cesspools, that will let it out all over the ground, only a little under, so as to be concealed from sight. Repeat this, year after year, on the hypothesis that it will take care of itself. In the absence of classified facts, assert the perfect healthfulness of the city. Do not admit that any deterioration of health from these causes can take place, unless there is a summons from typhoid or typhus fever, or some other specific epidemic, to quit. Let all the other tax on vital force and vigor count for nothing, and even if this comes, explain it away as being brought by summer boarders." This plan has been adopted in many a mountain district, until fevers have discredited mountain-air. It is still adopted in many inland towns which are not health resorts. Our coast is thus far fully on a par with other watering-places. It is only because we desire that it shall excel them, that the note of warning is sounded in time.

Of this coast, as a whole, reaching from Raritan bay to Cape May, as furnishing localities for towns, cities, and for health resorts, too much has not been said. Its location as to the great ocean, its accessibility to centres of trade, its forests and plains, its soil and climate, give facilities of adaptation, and promises of salubrity, such as will continue to invite increasing population, unless art succeeds in subverting what nature has devised. But all along, certain governing principles must be held in practical esteem. Climate and health are made up of many factors. Good locality in a temperate clime, fitness of geological structure, pure air from sea and land, and good water already determine many things in our favor. Yet these are not to be assumed to be entirely the same, even at adjacent points. Here and there changes occur in the underlying ground which must be understood. Rivers flowing toward the sea differ much as to their banks, their rapidity of flow and their deposits. Even amid wide stretches of sand and gravel, beds of organic matter are found. Water-supply differs much according to the water-shed it represents or the character of the soil through which it is drawn. Even when equally good as to healthfulness it may have taste derived from mineral or vegetable matter. Prevailing winds and the kind and extent of near forests have much to do with climate and health. So in choosing amid good localities, there is room for much variety. Again, independent of such structural arrangements as have to do with buildings, there is great difference in the preliminary or constant surface work which different localities need.

Some places are made unhealthy by the mere upturning of the soil.

There are kinds of ground, of drift material, and of rock, which, in their exposure to the air and in their disintegration, produce bad air and disease. There are meadows which ought not to be covered up, and mud of rivers which ought not to be used for filling in.

There are many places in which underground drainage is the one essential thing, before there is any building, so that a dry, well-aired groundwork can be secured.

There are other places in which the natural drainage is just sufficient, but which need additional aid in this direction so soon as buildings begin to be erected. We could point to two or three places on the coast in which there is reason to believe that excavation and imperfect drainage have already started causes of malaria, which will continue unless the evil is appreciated and the remedy applied. Yet, as a whole, the stretch of sea-coast is as free from malaria as any mountains on the continent.

Another frequent and suspicious occurrence along the shore, is the interference with natural water-courses, either by inattention to natural underground drainage, or the partial stoppage of waters in their course to the sea, by artificial ponds or lakes, or the impounding of tidal seawater, or the mingling of stagnant fresh and salt waters, so as to make of little natural ponds a something that can be called a lake. It is not always that such lakes are a nuisance, but all such stoppage of water near its exit to the sea, is to be presumed to be an error, unless high engineering authority can show why any given case is an exception.

CAPE MAY.

Cape May, as the first important city at the southern extreme of the State, may first engage our attention. Our examination of it was made in April, 1882. It is a city of about eighteen hundred permanent population, but in summer, varies from fifteen to twenty thousand. Of its climate, we need not specify at length, since its advantages in this respect have been so often set forth. Yet it is well to note that the more closely we study its climatology in relation to disease, the more apparent is it that it has an evenness of temperature and a freedom from frost more than its latitude and longitude would indicate, and deserves, as does much of our coast line, a careful study in the interest of health. When we recently had occasion to compare data as to disease, with those of Professor Smock as to climatology, it seemed quite apparent that a very hopeful study presented itself as to the special climate conditions of this section.

The soil of Cape May is admirably adapted for a city. It is a common fallacy that sandy soils, as being so loose and porous, are best adapted for close population. The fact, however, is, that gravelly soils are much preferable as percolators, and that alternate layers of gravel or mixed soils serve much better to dispose of organic matters that may reach the surface. The soil which underlies Cape May city is mostly gravelly, with sand under the gravel-bed, and then another layer with bay-shore gravel.

Where there is filling in, this is often done over salt-meadow land. Although this made ground, at present, makes up but a small portion of the city, and although the salt marsh is underlaid by gravel and sand, it would be wiser, in the filling in, to provide such drainage as would help to dry out this intermediate layer of organic matter, which, by the covering, becomes a subsoil too full of organic matter. The water-supply of the city is well managed and of excellent quality. It is derived from three sources: Two of these are large circular wells which go down into the gravel-bed, and are not in the same strata as most of the old wells of the town. These strata are in most places divided by a narrow strip of clay, so hard as to need the pick in excavation.

The water from the upper well is pumped up by the Holly system into the tank at the lower well, and from both there is a supply sufficient for the ordinary uses of the city.

About sixty feet from the second gravel-bed well is an artesian or bored well ninety-seven feet deep. In the boring of this, at about ninety-four feet, a cedar log was reached which had to be bored through. Just beneath this a good supply of water was secured. An eight-inch pipe leads down to this supply. The water is pumped by steam to a tank thirty-four feet high, having a capacity of sixty thousand gallons. There is also another tank with a capacity of thirty-five thousand gallons. The steam pump can raise sixty-five gallons per minute.

The water generally stands in the tube of this well at thirteen feet from the top. In very dry weather when in use it has gone down to eighteen feet, and has been pumped to twenty-two feet as the lowest. All whom I have been able to consult regard the supply as inexhaustible. The water is soft and pleasant, and quite tasteless unless a slight sulphur taste is perceptible.

We think it can be said that the city has a good and abundant water-supply. Here and there a cistern is still used, but this is scarcely needed. The poorer classes still depend upon wells which vary in depth from ten feet to sixteen feet. It is desirable to discourage the use of surface water and also to look after the abandoned wells, that these be filled up.

It is worthy of notice that one other artesian well was attempted previous to the one now in use. This was put down to the depth of two hundred and twenty-four feet, and this reached salt water impregnated with other minerals so as not to be fit for use. It is probable that the failure was owing to over-deep boring or to some change of strata. If need ever requires, it is quite probable that other artesian wells can be provided. On the whole it can be said that few sea resorts on such narrow strips of land can be found with so good a water supply.

Sewers. A careful examination was made of the sewer system of Cape May city. Some changes and repairs which were being made gave an excellent opportunity for careful examination.

The main sewers were constructed about thirteen years since and additions are from time to time being made. The city has no map of its underground structures, and like most of our cities much needs a complete sanitary map. The gradients of the different sewers could not be obtained, but there was good evidence that they are fairly flushed and that the fall is sufficient unless some special hindrance occurs. One sewer which was being taken up on account of deficiency of fall, illustrated the fact that portions are sometimes laid with too little fall. There is obstruction because there is irregularity of fall more frequently than because from "end to end there is too little fall." This sewer consisted of large drain pipe laid about ten years since. The pipes and cement were in good condition. The obstruction found had been caused by a variation in grade, which had apparently been made to suit a gas main, and only requiring the simple remedy of raising the line of pipe before it was reached. The pipes beyond this were so clean as to show a good flushing. They are all of vitrified pipe except a part of the terminus of one, which is of hemlock. The outlet of these sewers is by three distinct channels—one into Hedges' creek, quite out of the town, and the other two into Cape Island creek, not far from each other. Hedges' creek carries about two-fifths of the sewage and the other two the remainder. The whole system is between three and four miles, but accurate data are wanting.

As the emptying is into tide-water at points where the tide rises from three to four feet, the mouths of the outlets are covered a part of the time, but not so long as to interfere with frequent delivery. For this reason there should be more frequent man-holes. The sewer-pipes are from ten to sixteen inches calibre, and often unnecessarily large. They carry all the storm-water which enters by gully-traps at the corners of streets. At some of these, there is free ventilation. We think that these underground sewers should all have free access to the air by frequent openings, so that they can be flushed by the breezes, and so that sewer-gas cannot have either a place for production or for lodgment.

It is much easier to keep sewer-gas out of these sewers than it is to keep it out of hotels and other public buildings. For reasons hereafter to be given, we urge upon the Board of Health the keeping of house sewer-gas out of the sewer system, *by free ventilation of the sewers, and by intercepting all house sewers by a trap between the house and outside system, and by a ventilation either by man-hole or shaft on the house-side of the trap.* Have no conveniences for the manufacture of sewer-gas, and protect yourself from the modern-convenience plans of manufacturing sewer-gas which are mostly to be found inside of buildings. It is not only good in theory, but the best practical way, in such cities as this, of teaching householders and hotel-owners that the city has more to fear from them than they have from the city.

The garbage of Cape May city is carefully excluded from sewers, and seems well removed by those living at a distance whose interest it is to remove it fresh for use. Yet it is well for all local Boards to have the mode of removal under supervision, and subject to ordinance, if need be.

We now come to speak of the conditions of hotels and residences, as related to outside sanitary conditions.

We find at Cape May the structural provisions for water, for disposal of sewage, and for all that relates to outside sanitation, either good or capable of easy correction, and a Board of Health which comprehends its work far better than is usual. The chief lack is in the sanitary inspection and fitting of buildings—a lack common elsewhere, but especially needing attention at summer resorts. Buildings occupied but part of the year are especially exposed to insanitary disorders. Water is drawn off, so that all traps are emptied or left imperfectly sealed by foul water. The buildings thus become ventilators to the sewers, while the few that remain to care for them are usually totally

ignorant as to what constitutes sanitary care. Rats and rust do their work on the pipes. Thus walls are saturated with bad air, and no building is fit to be used, unless a *sanitary expert* and *an honest* and capable plumber have thoroughly examined it before re-occupancy. This is especially true if it has patent tubs, patent water-closets, and all the modern conveniences. We have examined here and elsewhere, many a hotel, in which the chief evil arose from the fitting up of its artificial systems. With such water-supply and delivery as Cape May possesses, and such sanitary care of buildings as might be had, it ought to be a health resort equal to any in the States. There is little danger from sewer-air in Cape May, save such as is made in the buildings. It will not be made or kept there, if thorough cleanliness is preserved, and if the machinery for indoor appliances is not as it usually is, defective. Although we have the record of facts in detail, we do not propose to speak of any hotels by name, either here or elsewhere, since they are so much alike, and since so many of them need some alterations, or the skilled oversight of a sanitary engineer. In many, traps are defective, fixtures are rusty and leaky, workmanship about them is imperfect, ventilators are not carried to the roofs, and there is no outside man-hole or other disconnection so as to allow all inside pipes to be flushed by currents of air. Even the school or trough-closet might, in many cases, well replace more elaborate constructions. The pan-closet, as we find it in most hotels, is very objectionable. It is not worth while to be fitting up contrivances which complicate and then call them health-preservers. These do not often originate specific diseases, but if such happen to be introduced from other places, these unfavorable accommodations provide for the extension and multiplication of cases. The principle which should apply to all inside conveniences where the delivery is by water-carriage, is that of regulated flushing by air as well as by water.

It is for this reason that with the exception of a single trap in the house to each basin, closet, etc., and one outside of the house and beyond an air opening, modern sanitary engineering is adopting fresh air as a disinfectant and discarding many of the artificial complications. If the Boards of Health of our summer resorts could, in addition to general oversight, have a skilled inspection of all hotels and boarding-houses early enough each season to secure right structural conditions, such places as Cape May could be even more fully guaranteed as to health and comfort. As it is, we find the Board of Health of this city intelligent as to its duties and efficient in its work.

Cape May Point is located about two and one-half miles from the city. It has no sewer system, but a water-supply similar to the gravel wells of Cape May. It is at present a healthy resort, but if growing, will still have to settle some questions of health care.

ATLANTIC CITY.

This growing summer and winter resort has a constant population of about seven thousand and claims a summer population of sixty thousand, more or less. It foundation is upon sand. This, in modern times, is not unsafe unless it leads to the false view that everything that soaks into the ground keeps on going in, and so will remove itself without any plan or aid from man. Mere strainers do not dispose of organic matter if it is very abundant. The present water-supply of the city, with the exception of a few wells, is by cisterns. These are mostly built above ground or only partly beneath it, and made of brick and cement. There has been some complaint that when not well protected they absorb gases, but in general the people regard the supply of water as good. This opinion is not so fully shared in by visitors. A company has been formed to supply the city with water from what is said to be an unexceptional source on the mainland—the pipes are already being laid. We think there is much need for this improvement, and that a full supply of good water is needed from a reliable and unfailing source. Next to this, cisterns properly built and properly cleansed are reliable. The city has no sewer or water-carriage system and does not at present contemplate one. The reason given is that it is difficult to obtain sufficient fall, and that they hope to be able to manage other systems. How to do this after water is introduced is not so clear. Now that one million of gallons of water can be raised a foot for about nine cents, we do not need to consider lowness of grades as an objection where there is an ocean or large creeks for discharge. No city on the coast can better afford to devise and execute a system in accord with the best sanitary engineering. The storm-water is partly conveyed off by wooden conduits which run out and discharge upon the meadows. The city will yet have to choose between a sewer system or an increase of filth. Fecal matter is mostly received in privies either above or below ground, according to the fancy of the owners. Two odorless excavating machines owned by private parties serve for the cleansing. While there are some rules as to emptying, and while complaints are heeded, there

is not such an administrative system as would be approved in any city of efficient sanitary police. In one hotel where a water-carriage system had been arranged, the management was anything but satisfactory. It is not impossible that the dry system might be a successful one. It can only be so where the form and condition of privy vaults and the modes of removal are regulated by ordinance and enforced by a sanitary inspector or police—with the most rigid accuracy—or conducted by the city itself.

The dry system as here attempted, leaves a large amount of liquid slops, kitchen drainage, wash-water, etc., to be disposed of by other methods. This is generally received into open cesspools, and what does not get out into the sand is carted off in wagons to a meadow, a mile from the city, where it is from time to time imperfectly composted. The carting is done by individual arrangement. Some avoid this by a succession of two or more cesspools and a more general discharge into the ground. Some of the residents speak with great confidence of the power of this loose sand to dispose of all liquid refuse. One of the most prominent physicians said that the soil is so loose that all liquid refuse is sure to percolate through the soil and find its way to the sea before any harm could be done. While, therefore, believing in general removal, he did not think a sewer system required, or that cesspools would do harm in this city for the next thousand years. Notwithstanding this, we found pits where bath-water without grease did not drain off from shallow vats, and where cesspools were full to the top with liquid filth. Grease tanks were not generally in use. While a method of interrupted irrigation might be practicable if done on a system, we failed to see that by any cesspool system, the ground could be permanently relied upon for safe disposal.

The garbage is disposed of by contract to parties who collect it, it is said in an unobjectionable way, and carry it in sealed packages or donigans to the country. The two districts into which it has been successively carried for the last two years, have protested, and now it is delivered to a market-gardener near Haddonfield.

In individual cases, we found great attention being paid to sanitary conditions—in some with measurable success—in others with great failures. The Board of Health is earnest in its endeavors. Public sentiment and the new Board are now attempting the solution of sanitary problems for which the present provisions are inadequate. The absence of structural arrangements for delivery can only be

compensated for by excellent administrative skill and oversight of cruder methods. Until this is reached, it is hoped the city may continue to realize its boasted salubrity. But with a great present and a hopeful future, it cannot afford to run risks which two or three English coast resorts on the sand did run and received the results.

VINELAND.

(Examined April 18th, 1882.) Vineland is a beautiful borough, in the township of Landis, Cumberland Co. The township has six thousand inhabitants. Although not on the sea, it is a favorite resort. Dependence for water-supply is upon wells, from twenty to thirty feet deep. The natural springs and water-bearing strata give a good quality of water. As it is not easy to secure any other water-supply except by cisterns, it is very important that the soil be kept free of all organic matter. Cesspools and privy-wells are too common. The cellars are, some of them, damp, notwithstanding the natural dryness of the soil. Many of the houses and stores are very close to the ground, so as not to give facilities for the ventilation of cellars.

The High School building is, in many respects, a model, and much attention is given to its sanitary condition. We visited a shoe and hat factory, in which there was evident effort to secure sanitary advantages for the workmen.

The borough, for riddance of all refuse, both liquid and solid of all kinds, stands much in need of a complete system under exact sanitary police. We think too much has not been said of the many advantages of Vineland. But we also think that until public opinion supports an efficient Health Board, and consents that all cesspools and privy-vaults, and their mode of emptying be regulated by some law, and put under the oversight of a sanitary inspector, the town will not, infrequently, have wells affected by organic matter, and the air of some of the houses not be as pure as it should be. Wells should be properly made, the upper parts cemented and raised above the ground, so that there should be no surface drainage toward them, and then the ground should be kept clean. This means that no refuse should be placed deeply in it, or be long heaped upon it, or be let to run into open cesspools, but rather that all offaling should be so distributed as quickly to aid plants, or else be carried away for more extended irrigation or composting. Since the examination made by the Board, public spirit has been greatly aroused, and no city of its size is more fully

comprehending or urging on requisite sanitary arrangements. We next pass to the more northern and eastern coast of the State, as next to the sea resorts already noticed, the most populous district.

The examination of the region known as the Highlands, so far as it is being largely occupied, shows the importance of taking full advantage of sanitary science and art before there is more rapid increase of population. In much of the excavation and filling up, there is need of close study of drainage. Already, some malaria has developed which is not natural to the locality. We have visited three of the localities to the north of the Hotel Bellevue—but, as they are comparatively new as summer resorts, we leave details as to them for a future report. As to all localities that are fronting the Sandy Hook peninsula, the owners should early settle as to permanent sources of water-supply, and the methods for delivery of sewage. The present use of Shrewsbury river as an open sewer-main, or the interposing of cesspools for occasional emptying into it, may not, as yet, affect the air or the stream. But close engineering and sanitary examination as to its capacity, its flow, its deposits, and its availability, present and prospective, should not be delayed. This is much better than false security on the one hand, or than those wild and denunciatory sanitary booms which break forth sometimes from a very little occasion by way of New York or Philadelphia. The vicinity of the Hotel Bellevue, while offering many advantages, illustrates how various hotels and localities near by must settle this question. As in another article we notice the outbreak of fever last summer at this point, we need not dwell upon it here.

Sea Bright, as a favorite locality near this, has already the water-supply of Long Branch. Many of the hotels and private cottages have appreciated the importance of early sewage delivery, or where compelled to use some form of cesspool have closely examined into methods. Much attention has also been given to adequate house plumbing. But the want of system of close house-to-house inspection each spring and fall by a local Board of Health, or by an approved expert, and the tendency there is to use cesspools, and to adopt devices sometimes more original than competent, needs to be carefully watched. Here, as elsewhere, it is the right of all those who stop at large hotels or summer boarding-places to have the sanitary conditions duly certified by something more than the earnest, and often honest but mistaken assurance of the proprietor. The same legislation which in cities, marks tenement-houses and emigrant-houses extra-hazardous, and passes

special laws as to them, should not overlook these public houses which crowd with inmates, and have often better facilities for reception than they have for the safe delivery of all contents. In all places where no sewer system has been adopted, it seems to us that the regulation of house sewage and all closets should be committed to a responsible local government, which should secure all necessary uniformity and insure healthful methods. While there has been much unintelligent assertion as to insanitary conditions, there is, and always will be, need of constant supervision in order to preserve for this coast its well-known salubrity.

LONG BRANCH.

The soil of Long Branch is mostly of clay, gravel and sand in successive layers. The general contour of the land is favorable to drainage, to which, however, little attention has been given. Not far to the rear of the sea-front there is a depression or small valley, through which a natural brook runs. Not only should this be kept entirely clear of all possible pollution, but in places the ground immediately adjacent to it should be drained and filled in. Instead of this there have been here and there removals of ground, so as to increase the overflow. Here, as in other seaside resorts, there is need of caution as to the causation of malarial disease by the careless handling of the earth in embankment, etc., and by imperfect drainage or the ponding of water at locations where there are no indications for artificial ponds. All local Boards of Health should have in thought and plan these questions, which are deeper and broader and more essential than to find out some special nuisance. It is for this reason that sanitary maps are very desirable which shall show the character of the soil, the natural water-courses, water-sheds and ponds, which shall note and record all underground structures, and show not only contour and topography, but in covered structures give the depths, gradients and other varied information such as is needful where questions of improvement or as to drainage, sewerage or structural conditions may arise. No place on the shore should be without a complete sanitary and contour map.

Water-supply. The general depth of wells is from ten to twenty feet, the water in some being soft, in others hard. Long Branch, however, has what seems a good water-supply from a brook about two miles distant, the water being raised to a reservoir and from thence distributed to the hotels and to most of the cottages. This fortunately

insures the people against the drinking of soil contaminations. It is not, however, so abundant as to warrant a supply for too many adjacent places.

Sewerage. Long Branch has as yet no system of sewerage. As a consequence, the cesspool system largely prevails. The methods are under the control of individual owners, except where the Board of Health has occasion to make complaint. The consequence is that the provisions are good, poor, bad or outrageous according to the conceptions of proprietors. In one case we found an ingenious device by which all slop-water is pumped up from a close tank daily, and flows by proper pipes to an iron perforated box several hundred feet out to sea. The plan seems thus far successful. The fecal refuse is voided in dry vaults, in which sand is plentifully used twice per day.

The garbage runs down a shoot into a brick white-washed vault, where it is received in a wagon and carted away. The whole plan is that of daily removal of everything except the privy deposit. This is treated on the earth-closet system on a large scale. At this hotel the remains of abandoned cesspools were both instructive and comforting.

Here and there, along the shore we found cesspools for filth storage of all kinds and degrees as to locality, numbers, and size. In one case, four in a row beginning near the house, and one receiving the overflow of another, while all allowed soakage into the ground. Three privy wells in succession did the same thing. In another case, the chief privy cesspool was only a few feet from the closets and the overflow cesspool a little further off. We saw one after another of these cesspools varying in degree and in badness according to the inventive arts of various proprietors. Most of them were of brick or of plank, and all provided for soakage. The boast of the landlords always was, that they are cleansed before hotels open each season, and that they are well covered during all the summer. Intermediate ventilation between those slop-ponds and the indoor arrangements was found to be the exception—pan-closets were used in most of the buildings. While we can conceive that under excellent management, these cesspools may be prevented from causing an outbreak of disease, and may be tolerated, yet we were glad to find many of the proprietors urging upon us the advocacy of a water-carriage sewer system. The time has passed when the leaky cesspool for towns and hotels system can be sustained. A sewer system is greatly needed at Long Branch, and, until provided, it is greatly to the interest of those who entertain summer visitors to provide a method of riddance similar to that to which we have at first referred. We are glad to know that the people

are aroused, and that the risks of last summer will not be repeated. Until some general system is adopted and a sewer system fully adequate and properly built is provided, there will be all the differences which individual management can devise. West End was found in its arrangements entirely similar.

No examination has yet been made of Elberon. Its relations of soil and water-supply are much the same, and its proprietors seem determined to secure for it the best sanitary advantages.

ASBURY PARK.

Asbury Park is located on a sandy soil, "with an underlying stratum of clay varying from seven to fifteen feet beneath the surface. The clay-bed is from three to seven feet in thickness, and is underlaid by a stratum of gravel." Ten years ago it was woodland, the forest being of pine and oak. It varies from a population of two thousand in winter to twenty thousand or more in summer. This fluctuation has great advantages and disadvantages, since it gives opportunity for important changes a part of the year, and by the sudden influx often causes evils that may be only in part incident to the locality.

The city ought not to thrive without a perfect system of sewerage and water-supply, and a method of sanitary inspection thorough and frequent. It has the advantage that it is largely controlled by a gentleman who is active and powerful in its sanitary interests, and by a Board of Health which secures sanitary administration. Its sewer system, now embracing over nine miles of pipe, discharges, by means of an intermittent tank, at a proper point into the ocean, and is flushed by waters from the lake. It needs close attention as to grade, and flush, and ventilation, but most needs a more universal connection of all permanent buildings with it. Strict ordinances are adopted and enforced as to the construction of privy-vaults where allowed, and cesspools are discouraged. The overflow of these vaults is into the sewer system. Deep drainage is being looked after at needed points. Surface refuse is looked closely after. Yet, such places cannot be too much impressed that summer success depends on such active, sanitary policing as prevents any accumulation of filth.

Wells are still depended upon, but it is expected that a water-supply will be speedily secured. Water from the soil cannot be permanently depended upon here. In the excavations and changes taking places the need of additional drainage cannot be overlooked, especially as holes or ponds are often made by careless removal of ground. It

is hopeful that its future is recognized as demanding important improvements.

One of its Health Board has recently said that if not another building should be erected for the next year, and the time be spent in putting all the property in the borough in perfect sanitary order, it would be a profitable investment for the future.

OCEAN GROVE.

Ocean Grove depends, for its water supply, on driven wells and lake-water. Like some of the other coast cities, it will need, in the near future, some other form of supply. It has a sewer system which delivers into ill-constructed tanks, but, before another season, some changes will probably be made.

The system of water-closet disposal is varied, and depends too much upon the will of each family, except where the nuisance becomes flagrant. The town should ultimately adopt either a public system of weekly dry removal, or connect all closets, both indoor and out, with a sewer system.

Ocean Grove is so much a camping-place for the summer, that to the parts thus occupied the strict rules of military sanitary police should be applied and executed by an inspector constantly on duty.

The system of garbage hogsheads in the form of cesspools should be entirely broken up.

Both examination and reliable testimony of residents and sojourners have satisfied us too much deference is paid to piecemeal plans and suggestions by those who, although very able in their respective callings, are not to be relied on in either sanitary construction or advisement. We expect to see this excellent location improving rapidly in sanitary methods and discipline, as well as in numerical prosperity.

Ocean Beach depends on driven wells for its water-supply, some of which are good and some of them poor. It has no sewers and its cesspool systems are objectionable. This fine locality ought, by sanitary improvements and administration, to be placed on a sanitary basis. At present every man doeth what is right in his own eyes.

New Brighton has not as yet developed any adequate system.

Spring Lake receives its water supply from the lake, which is a natural one, and which is carefully guarded from contamination. It is much superior to most of the seaside lakes, but it remains to be seen whether it will be sufficient and unexceptionable as there is increase and closer proximity of buildings. Most of our seaside resorts greatly

err in that all questions of water connection, sewage, etc., are not, from the start, regulated by ordinance. There are a few wells in use. The principal hotel carries its slop-water and liquid refuse by pipes to an inlet from the sea, where it has a satisfactory discharge. The privy vaults are well managed on a dry-closet system, the vault being high and easily accessible for the addition of dry earth or for removal. Some of the cottages depend on cesspools. It would not be difficult to arrange a system which would include all present buildings and serve as a plan for future additions.

Sea Girt. The soil is clay, gravel, clay and sand in successive layers. That part of the place nearest the Tremont Hotel depends upon driven wells about twenty feet deep and the water seems to be of an excellent quality.

The hotel has a combined privy and slop-water system with discharges into a wooden tank so carried out to the sea as to be satisfactory. The reliance for internal ventilation is upon a chimney. Most of the cottages depend upon cement vaults and dry removal, and upon cesspools for slop disposal. While we do not find any positive sources of evil at present, yet we do find want of uniformity of administration and absence of structural arrangements such as the patronizing public will ere long demand. The time is not far distant when it will not be sufficient for a proprietor to show his own admirable, unique and original contrivance, or for an association to pass rules and leave the administration to each owner. We were glad to find just one large establishment which had the whole building subjected to sanitary examination each year, in order to insure the perfect repair of every fixture and skilled examination of every contrivance. That part of Sea Girt represented by the Beach House has a natural well twenty-five feet deep of good water-supply.

The water-closet and slop systems are united and carried off by glazed pipes with intervening man-holes, in which there is a small settling basin and a trap made by the mode of inflow and exit. The waste goes finally to a distant wooden cesspool in the sand, designed to allow the liquid to soak away into the ground at a long distance from any dwelling. The plan answers well where there is only one building under good administration. Cottages are compelled to depend on systems of their own. The sewage was formerly carried into a stream, but those in the neighborhood of Squan raised such objections as to lead to the distant cesspool system. We found good fire escapes here, in which some of the hotels are very deficient.

Point Pleasant was not closely examined, but information as to its water-supply and sewerage shows it to be of much the same character as that of Bay Head.

Bay Head. The soil here is more largely sand than in the vicinity of Spring Lake. As the town extends, much salt meadow will be covered and its proper drainage should precede this. The present dependence for water-supply is upon cisterns or driven wells, which vary much in depth and quality.

The association controls the kind of privy-vaults and secures regular removal. The slop-water disposal depends upon cesspools. Here, too, there are important sanitary questions to be settled, to which expert attention is already being given.

In all these towns where no sewer system prevails, all depends upon a general system of ordinances, and their enforcement under the direction of a competent and honest sanitary inspector.

After a careful examination of some of the most prominent of our seaside resorts, we do not find sufficient ground for many of the extravagant and sensational reports which have been made. We do see many defects, but generally just such as are to be found in every summer resort which has grown into such rapid prominence as to lead to careless construction and arrangements. The most discouraging cases have been those where a local Health Board is unwilling to recognize real defects, and hopes to cover up negligence by boasting. A single year of adequate sanitary work, would place these resorts upon such a sanitary footing as a proper vigilance could easily maintain. Much defect arises from bad housekeeping, for which the keepers of hotels and boarding-houses are responsible. Buildings are not put in sanitary order as they should be at the close of each season. The thorough fall house-cleaning is often omitted, and the landlords either shut up all but their own apartments, or haste away with the boarders. Cesspools and outbuildings are left to be emptied just before the opening of the next season. All this work should be done in October or November, and only the necessary remainder be left for repetition in the spring. Visits made by us in April and May fully exposed some of these errors. If the advice of this board is heeded, as we believe it will be, the condition of our sea-side resorts will be greatly improved before another season, and our State as well as the especial localities share the benefit of a large influx of visitors, many of whom become permanently identified with the interests of the State.

SANITARY INSTRUCTIONS IN SCHOOLS.

Report of a Committee of the N. J. State Board of Health.

LABAN DENNIS, M. D., Chairman. FRANKLIN GAUNTT, M. D.,
EZRA M. HUNT, M. D.

In pursuance of a plan agreed upon by the State Board of Health, for securing in the public schools throughout the State, more adequate attention to instruction in physiology, hygiene, and sanitary science, with reference to the ultimate health and well-being of all the children and youth, and so, finally, of the whole population of the State, Drs. Dennis, Gauntt and Hunt were appointed a committee to look after this subject, and press it upon the attention of the authorities in charge of the educational affairs of the State.

The committee issued the following circular:

CIRCULAR AS TO SANITARY INSTRUCTION AND TRAINING IN SCHOOLS.

At its last session, the Legislature of the State of New Jersey, in Chap. CLXV., Sec. 2, enacted the following provision:

And be it enacted, That the State Board of Health shall be directed to confer with the trustees of the State Normal School as to definite instruction to be given in the practical care of the health of teachers and pupils, and as to provisions for such instruction.

At a meeting of the New Jersey State Board of Health, held at Trenton, the subscribers to this circular were appointed a committee to endeavor to secure in the public schools of this State such instruction in physiology, hygiene, and sanitary science and practice as shall most efficiently carry out the objects for which the Board was established, viz., the health, the happiness, and the prosperity of the people of the State. To this end, we appeal most earnestly to all who are interested in the educational work of this State. State and local Boards of Education, trustees of the State Normal School, of colleges, academies, seminaries, and of local districts, State, county, and city superintend-

ents, principal, and teachers in all our institutions of learning, are asked to consider most seriously, and aid most effectually in instituting and carrying out a scheme for such instruction as we have indicated.

We would call your attention to the fact that the primary object of the public school system of the State is to secure good citizenship. There can be no complete citizenship without a knowledge of and obedience to the laws of one's own being and the laws of society—civil, sanitary, and social. With these, it is safe to say, we shall secure among all classes of the community the best health, the highest productivity—moral, intellectual, and physical—and the greatest amount of well-being and happiness. We would remind you that, hitherto, the laws of one's own being and those of communities, constituting the great body of facts known as hygiene and sanitary science, have been very much neglected in the usual course of public instruction in this State. Thus the young have been permitted to grow up exposed to all the dangers to life and health which follow inevitably the disobedience of Nature's laws.

Is it not practicable that some of the time now spent in teaching branches of knowledge indirectly or remotely serviceable to the learner, might, more profitably to the pupil and to the State, be devoted to imparting such knowledge as must needs be practically useful every day and hour of one's life?

Is it not equally evident that the kind of knowledge which contributes directly to the maintenance of health and vigor of body and mind, the prolongation of life, and the fullest development of all the faculties in a complete and perfect manhood and womanhood, must be second in importance to none other?

If this be true, is it not equally clear that instruction in such should be as systematically and thoroughly given in all grades of schools, as upon any other subject? Admit these propositions and you will agree that we need to modify, as speedily as possible, our scheme of education.

It need hardly be said that the change, to be effectual, must be radical. Teachers must be, themselves, taught. Should not the Normal School begin this work soon and thoroughly? Teachers' Institutes should make it a prominent part of each meeting. State, county, and city Superintendents should unitedly bring to bear all their influence to secure it a place in the regular course of study in the schools under their charge, and to stimulate the teachers to give their best efforts to make it as thoroughly practical as it will be intensely interesting when

properly pursued. Boards of trustees, upon whom now devolves the duty of determining the studies to be pursued in their respective districts, should at once take steps to introduce this, the most important of all, into the course, and by faithful oversight see that it is adequately and properly taught. Not by occasional lectures here and there before bodies of teachers, not by bits of advice to pupils on the part of well-meaning and well-informed teachers can this work be properly done, but only by systematic, oral, and text-book instruction, as faithfully and persistently pursued as possible, and adapted to the ages and capacities of the pupils. It need hardly be said that the subject is broad enough and deep enough to engage the profoundest thought of the foremost scientific minds of the world; yet its facts are the facts of every-day life, many of them so simple, so clear, as to be readily taught and practiced.

With this instruction, so adapted to all ages and capacities, we would combine physical exercises, varied, beautiful, and practical, fitted to develop the bodies and strengthen the minds of the growing pupils. Thus they will secure, as the limited time they have been under training will allow, knowledge immediately serviceable in the battle of life, and bodies well fitted to put it to practical use.

The board will cheerfully furnish names of text-books suited to various grades of schools, by means of which a beginning in these subjects may be made, and when once introduced the demand for adequate instruction will, as in England, produce multitudes of works, from which the teacher may select those best suited to inculcate this needful knowledge, and to train pupils in its practice.

Trenton, August 21st, 1882.

L. DENNIS,
F. GAUNTT,
E. M. HUNT,
Committee.

Copies of this circular, besides being distributed to school officers, were sent with a note soliciting earnest attention thereto on behalf of the committee, to each member of the State Board of Education, the Trustees and Principal of the State Normal School and the State Superintendent of Public Schools.

In order to be able to answer more fully and intelligently inquiries as to text-books and other apparatus suitable for carrying on this work, the circular note herewith appended was addressed to all the prominent educational publishers in this country advertising works

on anatomy, physiology, hygiene, sanitary science and gymnastics for schools.

GENTLEMEN—The committee of the State Board of Health issuing the accompanying circular, desire to call your attention to the last paragraph thereof, and would be pleased to examine specimen copies of your publications on physiology, hygiene, gymnastics and sanitary science for schools, with reference to a recommendation of the best for use throughout the State.

Yours respectfully,

L. DENNIS,

Chairman.

The responses to this note were very general and entirely satisfactory, as showing liberality on the part of publishers, and a most creditable exhibition of material excellently well suited to all the purposes of instruction in these subjects, from the primary school to the college. A classified list of those received is herewith given, with the name of the author and publisher, and a very brief mention of some of the points of value in each. We have examined likewise a number of English works the text of which is often excellent, having been used in some cases as the basis of our own. In fullness and perfection of illustrations our publishers take first rank. Special mention should be made of the work of Mrs. Charles Bray, "Physiology for Schools," published by Longmans, Green & Co., London, as a very readable and instructive book for teachers of primary classes.

ANATOMY, PHYSIOLOGY, AND HYGIENE.

PUBLISHER.	TITLE.	AUTHOR.	REMARKS.
Am. School Book Co., St. Louis.	First Lessons in Physiology	C. L. Holze	A good work for beginners.
D. Appleton & Co., N. Y.	Physiology	M. Foster	A science primer to be read to beginners.
" " "	Physiology and Hygiene	T. H. Huxley and W. J. Youmans.	A most excellent book for students somewhat advanced.
Clark & Maynard, N. Y.	" "	J. C. Hutchison	A very suggestive and valuable book.
Eldredge & Brother, Phila.	Anatomy, Physiology, and Hygiene	J. C. Martindale.	A clearly-expressed, compact work.
J. L. Hammett, Boston	Outline Physiology	A. F. Wood	A summary for children under twelve.
Harper & Brothers, N. Y.	Physiology and Hygiene	J. C. Dalton	An excellent work.
H. C. Lea, Phila.	Anatomy and Physiology	H. Harkshorne	A very good book for advanced students.
J. B. Lippincott & Co., Phila.	Second Book on Anat'y, Physiology, and Hygiene.	C. Cutter	Enriched by comparisons with all animal life. Teachers should consult this.
Porter & Coates, Phila.	School Physiology	R. J. Dunglison	Full of good things, clearly expressed and well illustrated.
G. P. Putnam's Sons, N. Y.	Animal Physiology	J. M. Fothergill.	A good book for beginners.
" " "	Elements of Animal Physiology	J. Angill	A clear, concise, and serviceable book for middle-grade pupils.
" " "	Animal Physiology	J. Cleland	An admirable work for advanced students.
Sheldon & Co., N. Y.	Hooker's New Physiology	W. Hooker and J. A. Sewall	Style easy, natural, and attractive.

HYGIENE.

P. Blakiston, Phila.	Healthy Homes	G. Wilson and J. G. Richardson.	Full of excellent material for the teachers and pupils.
" "	Bible Hygiene	A Physician	A summary of the health-hints of the Bible, and other authorities.
Macmillan & Co., N. Y.	School and Industrial Hygiene	D. T. Lincoln	Full of good counsel for teachers.
" "	First Lessons on Health	J. Berners	A manual of simple instruction for the young.
G. P. Putnam's Sons, N. Y.	The Maintenance of Health	J. M. Fothergill.	A most valuable work; should be in the hands of many teachers and parents.
P. Blakiston, Phila.	Easy Lessons in Sanitary Science	J. Wilson	A manual of practical hints.
G. P. Putnam's Sons, N. Y.	Hampton Tracts for the People	Various Authors.	Full of excellent advice and instruction.
" " "	First Book of Knowledge	F. Guthrie	A compend of information about materials used in arts and manufactures, incidentally helpful in teaching sanitary science.

GYMNASTICS.

Cowperthwaite & Co., Phila.	Vocal and Physical Training	L. B. Monroe	Particularly adapted for chest and voice culture.
E. Steign & Co., N. Y.	Hand-Book of Calisthenics and Gymnastics	J. M. Watson	A complete manual on elocution and gymnastics, well illustrated and admirable.
" " "	Manual of Calisthenics	" "	Selected from the above.
Van Antwerp, Bragg & Co., Cin.	Manual of Free Gymnastic and Dumb Bell Exercises.	J. H. Smart	Well adapted for beginners.

SECRETARY'S SUMMARY OF REPORTS

FROM LOCAL BOARDS OF HEALTH, WITH EXTRACTS AND COMMENTS.

The following townships and cities have either in this or previous years notified us of the formation of local Boards of Health under the law of 1880, or its supplements.

ATLANTIC COUNTY.

Absecon, Atlantic City, Buena Vista, Egg Harbor City, Egg Harbor Township, Galloway, Hamilton, Hammonton, Mullica and Weymouth.

BERGEN COUNTY.

Englewood, New Barbadoes, Saddle River, Lodi, Palisade, Union, Midland, Ridgewood and Washington.

BURLINGTON COUNTY.

Beverly City, Bordentown, Burlington City, Chester, Chesterfield, Cinnaminson, Easthampton, Evesham, Little Egg Harbor, Lumberton, Mansfield, New Hanover, Northampton, Pemberton, Randolph, Southampton, Springfield and Washington.

CAMDEN COUNTY.

Camden, Centre, Delaware, Gloucester Township, Gloucester City, Haddon, Merchantville Borough, Stockton and Winslow.

CAPE MAY COUNTY.

Cape May City, Cape May Point, Lower, Middle and Upper Townships.

CUMBERLAND COUNTY.

Bridgeton, Deerfield, Fairfield, Greenwich, Hopewell, Landis, Maurice River, Millville, Stoe Creek and Vineland.

ESSEX COUNTY.

Belleville, Bloomfield, Caldwell, Clinton, East Orange, Franklin, Livingston, Millburn, Montclair, Newark, Orange, South Orange and West Orange.

GLOUCESTER COUNTY.

Clayton, Franklin, Greenwich, Glassboro, Harrison, Mantua, Monroe, West Deptford, Woodbury and Woolwich.

HUDSON COUNTY.

Bayonne, Harrison, Hoboken, Jersey City, Kearny, North Bergen, Town of Union, Union, Weehawken and West Hoboken.*

HUNTERDON COUNTY.

Delaware, East Amwell, Franklin, Frenchtown Borough, High Bridge, Holland, Kingwood, Lambertville, Lebanon, Raritan, Readington, Tewksbury, Town of Clinton, Union and West Amwell.

MERCER COUNTY.

Chambersburg, East Windsor, Ewing, Hamilton, Hopewell, Lawrence, Princeton, Trenton, Washington and West Windsor.

*NOTE.—The Hudson County Board of Health has general jurisdiction, and these are only auxiliary thereto.

MIDDLESEX COUNTY.

Cranbury, East Brunswick, Monroe, New Brunswick, North Brunswick, Perth Amboy, Piscataway, Raritan, Sayerville, South Amboy, South Brunswick and Woodbridge.

MONMOUTH COUNTY.

Asbury Park, Eatontown, Freehold Township, Town of Freehold, Holmdel, Howell, Manalapan, Marlboro, Matawan, Millstone, Neptune, Ocean, Ocean Grove, Raritan, Keyport, Shrewsbury, Red Bank, Upper Freehold, Wall and Manasquan.

MORRIS COUNTY.

Boonton, Chatham, Chester, Dover City, Jefferson, Mendham, Morris Township, Morristown, Mount Olive, Passaic, Pequannock, Randolph, Rockaway, Roxbury and Washington.

OCEAN COUNTY.

Berkeley, Eagleswood, Jackson, Lacey, Plumsted and Stafford.

PASSAIC COUNTY.

Acquackanonck, Manchester, Passaic, Paterson, Pompton, Wayne and West Milford.

SALEM COUNTY.

Lower Alloway's Creek, Lower Penn's Neck, Mannington, Pilesgrove, Quinton, Salem City, Upper Penn's Neck, and Upper Pittsgrove.

SOMERSET COUNTY.

Bedminster, Branchburg, Bridgewater, Franklin, Hillsborough, Montgomery, North Plainfield and Warren.

SUSSEX COUNTY.

Andover, Byram, Frankford, Greene Hardyston, Montague, Newton, Sandyston, Sparta, Stillwater, Vernon and Wantage.

UNION COUNTY.

Clark, Cranford, Elizabeth, Fanwood, Linden, New Providence, Plainfield, Rahway, Springfield, Summit, Union and Westfield.

WARREN COUNTY.

Allamuchy, Belvidere, Franklin, Frelinghuysen, Greenwich, Hackettstown, Hardwick, Harmony, Knowlton, Lopatcong, Mansfield, Oxford, Phillipsburg, Town of Washington and Washington.

All of these are organized under the more recent laws, except Camden, Newark and Plainfield, which make report, but still act under their respective charters.

We thus have had, in all, reports from two hundred and thirty-one local Boards of Health, which, although differing much as to their efficiency and as to their reports, have done much in the care of the public health.

The few townships that have not formally organized, should remember that, in case of any nuisance or any sudden outbreak of disease, the citizens will have ground of complaint, if there has not been such organization as will admit of ready service. Although in townships, each new township committee does not need to re-organize in form, there should, at least four times a year, at regular meetings, be inquiry as to health matters and attention to special causes for action, as may be needed. Those townships which have not formally organized their Health Boards, nevertheless, can be compelled to act as such under Chap. CLV., Sec. 3, 1880:

3. *And be it enacted*, That in each township of the State outside of city limits, the township committee, together with the assessor and the township physician, if there be such an officer, shall constitute the Board of Health for all of said township outside of any city limits, and shall have the same powers as are possessed by any city Board of Health within the State, so far as they could relate to any unincorporated district.

The following suggestions are made to local Health Boards:

SUGGESTIONS TO HEALTH BOARDS.

In addition to other directions, to be found in this and other yearly reports of the State Board, it may be added—

I. Let each township committee, at its usual meetings, when the assessor is present, sit also as a Health Board and enter the fact in the township health book, together with any item of business.

II. Whenever new officers are elected, there should, at the first meeting, be an entry in the health book of the names of the Health Board as thus made.

III. Where there is no township physician as a member of the Board, some of the Boards have invited some adjoining physician to act as their adviser, but it is better to elect a medical member.

IV. Carefully examine all laws relating to the construction of local Boards and their duties. Correctness and promptness of action are most important. The failure of a law is oftener in delay or mistakes in its administration, or in technical errors, than in the defects of the law.

V. The reports of the State Board of Health, as sent, are not the property of individuals, but of the Board. The keeper of the town health book should keep control over them, and see that when loaned to others, they are returned to him, and passed over into the hands of the succeeding officer.

VI. We ask the same promptness in future annual reports as in these, and that the few who have failed to organize, or to make full report, will fully arrange at the first meeting of the township committee, and notify us.

VII. As the returns of marriages, births and deaths so much indicate the progress and health of communities, and are essential in the study of local conditions, all Boards should insist upon prompt returns, and report to the Secretary of State any omissions. It is, too, the legal right of every citizen to have such a record. Any neglecting returns are liable to suit at law.

VIII. All communications should be addressed "State Board of Health," or "Bureau of State Vital Statistics," State House, Trenton.

IX. You need carefully to consult the references contained in this report to laws, circulars, etc. While the supplement of 1881, Chap. CLV., does not repeal any part of Chap. CLV., Laws of 1880, yet as Sec. 5 more closely defines the methods of summary proceeding, it is best for city and borough Boards of Health, and also may be well for township,

to adopt ordinances in accord with the supplement and publish the same. And it is always at the option of a Board of Health and a question of advisement whether to proceed by complaint before a grand jury and by the common law as to nuisances, or by seeking injunction, or under special acts. When the nuisance is of such immediate peril as to require summary abatement, these special laws are directly applicable.

See, also, Circular XXI., Fifth Report (1881), pages 184–188.

We do not need, this year, to repeat the names of all Boards which have reported, but shall make a summary or selection only from such as refer to points of especial public interest. In some cases, for brevity, only the substance of the report is given and not the exact language.

ATLANTIC COUNTY.

ATLANTIC CITY. - *Report from* THOMAS MCGUIRE, *Secretary.*

The water-supply is chiefly by cisterns, although we have an abundance of water introduced from the mainland.

The drainage is done chiefly by eight sewers, running across the city and emptying into a drain on the meadows, provided for that purpose. Council is now preparing to build one or more sewers of brick and stone clean across the city. The low lots are being filled up to city grade.

We continue to dispose of our garbage and effete matter the same as last year, viz., by shipping it to the farms on the mainland. The most important function of the Board of Health is that concerned in the investigation and suppression of nuisances, which come under their notice frequently, many of which are of a complicated nature, involving patient investigation and assiduous care in their management. The time has arrived for energetic measures, and the city government and property-owners feel their responsibility; the city government has made liberal appropriations for the improvement of streets and sidewalks; the property-owners are paying more attention to, and are busily engaged in, filling to grade low lots. More attention is being paid to drainage, and, if things go on as commenced, I am satisfied that there will be great improvement in this city and surroundings by another year. There does not seem, nor has there been during the season, any prevalent disease. We have had but few deaths since my last report. We have not only good water in our cisterns, but an abundant supply of good and pure water from the mainland, which is a great convenience and a protection against fire.

HAMILTON. - *Report from* D. B. INGERSOLL, M. D., *May's Landing.*

The report complains that, while the law as to vital statistics is well complied with, physicians are not accurate enough in stating the cause of death. Also, that there is need of a more stringent law regulating practice, so that only those who are regularly graduated shall practice, and mere time of practice shall not be a test.

The report adds, We would also call your attention to the fact that the law requires the Board of Health to abate nuisances, without giving them the means to do it. Thus, if it notify the owners of land to abate a nuisance detrimental to the health of the people, or they will proceed to do so and charge to owner, where will the pay come from, if the owner refuses to pay? or where can we procure funds to conduct a suit for damages? We think some legislation in this direction is called for.

We cannot but again call your attention to the evil to the youth of our land, and we may truly say the growing evil, because of the use of tobacco in its various forms, entailing, as it does, upon the future men and women all the terrible consequences of this habit. We think that legislation should be recommended by the State Board of Health to prohibit its use or sale to those under a certain age.

Other reports of the county note no special defects and no unusual sickness.

BERGEN COUNTY.

ENGLEWOOD. - - - *Report from* J. W. TERRY, M. D.

There can be no doubt that the malarial diseases prevalent in the lower parts of the town are largely, if not exclusively, due to the low, imperfectly drained meadow-land lying by the side of the railroad, and extending to the Hackensack river, and known as "the swamp." A dam across the mouth of Overpeck creek seriously interferes with the natural drainage of these meadows, as also does the railway embankment with the low lands lying directly to the east of it. A petition, signed by a large number of prominent citizens, is now before the Court of Common Pleas for Bergen county, asking for the drainage of these meadows, under the provision of the State law of 1881.

There is no general system of sewerage in Englewood, although there are a few lines which give relief to a few localities—the principal one, about two thousand feet long, runs from the corner of Engle

street and Palisade avenue, through the latter street to William street, and thence to Overpeck creek at the Englewood avenue crossing. The prime necessity, however, without which little can be done in the way of sewerage, is a main sewer or canal, to serve as an outlet from the town to tide-water, and into which all lesser sewers can empty.

SADDLE RIVER. - *Report from* JOHN E. KIPP, *Dundee Lake.*

The report notices a much less prevalence of malaria than the previous year.

UNION. - - *Report from* G. K. ALYEA, *Rutherford, N. J.*

Have had but one case of small-pox, provided for by the Board of Health. Every person willing to submit has been vaccinated. There was vaccination of children, by order of the Board. The spread of small-pox, during last winter, was no doubt checked by this timely provision. Only three persons died.

BURLINGTON COUNTY.

CHESTER. - - *Report from* WM. NEWTON STOKES, M. D.

The report notices a decline in the malarial fevers which had occurred during a former year, although many cases had occurred in adjoining townships near the river. Moorestown, both because of its porous and absorbent soil and its high elevation, had good drainage and usually excellent healthfulness.

CAPE MAY COUNTY.

CAPE MAY CITY. - *Report from* C. S. MAGRATH, *Cape May.*

In relation to drainage and sewerage: Much has been done the past year towards perfecting the drainage facilities of the Island, and about $15,000 have been expended by the corporation alone. The defects of sufficient fall in some cases have been remedied, and in others, sewer-mains have been enlarged and extended. A few cases of sickness, traceable to the defects in the sewerage and undrained area under one of the large hotels, have been reported, and measures at

once adopted for remedying the same. The prevalence of malaria, which has attracted so much of public attention to our summer resorts, has, by no means, been strikingly noticeable here, the total number of cases reported not exceeding half a dozen.

(As the water-supply and sewer-system is described in another connection, we do not need to quote the rest of the report.)

MIDDLE. - - - *Report from* S. H. TOWNSEND, *Sec'y.*

The only nuisance reported to the Board was the county jail, situated at court-house. The ventilation from the privy became clogged, and the four inmates became sick or nearly so. The chairman of the Board notified the committee on public buildings (freeholders) to have it attended to immediately, which was done, and now it is all right.

CAMDEN COUNTY.

CENTRE. - - - *Report from* F. E. WILLIAMS, M. D.

Malarial fever is noticed as having been somewhat in excess the last year.

HADDON. - - *Report from* J. STOKES COLES, *Haddonfield.*

There is a custom quite generally followed by persons building new houses in Haddonfield, of having stationary wash-stands and water-closets in their houses, which, together with the pump-trough, drain into wells from twenty to sixty feet from the house; the privies also have wells. As our drinking water is derived almost entirely from wells, there will surely be trouble in the course of time, unless people are *compelled* to have *cemented* sinks which can be emptied as occasion requires. So far the drinking water of Haddonfield has been excellent.

GLOUCESTER.—There has been an unusual prevalence of malaria in this township, especially in the vicinity of some stagnant ponds.

CUMBERLAND COUNTY.

FAIRFIELD. - - - *Report from* DR. S. M. SNYDER.

An extended account is given of an outbreak of typhoid fever affecting four members of one family, the first occurring in a girl who

was first sick two weeks in Camden. No local cause is known, and it is claimed that the family had before shown a strange predisposition to fever.

ESSEX COUNTY.

BLOOMFIELD. - - - *Report from* J. K. OAKES, *Sec'y.*

The prevailing diseases are the various forms of malaria from July 1st, 1881, to July 1st, 1882. No especial sickness from July 1st, 1882, to date. Whilst making the above statement of diseases we consider our town more healthy and less subject to malarial fever than some of our neighboring towns in this county.

We are expecting next year to have the aid of an association recently formed for the improvement of the town, who, by making suggestions and counseling with the Board, may help us in the abatement of nuisances and thus improve the health of the place.

EAST ORANGE. - - - *Report from* JOHN L. ROBERTS.

There is no public drainage system. The Waring system is used in some private places, which seems to work satisfactory. Brooks are not used for sewage matter, but once in a while we catch a pipe running in and stop it.

MILLBURN. - - - *Report from* ISAIAH WILLIAMS.

There have been some complaints from individuals against what is called Condit's pond, also the head-waters of what is called Factory pond. Dr. Whittingham sent a communication in reference to the former to the Board of Health, but three members refused to organize as a Board of Health in order to consider it. There has been no meeting of the Board of Health this year. Cause, as above. I make this sinple statement because I look upon it as a duty.

It is the purpose of our neighbors, Springfield township, to endeavor to have a law passed at the next session to abolish Factory pond—straighten and widen parts of the Rahway river. This is an improvement I endeavored to interest the people in over ten years ago. It is without question a matter of very great importance to the health of a large district, embracing a part of three townships.

ORANGE, - - *Report from* T. W. HARVEY, M. D.

The Board of Health for the current year is constituted as follows: Geo. H. Hartford, Mayor; Aldermen, Wm. Wang, Chairman, Christopher M'Cullough, James Young; Wm. M'Chesney, Health Inspector; Thos. W. Harvey, M. D., City Physician and Secretary.

The Board of Health have little to add to the report of last year. The regular inspections have been made as usual; every year less difficulty is met with in persuading citizens to keep their premises in order.

We have had our usual difficulties with the small brooks running through the town; although the discontinuance of the use of the brooks as sewers for cesspools and vaults has ameliorated their condition to some extent, they still receive a great deal of refuse that cannot be prevented from flowing into them until there is provided an efficient sewerage system.

The water-supply question is rapidly approaching solution. There has been organized a Water Board, which has given out the contracts for the city, and for making the necessary reservoirs, &c.

The source of supply is the west branch of the Rahway river. The water is to be taken at a point where the supply from a water-shed of five square miles can be collected in a large reservoir. The water is to be conducted by iron pipes around the mountain to the city limits, a distance of six miles, by gravity. The water-shed is one particularly well fitted to supply pure water. The soil is rocky, the land principally used for grazing purposes and thinly populated. The water comes, principally, from the trap-formation, and the stream is free from factories and other nuisance-breeding establishments. The steps that led to the present condition of affairs, are interesting.

In the autumn of 1878, an organization was formed, called the "Citizens' Health Association of the Oranges, Bloomfield, and Montclair." Its objects were, the spreading of information about, and exciting an interest in sanitary reform among the people of this section. Its operations were confined mainly to Orange and East Orange. It lived two years, and when its mission seemed fulfilled, it died. Its work, however, lived after it.

During these two years, it had frequent meetings, and was addressed by many speakers well known in sanitary circles, on the subjects of water-supply, sewerage, and of house sanitation. Its committee on water-supply during its study of this problem, discussed the following sources of supply:

1. That Orange, in common with the other towns, should take its supply from the Passaic at Little Falls.

2. That the city should be supplied by the driven-well system (under the Green patent) from a low part of the town, northeast of the city proper.

3. That shallow wells should be sunk in the same neighborhood, and that a reservoir be formed from whence the water could be pumped to a stand-pipe.

4. The Peckman river, a tributary of the Passaic, between the first and second mountains.

5. The west branch of the Rahway in the same valley. These sources were studied carefully, and propositions were received from engineers for obtaining a supply from some of them. But the minds of the people were not yet awake to the necessity.

In the winter of 1880, the New England Society joined the Health Association in the agitation of the subject. In the summer of 1880, appeared the advertisement of the sale of the charter of an old water company. This attracted the attention of the gentlemen who had been on these committees, and they bought it in, and formed the Orange Water Company. This company now took up the question in a more practical manner, and at the end of a year, presented a proposition to the authorities of Orange and East Orange, to supply them with water from the west branch of the Rahway if the two towns would guarantee a certain income by agreeing to hire a given number of hydrants. If only one town could accept their proposition, they proposed to obtain their supply from wells, until they could afford to go to the Rahway. These propositions created a great deal of discussion, and at a public public meeting held a month or two later, in Orange, it was determined by the town authorities to appoint a committee to see if there were not other sources of supply. This was the first move made by the authorities of Orange, for several years, in the matter of water-supply.

This committee accordingly worked over the same old ground, and in addition it was suggested to them to obtain the water from one of the brooks running down the east side of the mountain. This seemed so feasible and so cheap that the committee reported in favor of it, and the Common Council submitted the question of bonding the town for water works to the people at a special election. Water carried the day.

This gave the city government the first opportunity that they had for spending any money in the investigation of the subject. The committee again took up the subject, this time with the advice and assistance of capable engineers, and they reported a second time in favor of the present scheme. A Water Board was accordingly organized, the bonds issued, and the matter awaits now the decision of the courts as to the water-rights and privileges.

In East Orange, in the meantime, the proposition of the Water Company has been accepted. They have nearly all their pipes down and expect to pump water through their pipes by the 15th of October. Their source of supply is a series of wells in the eastern part of the township.

During the year the Orange Memorial Hospital completed their new building. It has a capacity of forty beds. The plan is as follows: A brick administration building three stories high. The first floor has committee, consultation, operating and dining-rooms and a pharmacy. On the second floor there is a children's ward, a gynæcological ward, private wards and a matron's room, with bath-room, &c. The third floor is devoted to the nurses and servants and storage, with an available ward if it is needed. Connected with the main building is a two-story wooden pavilion, with a male ward below and a female ward above. This building has a capacity for twenty-six beds. It also has nurses' rooms on each floor and bath-rooms and water-closets, with accident ward on the first floor.

The kitchen is a one-story wooden addition to the main building, connected by a corridor. On the same lot is a dispensary building, a dead-house, a laundry, and an isolated pavilion.

The medical staff consists of eight attending physicians and a non-resident house physician. The nursing is in charge of a trained nurse, under whom are the pupils of the training school recently established in connection with the hospital.

During the last twelve months, many patients have been treated in the hospital, and in the outdoor department.

The chief work accomplished by the Board of Health this year has been the following ordinance:

A further supplement to an ordinance entitled "An ordinance establishing the Board of Health of the town of Orange," approved May twelfth, eighteen hundred and sixty-five.

Be it ordained by the Common Council of the city of Orange, as follows:

1. Every physician, or person acting as such, who shall have any patient, within the limits of said city, sick with scarlet fever or

diphtheria, shall forthwith report the fact to the Health Inspector of the said city, together with the name and age of such patient, and the street and number (or other location) of the house where such patient is being treated; and, in default thereof, shall forfeit and pay twenty dollars for each and every such offence.

Passed July 10th, 1882. HORACE STETSON, *City Clerk.*

Approved July 12th, 1882. GEO. H. HARTFORD, *Mayor.*

The following circular was issued:

ORANGE BOARD OF HEALTH, July, 1882.

DR..... .....

DEAR SIR—Your attention is respectfully called to the following ordinance, passed at the last meeting of the Common Council:

A further supplement to an ordinance entitled "An ordinance establishing the Board of Health of the town of Orange," approved May twelfth, eighteen hundred and sixty-five.

Be it ordained by the Common Council of the city of Orange, as follows:

1. Every physician, or person acting as such, who shall have any patient, within the limits of said city, sick with scarlet fever or diphtheria, shall forthwith report the fact to the Health Inspector of the said city, together with the name and age of such patient, and the street and number (or other location) of the house where such patient is being treated; and, in default thereof, shall forfeit and pay twenty dollars for each and every such offence.

Passed July 10th, 1882. HORACE STETSON, *City Clerk.*

Approved July 12th, 1882. GEO. H. HARTFORD, *Mayor.*

When the Health Inspector has received the notice he will notify the Superintendent of Public Schools that the house reported is infected, and that no pupils from the infected house must be allowed to attend school until the house is reported free from disease by the medical man in charge or by the Health Inspector. In this way it is hoped that we may remove one of the most active agencies for the spread of these diseases.

Arrangements will also be made with the teachers of private schools

by which they shall receive information of the existence of these diseases among their pupils.

It is earnestly hoped that the medical profession will assist the Board of Health in their efforts to restrict the spread of these diseases in our midst by sending their reports to the Health Inspector as soon as they have cognizance of any cases of these diseases.

Blanks will be furnished by the Health Inspector upon which to make returns, and may be obtained by application to him by mail.

By order of BOARD OF HEALTH.

During the autumn of 1881 we had a great many fatal cases of diphtheria. During the four months ending December 30th there were twenty-one deaths; since January 1st there have been eleven deaths—most of these occurred during May and June.

From February to August we had scarlet fever prevailing. In many cases there was great malignancy. There were in all thirty-three deaths. It prevailed chiefly in the crowded neighborhoods and on the low grounds where the mechanics and laboring classes live.

Of typhoid fever we had very little, four fatal cases during the year.

Respectfully submitted,

THOS. W. HARVEY, *Sec'y*

SOUTH ORANGE. - - *Report from* A. A. RANSOM, M. D.

Have moved a large dam early in the spring, letting the water in branch of Rahway river flow through and not back up in the village. It was done under the State law.

GLOUCESTER COUNTY.

GLASSBORO. - - - *Report from* JOHN E. PIERCE.

It had eleven cases of small-pox and found it necessary to build a small-pox hospital.

GREENWICH. - - - JOHN STETSON, *Paulsboro.*

The slaughter-house in Paulsboro is situated within one hundred yards of the main street, and is surrounded on all sides by dwellings.

It is in contemplation to thoroughly drain the main street in Paulsboro. There is a marked improvement in the sanitary condition in our township during the past year by the abatement of nuisances under legal notice and inspection.

MONROE. - - *Report from* J. G. EDWARDS, M. D.

The principal diseases are consumption and malaria. The latter was almost unknown till within the last two years, and during last autumn it assumed such alarming form as to cause the local Board of Health to take active measures in sanitary precautions.

Consumption is the most prevalent of all human diseases, and each year it claims its annual holocaust of victims, and its prevalence does not seem to depend upon hereditary influences.

The principal vocations of industry are glass-blowing and sewing. The women engaged in city sewing on their machines suffer from this disease very much more than the males in glass-blowing.

HARRISON. - - *Report from* E. D. DE GROFF, M. D.

The report says there has been an increase of malarial diseases in Harrisonville, although it is not attributed to the mill-pond near by. A nuisance caused by a slaughter-house was, on complaint, abated.

A contagious disease among poultry has proved very fatal.

HUNTERDON COUNTY.

WEST AMWELL. *Report from* GEO. H. LARISON, M. D., *Lambertville.*

The general health has been good, except in one mile of the township which borders on the Delaware river. Here, nearly every one within a third of a mile from it has had chills and fever.

LEBANON. - *Report from* A. T. BANGHART, *Glen Gardner.*

Refuse is very carelessly thrown in the streets and not very far from the dwellings. Excreta is not properly disposed of, and disinfectants not generally used. Privies in the towns of Glen Gardner and Junction are not in as cleanly a condition as could be desired. In both places malaria and typhoid have existed to a greater extent

than ever before. Its cause, considering the high and healthy location of the country, is difficult to ascertain. (!) Complaint has been made that a mill-race running through the town, has been used as a place for depositing refuse and excreta by those residing along its banks. Most of the cases are near it, except at Junction, where physicians are at a loss to give any solution of the problem.

Six cases of typhoid fever occurred near White Hall, in a family named Tiger (farmer); three deaths resulted. Cause was found in the stopping up of a sluice-way running from the house. Near the mill-race spoken of at Glen Gardner, three cases; one death just occurred, two others now convalescing. Some cases of malaria, not considered dangerous, accompanied by chills, now exist. Was very healthy during the summer. The deaths referred to have all arisen since July 30th, but township, generally, has not been so unhealthy as it was during the last year.

EAST AMWELL. - - *Report from* P. C. YOUNG, *Ringoes.*

The report mentions malarial fever as still quite prevalent; also, epidemics of measles and whooping cough and isolated cases of dysentery. Thus, there was considerable sickness, but very few deaths.

KINGWOOD. - - *Report from* H. P. SHAW, *Kingwood.*

Many cases of dysentery are reported.

MERCER COUNTY.

TRENTON. - - - - *Report from* WILLIAM CLOKE.

Since the formation of the new Board under the law of 1880 and 1881, it has successfully carried through one great sanitary improvement of decided importance. A fetid and sluggish bayou of filth, two thousand four hundred feet in length, called Petty's Run, had for years been a reeking pest spot in the northeastern part of the city. The new Board has taken this resolutely in hand and secured its complete abatement. It next proposes to address itself to another part of this same run, west of the canal, which has also been for many years a pestilential and disease-breeding nuisance. The water-power nuisance, consisting of the sewage and filth-polluted race-way of the Trenton Water Power Company, which winds for nearly

a mile through the thickly populated part of south Trenton, has also been taken in hand by the Board with promising results. All those who drain or sewer into this stream have been notified to cease doing so, and those who refuse will be prosecuted. Nearly all who have been notified signify their willingness to comply with the orders of the Board. The Water Power Company itself has been notified to abate the nuisance already existing in its race-way, and it promises promptly to do so.

The Board is very much gratified with the results thus far achieved, and with the cheerful and prompt way in which the citizens comply with the requirements of the code, and try to co-operate with the Board in cleansing and improving the sanitary condition of the city. The Board has not yet taken up the question of sewerage, as that is now being considered by the Common Council, which has appointed a special committee on the subject.

CHAMBERSBURG. - - - *Report from* H. R. HAVEN.

Water is supplied from the city of Trenton water works, but some wells are yet in existence which have been detrimental to health. Some persons owning wells have turned them into cesspools, which has contaminated the water of others. Several cases of typhoid fever have originated from this cause.

Surface drainage is now relied on, but we find that the surface of the borough is so level, that sooner or later, some other system will have to be adopted. Malarial fever has not been as prevalent as last year.

HIGHSTOWN. - - - - - *Report from* W. W. SWEET.

The report alludes to the supply of a hotel and of some houses by a spring, cisterns connected therewith being used. Also to some interferences with natural drainage. Eruptive diseases have been remarkably prevalent, such as measles, chicken-pox, and small-pox. The form of the cases of small-pox seems to have been of the hemorrhagic variety, last year noted as occurring at Rahway and Egg Harbor City.

MIDDLESEX COUNTY.

NEW BRUNSWICK. - *Report from* T. L. JANEWAY, M. D.

Only about one-third of the city is sewered, and this system, as stated in last year's report, being constructed on the defective princi-

ple of having its outlet in the slack-water of the Delaware and Raritan canal, is to be considered as more prejudicial than advantageous. Other portions of the city are entirely dependent upon surface drainage, the gutters, the streets, &c.

MONMOUTH COUNTY.

ASBURY PARK. - - *Report from* H. MITCHELL, M. D.

The sewer system in Asbury Park has stood the test of another year, and has served its purpose satisfactorily. Improvements are in progress calculated to make the outlet into the sea more durable, and also to further ventilate the street-pipes.

Garbage has been removed from the borough, and treated, during the past summer, in a manner entirely satisfactory to the Board. Water-tight barrels were substituted for wagon-boxes for the collection and transfer of garbage, and it was carried through the streets without spilling. It was deposited in pits four feet deep and four feet six inches wide, and these covered, daily, with earth. The site selected for depositing the garbage is not near any water-course, and is about three miles from our borough limits.

Excreta is removed with sufficient neatness and decency. It is placed in air-tight barrels, and its removal creates no nuisance in the borough, though the manner in which it is deposited (about two and a half miles from our limits) has caused complaint.

FREEHOLD. - - - *Report from* H. B. COSKILL, M. D.

The report gives interesting details of cases in which vaccination prevented small-pox, and of two cases in which children who were vaccinated two days after the eruption in the case of their father, and who contracted the disease, but had a mild varioloid in consequence of their vaccination.

FREEHOLD BOROUGH, - - *Report from* C. F. RICHARDSON.

The abundance of iron permeating our subsoil does much to render harmless the impurities filtering into water.

The average distance of water-closets from the wells is too small to insure perfect safety, but it is only a question of time when the disinfecting powers of the ground will become materially weakened. In

some few cases kitchen sinks, &c., are connected with outside cesspools, but generally the slops are allowed to wander at will.

During the year the town has been visited by small-pox, six cases in two houses, without fatal results.

Immediately upon the appearance of the first case, a system of house-to-house vaccination was effected by this Board, at the expense of the town, which resulted in the vaccination of about 370 persons, about 245 of whom took successfully, and we believe there is not now a more thoroughly vaccinated town in the State. To this, the faithful care of the attending physicians, and the vigilance of this Board, can be attributed the speedy and complete stamping out of the disease.

The report also contains a statement as to a case of flagrant nuisance which the Board had to abate, and for the six dollars expended, they sued the owner. The case went against the Board on the ground that the plaintiff had not been notified to attend. This and another case are being fully presented to proper legal examination. Unless some technicality embarrasses appeal, the principle involved will soon be tested, or if not in this case, by some other which may arise.

OCEAN GROVE. - - - *Report from* A. E. BALLARD.

There is a system of sewer pipes, reachable from all the main avenues, and extending with the increase of population, made of twelve and fourteen-inch terra cotta, cemented at the joints, emptying into vaults of from forty-eight to sixty feet in length, sixteen to twenty in width and depth, upon the shore, made of plank, with open bottom, covered first with plank and afterward with sand, with ventilating shafts supplied with fire near them, opened usually on Saturday nights, and oftener, if required, and washed out by the sea. No sickness has been attributed to the drainage of sewage—no malarial fevers have originated here. There has been no interference with the natural water-courses, except to give them more perfect outflow into the ocean, and to admit, at will, the ocean into them. The general ideas of the State law as to drainage are carried out, and there is a regular map of the system of sewerage. The stream which fills Wesley lake does not carry any sewage after it reaches the Grove. Above that place there are two barns and a few people along its edges, where sewage to a considerable extent enters it. Plans are being prepared to remedy this by laying a large iron pipe or constructing a closed wooden way for the passage of the water beyond the limits of the population. By the frequent letting in of the sea into the lake, it is believed that no evil results have followed from the outside sewage so far.

The sewer system has been extended during the past year at a cost of between three and four thousand dollars, and ninety-one connections have been made. The cost of taking away the garbage, over what was allowed by the farmers, has been twelve hundred dollars, and vault-cleaning, fifteen hundred. A plan is now under consideration, for the coming year, to carry the sewer pipes to a common centre on the ocean front, at a point equally removed from the bathing-houses, and carry the pipes out into the sea beyond the breakers, without the intervention of shore vaults.

OCEAN. - - - *Report from* GEO. W. BROWN, M. D.

Refuse which accumulates in the streets in the township, generally does not amount to much, merely a few leaves, &c., but in the villages, we are sorry to say, it is too much neglected. Our streets, in the village of Long Branch, are watered during the summer months, and, in the fall, we find them literally "water-soaked." Then, after one or two storms, together with the falling leaves and other refuse, which are not properly carried away, we have, through the main street especially, about four to six inches of nasty, bad-smelling mud, which is very apt, with occasional rains, to last for weeks at a time. We have had some malarial fever here, and this, I think, is partially the cause of it. I do not think the streets are properly cleaned by the proper officers more than once or twice a year.

The township Board of Health is the only one in the township, and this is governed entirely by the State laws. The Board is still in its infancy, this being the first year of our organization, but we feel that the township has already derived great benefit by having such a Board, as the complaints against nuisances have been quite numerous, and all have been promptly attended to and abated, some of which have existed for years previous.

The report also notices other defects, but as active measures have been taken, we believe they will soon belong to the past.

RARITAN. - - - - *Report from* S. V. ARROWSMITH.

Small-pox occurred in the centre of the town of Keyport. Proper quarantine of the whole block was instituted. The Physician of the

Board was directed to visit all the schools within the town limits, both public and private, and to make an examination of all children in attendance as to the necessity of vaccination, and, by a resolution, excluded all who did not bear satisfactory evidence of protection, until vaccination should be attended to. As a further precautionary measure, five hundred copies of the small-pox circular No. 2, as published in the State yearly report, containing precautionary instructions, were procured, and freely circulated throughout the town, a copy being placed in the hands of each family.

The disease, in both cases, assumed the most virulent hemorrhagic form, and on April 1st, the case which first developed—that of Mrs. C.—ended fatally. The other, that of Miss C., though of the malignant type of so-called black small-pox, succumbed to the treatment and recovered.

The vigorous action of the local Board, though condemned by a few, was generally approved by the public, and resulted in confining the disease to the house in which it first originated.

UPPER FREEHOLD. *Report from* JOS. HOLMES, M. D., *Cream Ridge.*

Malarial fever is reported as the most prominent disease of the past year.

SHREWSBURY. - - *Report from* RICHARD A. SICKLES.

The report shows that there has been much discussion over alleged sickness at Red Bank. There were some cases of fever, either of a severe remittent or typhoid type, but the locality is one naturally healthy. The objections in Red Bank and some other parts of the township, are the too near proximity of wells, privy-vaults and cess-pools. If the Board of Health is well sustained by the co-operation of citizens, the good reputation of the locality can be easily maintained.

MORRIS COUNTY.

CHESTER. - - - *Report from* W. A. GREEN, *Chester.*

The springs are exceptionally good: I can now recall but a single exception. This spring is so situated as to receive the surface drainage, and furnish the water used by eight or ten families, in all of which a relaxed condition of the bowels has been apparent; whether

this pathological condition depends upon the continued use of this water as its exciting cause, or other filthiness, not prepared to say. The cisterns throughout the township are in a bad condition, the leaders have no turn-offs to convey away the first rain-falls, and consequently whatever organic or other impurities are deposited on the roofs are washed into the cisterns; this evil is almost universal. A great many cisterns are constructed altogether under buildings, and are entirely excluded from the air; some are never cleaned, others very seldom, while a few are carefully cleansed twice yearly. In most, if not in all cases, the pipes through which the water is drawn are lead. I do not know of a single instance where cast-iron pipe is used. A very few cisterns have filters, or rather, I should say, apologies for filters; for they are nothing more than a tin, zinc, or galvanized-iron receptacle filled with charcoal and gravel, through which the water passes as fast as received, and this gravel and charcoal are never replenished.

To report all the defects in drainage, natural and artificial, would perhaps require something to be said of nearly every house in the township; so, therefore, a single case to the point must suffice as a general exponent of what really exists to a greater or less extent throughout the township. Last summer, a year ago, I was summoned to attend a family composed of seven members, all of whom were stricken down by a low form of typho-malarial fever—the typhoid element markedly predominant. I at once began an examination of the premises to ascertain, if possible, the cause of this sudden and terrible outbreak. I found a well six feet from the back door, between which and the house milk-pans and kitchen utensils had been washed, and the waste-water, beside other slops and wash-water, had been thrown. From the well came a stench too horrible to describe. At this time, the water was so low the bucket would not fill. The water, however, had been used by the family until about two weeks prior to this time, when it became so offensive to smell and foul to taste, that they had to abandon it. Just around the corner of the house, say ten or twelve feet from the well, stood an overflowing swill-barrel, from which there was easy communication. All the family recovered except one, a young lady eighteen years old, in whom a hemorrhagic complication was superadded.

OCEAN COUNTY.

EAGLESWOOD. - - - *Report from* WM. P. HAYWOOD.

Water-supply is nearly altogether from wells; a few families, and I notice the healthiest ones and the longest lived, have always used spring or brook-water. In the principal village of this township, viz., West Creek, the well-water is exceptionally bad, hard, and of offensive smell. As the graveyard now well filled with the dead, is near the centre of the village, and on a rise of ground; and all the wells with offensive odor and bad taste are east of the graveyard, and near by (my own is about twenty-five paces), I have long ceased to use my well-water for drinking purposes, believing it to be contaminated with the decomposition of the dead bodies. If time would correct the evil I should apply to the Legislature to have the graveyard closed hereafter to interments, but from what I have seen and know, fifty years hence would make no improvement; the mischief is irreparably done in the former ignorance of our fathers. I have noticed that all the families living east of the graveyard have more or less sickness, a great deal more so than those living west of it; as the streams all run east to the bay shore, this may account for it. I had one death in my own family, and several others sick with typhoid fever. This happened several years ago; since then, we have stopped using well-water, and have been free from any diseases traceable to bad water. I find that where brook-water is substituted for well-water, children suffering from cholera infantum, or any one with bowel affections, rapidly recover, *i. e.*, where other proper means are resorted to, but medicine is of no use when well-water is used.

Our natural drainage is good. Some meadow and swamp lands have been artificially drained. No sewage matter of any account is carried off by brooks or streams.

The common mode of emptying privy-vaults is by mixing coal ashes, or road-dust, or its equivalent, with the contents, and removing a short distance, and covering with earth or sod, or both, and left sometimes for three to six months before using on corn or crops whose eatable product is above the ground. Some few ignorant persons use at once, even on their root crops.

PASSAIC COUNTY.

PASSAIC. - - - - - *Report from* F. H. RICE, M. D.

Much need of sewers; no natural or artificial defects in drainage. Much less malarial fever this year compared with last. No State law as to drainage or any other laws been applied here. Cesspools generally used, and many of them in a bad condition. Slop-water from the kitchen discharged in cesspools usually, but sometimes in privies.

WAYNE. - - - - - - *Report from* R. M. TORBET.

There are no defects in the natural drainage, except that noted last year. The amount of malarial fever has been less than last year, until the late severe storm, when there seemed to be a new outbreak of it.

There were quite a number of cases of scarlet fever in the township last fall. The disease was of a mild type, none of the cases being fatal. Also, a good many cases of mumps among the children of the different schools, making a slim attendance for a time.

There have been no especial cases of sickness since July 1st, except some small-pox cases in one family.

I think it would be well for the State Board to have prepared a set of ordinances in blank, to be sent to the local Boards, as a guide to them in carrying out the provisions of the act of last winter.

PATERSON. - - - *Report from* J. J. QUINN, M. D.

The report on vital statistics, and also that of the next year, will show the results of the small-pox epidemic, so far as deaths record it. It has had many incidents, caused much privation and great expense, but it demonstrated the need of a Board of Health under the State laws. The Board is formed too recently for a report.

MANCHESTER. - *Report from* WM. D. BERDAN, *Paterson.*

A few driven wells are used; some are satisfactory, and some are not.

The filters used are made of tin, divided into apartments, and these apartments separated by perforated partitions, the holes being smaller after each passage of the water; with an opening in front, so that leaves or litter of any kind may be removed at pleasure.

There is defective drainage in a piece of property near the village of Haledon. The physicians state it is the cause of malarial and other fevers in that neighborhood.

Otherwise, in this section, the amount of malaria is not so great.

The piece of property having defective drainage is soon to be properly drained and filled up with sand.

SALEM COUNTY.

MANNINGTON. - - - - *Report from* D. F. GRIER.

The report alludes to a disease of animals, also transmissible to man, which came under the cognizance of this Board, and was pronounced to be anthrax or splenic fever, in the earliest cases. Prof. Satterthwaite, of New York City, and his assistants also pronounced the disease anthrax, although, amid the swarm of bacteria, they did not discover the bacillus anthracis. Here, examination was confined to the blood taken from the vessels of the neck. This report confirms the diagnosis, as it is stated that Prof. Leidy, of Philadelphia, found in the liver or spleen the bacillus which is characteristic of the disease.

SALEM CITY. - - *Report from* HON. CHAS. S. LAWSON.

The Mayor reports the organization of a Board of Health. The arrangements of water-supply are completed.

UPPER PITTSGROVE. - - *Report from* C. H. NEWKIRK.

There has been an increase of malarial fever.

SOMERSET COUNTY.

BEDMINSTER. - - - *Report from* WM. P. SUTPHEN.

Instances have come to hand where it was necessary for our Board to recommend certain work to be performed, by which it is believed causes of sickness were removed. In every instance these instructions have been complied with. There is malaria in our township, not confined to any particular locality, and in instances cannot be charged to any known cause. Our observations are, that by writing on the door-posts of every house in the township "*Be Clean*," there would be less malaria and all other sickness.

BRIDGEWATER. - *Report from* A. P. HUNT, M. D., *Somerville.*

Citizens of our township depend upon wells, either dug or driven, principally the former, for water supply, save in Somerville and Raritan, in which a few are supplied by the Somerville and Raritan water works, from the Raritan river. We believe there are no objections to it, by those who use it.

The *Ancient* arrangement of water-closet construction still prevails, viz.: A pit is dug, probably walled, and the closet set thereon, and in very many instances, a well from which the family or families obtain their water-supply is in close proximity.

Serious and grievous complaints are made by farmers owning lands along the shores of the Raritan river, by reason of the refuse matter turned from the dye-house of the woollen mills at Raritan, into the river, thus impregnating its waters with the chemicals and refuse material therein contained. A few isolated cases of enteric fever are believed to have been traced to local causes.

HILLSBOROUGH. *Report from* W. H. MERRILL, M. D., *South Branch.*

It is believed that, if a cistern is large enough and especially deep enough, and well kept, that it affords very good water. Of course, it is desirable that the roof from which it is collected should be slate. Quite a number of driven wells are in use. Further time must elapse before we can tell how satisfactory they are.

As to malarial fever, there have been fewer cases, but the tendency to head symptoms has been marked, and severe congestion of the brain has been associated often enough to be noticeable.

During the spring, pink-eye was prevalent, but few deaths resulted. Chicken cholera has been less prevalent than in recent years. Those who have been troubled with it, do not try to raise many fowls, or sell the chickens early in the season.

No nuisance from trades of factories. However, it may here be noted that the attention of the Board has been called to a nuisance at Van Aken's station, caused by drainage from a silo used for storing beer-grains for cattle.

SUSSEX COUNTY.

BYRAM. - - - *Report from* C. F. COCHRAN, M. D.

The Health Board investigated the cause of three cases of typhoid fever at a farm-house, and traced the poison to a covered drain leading from the house; the remedy was applied, and no further trouble has been reported. A complaint was made by Mr. John Rose, that stagnant water was allowed to stand near his house, the water coming from the streets of Stanhope as well as from the houses on said streets. An investigation was made and a remedy sought.

GREEN. - - - *Report from* S. VAN SYCKLE, *Andover.*

In this township, there are three mills run by water, namely, Hunt's mills, Tranquility, and Huntsville. Tranquility and Huntsville have, in the past years, been very unhealthy on account of the lowness of the water, which uncovers the mud and leaves it bare to the air. But for this year, they have been much more healthy.

STILLWATER. - - - - - *Report from* C. V. MOORE.

The report shows that there are in the township too many cases of periodic fevers, and that the drainage of parts needs to be carefully considered.

UNION COUNTY.

PLAINFIELD. - - *Report from* H. H. LOURIE, M. D.

The epidemic of measles, last spring, in Plainfield, was unusually severe, and several deaths occured. An oilcloth factory has been complained of because of its odors. Driven wells are sometimes found impure and deepened. The city has no sewers.

SUMMIT. - - - - - - *Report from* D. M. SMYTHE.

The Board have given especial attention to privy-vaults and cesspools, and have pleasure in reporting that the ordinances of the Board in relation thereto, are being complied with, and the danger heretofore existing from overflow drains is rapidly diminishing. Cesspools and privy-vaults are emptied by means of the "odorless excavating process," and the refuse and excreta, after being made innocuous, are composted for fertilizing purposes.

A charitable institution—half orphan asylum—under the auspices of the Episcopalian denomination, has been opened since last report. The health of its inmates is provided for by careful sanitary arrangements.

The Board, chiefly through persuasive influence, have been instrumental in abating several nuisances, and placing many locations upon proper sanitary bases; every pond in the thickly-settled portion of the township has been *drained and filled.* The Board have in contemplation other important sanitary improvements.

No prevalent diseases during the last year.

The people at their last annual town meeting, voted an appropriation of *five hundred dollars* for health purposes, by means of which the Board have been enabled to correct certain conditions which would have ultimately become destructive to health interests.

The poulation of the township is two thousand and sixty-nine.

WARREN COUNTY.

BELVIDERE. - - - - *Report from* ISRAEL HARRIS.

There were several deaths from scarlet fever, and measles largely prevailed. Public funerals in case of deaths from scarlet fever were not had.

PHILLIPSBURG. - - - *Report from* S. W. DEWITT.

A special nuisance is a stagnant drain with not sufficient fall to carry off the bad water which collects therein. The council have promised to abate the same, but have not yet made a beginning.

No special disease of animals, except, early in the summer, the horses belonging to the street railway company were prostrated with a throat and head disease, and were not used for some weeks. They called it distemper.

No particular improvements, except that the Board has strictly enforced its ordinances in all respects, and the result is a better sanitary condition.

We know of no cause of disease prevalent. We have been surrounded with small-pox in neighboring towns and villages, but have had no cases here.

The malaria, which a year ago was prevalent during the dry season, has not made its appearance this season. We have heard of but few cases of the chills, while a year ago the town was full of it. We re-organized our Board of Health under the act of 1882, and adopted a code to govern us, but thus far have had no occasion to enforce at law any of its sections.

I think the Boards of Health of towns as well as of cities, should control the sale of milk, instead of having to call upon the State inspector; as it is under the present law, local Boards have no power to stop the sale of bad milk, but must call upon him.

OXFORD, - - *Report from* L. B. HOAGLAND, M. D.

During the fall and early winter of 1881, scarlet fever was quite prevalent in our township, and as our Board of Health was not then organized, nothing was done to prevent its spread, except what was done by the physicians, individually. There were, in all, about sixty cases and ten deaths; the majority of the deaths being from convulsions, during the first and second days of the disease. Would also note that there was an unusually large number of cases of dropsy followed it. Also a wide-spread epidemic of measles; no deaths.

About the middle of March, 1882, there occurred in the town of Oxford a case of discrete small-pox, supposed to have been contracted by a man loaning a stranger a shirt to sleep in one night, and then wearing the same himself, without its having been washed. With this as a centre, it spread until we had, in all, thirty-five cases. The Board of Health was organized at once, and adopted a stringent code of ordinances, relating to the spread of contagious diseases, which were posted throughout the township.

Meetings of the Board were held weekly, and all houses where small-pox was known to exist, were quarantined, and patrolmen hired to enforce the code of ordinances and supply the inmates of the infected houses with the necessaries of life.

Of the 35 cases, 16 were confluent, 7 discrete, 12 varioloid. There were seven deaths in all.

No person previously vaccinated was attacked with confluent small-pox, and no deaths occurred where persons had been vaccinated. About fifteen hundred persons were vaccinated during its prevalence, one-third of them with humanized virus, and the remainder with non-humanized bovine virus, the constitutional effect being much the more marked when the latter was used. One child, of 5 years, lost its life by taking cold in her arm; gangrene set in, and she died from septicæmia. Some of the sores were three or four months in healing.

At present, October 25th, 1882, there is considerable malarial fever in our township, and almost all the cases show a disposition towards a low typhoid type. Have had a few cases of undoubted typhoid fever, due, I think, to personal filth and improper ventilation of houses, together with bad drainage of the soil. The attention of the Board will be called to the existing conditions, and some action taken at once.

WASHINGTON, - *Report from* WM. M. HARTPENCE, M. D.

Public health laws are attended to only, as yet, upon complaint of the existence of a nuisance, or infectious or contagious disease, &c. The Health Board has no regularly appointed time for meeting, with the exception of what the State requires. The sanitary matters of this township are placed in the care of an acting health physician, who is Secretary of the Board and is authorized by the Board to act promptly in abating and removing all nuisances, &c., &c. The township is not provided with a pest-house or hospital. The registration of vital statistics is kept as the State law directs for all townships. For sanitary expenses and for the indigent poor, we will have to appropriate not less than one thousand dollars, due to an outbreak of small-pox, a report of which is herewith appended. The heating of houses is mostly by stoves, coal and wood being the fuel used.

About the 1st of April, 1882, information reached us, through private sources, that small-pox had broken out at Oxford, a small town lying north of us, where mining and the manufacturing of nails are carried on quite extensively. The southern limits of this town lie within this township. On May 3d, we received notice from the local Board of Health of Oxford township that the disease had spread to one family within our limits. A meeting of the Health Board was immediately called and the whole matter placed in the care of the acting physician. The infected family was immediately visited, and it was found that a small child had confluent small-pox. The family, consisting of nine members, together with the premises, were forthwith placed in quarantine, notice of "small-pox" was posted upon the house, and the whole put in charge of an officer. On the evening preceding the notice given the Board of Health, one of the daughters of the family was married, and several guests from Washington and Oxford

were present on that festive (?) occasion, while, at the same time, the child was lying up stairs (the house consisted of two rooms only) with this most loathsome disease, unvaccinated. There were five others also unvaccinated in the family. These were immediately ordered to be vaccinated, but the parents positively refused, giving as an excuse their belief that the conjoint effects of vaccination and small-pox would certainly kill the children, and no amount of persuasion and argument would convince them to the contrary, and, as the law did not *compel* them to be, the result was that three out of the five soon sickened and died with the most violent form of the disease. The parents, who had been vaccinated years ago in Ireland, had varioloid, but in a light form. The developments of the wedding were looked to with a deal of interest, you may judge, but, thanks to the immortal Jenner, vaccination, that efficient prophylactic, saved the whole county hereabouts. Out of the whole number of guests there were only three or four contracted the disease. One young woman near by, and within this township, took varioloid and gave it to her mother, rather an elderly woman, but vaccination saved them.

Another family, also living near by, consisting of six members, parents and four children at home, neither child vaccinated, took the disease. The first case, one of the children, resulted in death. Seeing the bad results from family number one, they consented to immediate vaccination when the first child was declared to have the disease. Fortunately, the vaccinations were all successful, and the result was that neither of the three remaining were ill enough to be kept in bed one day. If these are not cases in point positive of the efficacy of vaccination in mitigating or entirely aborting small-pox, then our judgments are certainly very deficient. As a result of the presence of this epidemic, a general stampede for vaccination was made popular, and vaccinations were resorted to by old and young, and it would be difficult to find one to-day unvaccinated or upon whom several attempts were not made.

Bovine virus was generally used, and our observations lead us to conclude that the constitutional effects were greater in a larger number of cases than we had observed in years past when using humanized virus; and, also, our experience makes us believe that the resulting sores were longer in healing (speaking in general) than with the humanized virus.

Scarlet fever appeared in the township during the spring months, but did not assume a marked epidemic character and was of a medium

type. There seemed to be an unusual tendency, especially in the milder cases, to albuminous nephritis afterward. Malarial or periodical troubles, as usual, prevail, but not to the same extent as heretofore.

Most of the other reports contain matters of local interest and information, which, together with the returns of vital statistics, enable us to judge of the health of the respective localities. It is especially apparent how many of the Boards of townships are increasing in efficiency and in their comprehension of the fact that undrained land and small villages, and often individual households, have local causes of disease. Much more watchfulness is used than formerly, and the people are becoming more intelligent as to needs, if not always as to methods. Now, it often occurs that in the local Board are one or more persons who carefully read the reports or other sources of knowledge, and thus become of great advantage by their advice in preventing, as well as managing, nuisances or other conditions unfavorable to public health.

REPORT UPON HEALTH FOODS, INVALID FOODS AND INFANT FOODS.

BY PROF. ALBERT R. LEEDS, PH. D., MEMBER OF COUNCIL OF ANALYSTS OF NEW JERSEY.

The importance of extended inquiry into the various subjects comprised within the scope of the present article may be best gathered from the following considerations:

1st. The preparation of these various kinds of foods has become a great and growing department of manufacturing industry. The amount of capital invested is very large, the competition keen, the temptation to put upon the market inferior and adulterated articles pressing, and the opportunities for deceitful advertising almost unlimited. 2d. The relative value, as food-substances, of these various preparations cannot be determined by a merely superficial examination, nor, in most cases, is the microscope alone sufficient, and this has led to the recent attempt, on the part of some manufacturers, to destroy the reputation of many articles of prepared foods, and to ruin the business prospects of their competitors in trade, by false and malicious publications. 3d. The necessity of health and invalid foods for thousands who are suffering from functional disturbances of the digestive organs, from diabetes, etc., is fully recognized by the medical profession, and the corresponding importance of encouraging the manufacture and sale of excellent, and of preventing that of inferior and adulterated articles. 4th. The frightful mortality among infants is due more largely to diseases of the organs of digestion than to any other single cause, and for this reason it may properly be said that no subject can claim for itself a more anxious and careful study than that of infants' foods. And when we discover, as we shall later on, that in some instances manufacturers are selling largely for infants' food

preparations entirely destitute of those elements upon which the nutrition of the body depends, and which could not be persistently used without permanent injury or resulting death, the criminality of such traffic can be adequately appreciated.

METHODS OF INVESTIGATION.

Before giving in detail the analytical methods employed, I regard it necessary to discuss the relative value of the results which can be obtained by the use of the microscope alone, and those which can be obtained when, in addition to the microscope, all other aids to complete investigation of foods are made use of. This preliminary discussion is necessary because of the claim recently put forth by Dr. E. Cutter that the microscope alone is sufficient for the purpose, and as a result, he has been led to make many false statements, at present circulated broadcast throughout the community and calculated to inflict much injury upon manufacturers and consumers alike.

In the examination of the various kinds of food-substances, I relied upon three sources of information: 1st. Their appearance under the microscope. 2d. Their physical properties and their behavior when washed with water, etc. 3d. Chemical analysis. At the outset I hoped, that by means of the microscope alone, sufficient information could be obtained to enable me to form an approximately correct estimation of the relative amounts of starch, gluten, cellulose, etc., in the flour, and so to form an opinion as to its food value. I had been constantly employed in the use of the microscope for detecting the adulteration of food, and had found that it often gave sufficient information to make it possible to dispense with chemical examination. This was frequently true of the spices, in the adulteration of which the starches of various cereals, powdered crackers, etc., are largely employed. I anticipated a similarly satisfactory result in the examination of the cereal foods themselves, but in practice this anticipation was not sustained. The reason is, that to admit of identification under the microscope, the physical characters of the bodies observed must not be destroyed by any treatment to which they have been subjected. Now, in the preparation of cereal foods, by the processes of milling, and in some cases of washing, to which they are subjected, the appearance of certain constituents of the grain is so far altered as to make their certain recognition very difficult and their quantitative estimation impossible.

What I mean by this statement will be more clearly seen by comparing the actual results of a chemical analysis of flour with those obtained by the microscopic examination. By analysis we can readily and accurately determine the percentages of starch, gluten, cellulose, albumen, gum, sugar and fat. Of course, it is out of the question to determine more than the first three constituents, viz., the starch, gluten and cellulose, by microscopic examination. But can we do so much as this? Can we even form a tolerably accurate guess at their relative percentages? I have made a great many attempts to do so, and have entirely failed. And lest any microscopist charge this failure to a lack of faithful use of the microscope, let me suggest that he subject his results to the only rigid proof of their accuracy. Let him first make a quantitative estimation of the percentages of starch, gluten and cellulose by means of the microscope, and then determine the precise percentages by chemical analysis. And, in order that he may be entirely without bias in his judgments, let him conduct the inquiry in the order named: first with the microscope and then with the balance, because the eye has a marvelous proneness to see whatever the mind is previously persuaded actually exists, but the chemical balance errs not. And if this course is taken, and the results of the microscopic examinations are carefully noted down, as I have myself done in the case of more than thirty differently prepared wheat flours, and afterwards compared with the figures obtained by chemical analyses, no manner of agreement will be found between them. For example, I find in my notes that a sample of a certain wheat flour finely ground, exhibited under the microscope a "large amount of starch, some gluten, and a considerable amount of fibrous tissue." I did not attempt to translate these results into figures, from a feeling of utter inability so to do, but thought that the adjectives might be useful for future reference. Another sample of flour, claiming to contain the constituents of wheat flour in the the same proportion as the original wheat grain, is put down as remarkable for the large number of perfect unruptured gluten-cells which it contained, and which gave rise to the impression that the relative amount of starch in this sample was small. Subsequently, both these flours were analyzed, and the former was found to contain 60.95 per cent. of starch, and the latter 70.98 per cent. In other words, the flour which I judged, from its microscopic examination, to contain the lesser amount of starch, actually contained 10 per cent. more than the other. To take another illustration, I find among my notes allusions to two samples of flour, specially prepared to diminish the natural percentage of starch, and which apparently

had the same relative amounts of starch when viewed under the microscope. But the one contained 59.72 per cent. of starch, the other 64.67 per cent.

It may properly be objected to these results, that I am speaking of cases where there was only a difference of five to ten per cent., and that in the cereal foods which are under discussion, the differences are much greater, so great, indeed, as to make an approximate quantitative analysis by the microscope possible. But I do not think this objection will hold good. For, in the first place, the amount of percentage variation in the composition of flours prepared with especial reference to their containing the constituents of the entire wheat, and those prepared like ordinary flour, and those prepared with a view of artificially raising the percentage of albuminoids to a maximum, is not by any means so great as is generally supposed.

I spoke above of a flour claiming to represent the wheat grain in its entirety, and with none of its constituents changed from their natural proportions. It contained 70.98 per cent. of starch. Another specimen, likewise supposed to contain the unaltered constituents of the entire grain, contained but 62.46 per cent. of starch. There is no reason to suppose that these flours did not represent the entire grain, because I have analyses of the entire grain, containing these same percentages of starch. Still another contained 72.65 per cent. of starch, and the latter may be taken as a maximum, or, if not a maximum, not far below the maximum, and having the advantage of being a figure determined by myself upon a sample of American flour. So, too, the number of 62.46 may be taken as not far from the maximum in a flour representing the entire wheat. Here we have a variation of only ten per cent., and yet the properties as food-substances of those whole wheat flours would be quite different.

I find notes of my own analyses of ordinary wheat flour, with percentages of starch varying from 65.66 per cent. to 71.41 per cent. These figures, like all the preceding, refer to the undried substance; on the dried, they would be 75.11 and 81.82 per cent., respectively. I do not happen to have analyzed wheat flour presenting as great variations in composition as the specimens analyzed by Vauquelin (Ure's Dictionary, p. 48,) according to which analyses the flour made from the hard wheat of Odessa, contained (undried) 56.50 per cent. of starch and 14.55 per cent. of gluten, and the flour made from the soft wheat of Odessa, 72.00 per cent. of starch and 7.30 per cent. of gluten. These are astonishing variations, the difference between the minimum and maximum of starch being nearly 16 per cent.

Finally, with regard to the cereal foods artificially prepared, I have samples in which the percentage of starch is as low as 49.43 per cent. (undried.) The entire range of variations is, therefore, between 49.43 per cent. and 72.65 per cent.; the balance in each case being gluten, and other bodies not starch. The problem, in other words, is not to decide between cereal foods containing no gluten and those which do, but between cereal foods rich in gluten, and those poor in gluten. There are no cereal foods, or even the poorest ordinary wheat flours, which do not contain some gluten. On the other hand, there are no artificially prepared cereal food-substances which do not contain starch. I thought that possibly a non-starchy food-substance might be found in the "Farine de Gluten," and purchased a package containing five hundred grams, at the price of a dollar. The high price surprised me, and I thought it was probably due to the labor involved in eliminating the starch.

This gluten is almost tasteless, very finely ground, and under the microscope shows abundant starch-grains. I did not see any unbroken gluten-cells—although I am not prepared to say they do not exist, and may have escaped unruptured from the processes to which this French gluten is subjected. Chemical analysis gave for the starch 53.38 per cent. (reckoned on the undried, 60.04 per cent. computed to the dried sample.) This result made me well nigh certain that the percentage of gluten in this so-called "Farine de Gluten" must fall considerably below one-half, and subsequent experiments show that I was not mistaken.

On looking over my own results, obtained by the use of the microscope and chemical analysis, and comparing them with recent publications on this subject, I find that I am in substantial agreement with Dr. George B. Fowler, judging from the results of his observations, detailed in his article upon "Farinaceous Infant Food" (Am. Jour. of Obstetrics, XV., p. 449,) and in agreement, also, with Prof. Jos. G. Richardson, M. D., as his views are given in an article entitled "A Serious Microscopic Blunder" (Philadelphia *Med. News*, June 1882.) On the other hand, my own results are entirely at variance with the statements contained in a paper on "Cereal Foods under the Microscope," published in the *Amer. Med. Weekly*, Jan., 1882, by E. Cutter, M. D.

In the last article, it is stated that wheat and other grains consist almost exclusively (which is untrue) of gluten and starch, and that the estimation of the relative amounts of these two ingredients can be

effected with certainty by the use of the microscope alone. The falsity of this assumption is most strikingly shown by the erroneous conclusions to which it has conducted its author. It has led him to make statements altogether at variance with those of the recognized authorities on the subject of cereal foods, and in contradiction to those supported by chemical analyses of the foods under question.

I do not wish better evidence of the unscientific nature of Dr. Cutter's methods of microscopic examination than his own statements. He acknowledges himself that in the mechanical processes to which the grains of wheat are subjected, the gluten-cells are ruptured, but proceeds throughout the article on the assumption that the richness of a flour in gluten can with certainty be detected under the microscope by the relative number of gluten-cells. This assumption leads him in the outset to state that "in making flour, three-fourths of the gluten is removed, and the chief strength of the flour is thus destroyed." If the gluten is removed, then chemical analysis ought to fail to find it. But chemical analysis tells an entirely different story. I find, according to Vauquelin, that the minimum amount of gluten in the wheat flour analyzed by him, was 7.30 per cent., and the maximum amount 14.55 per cent. The amounts of starch in these two extremes were 72 and 56.50 per cents., respectively, the starch varying approximately inversely with the gluten. I say approximately, because other constituents vary also, and the correspondence is only approximately correct. Thus, according to Vauquelin, one sample of flour from the soft wheat of Odessa contained 12 per cent. gluten and 62 per cent. of starch. Another sample from the same Odessa wheat contained 12.10 per cent. gluten and 70.84 per cent. starch, or more than 7 per cent. greater of starch. But the former has as much as 7.56 per cent. sugar, the latter only 4.90 per cent. The average percentage of gluten in the eight samples of flour analyzed by Vauquelin (loc. cit.) was 10.93 per cent., of starch 68.08 per cent. (computed on the undried samples.) According to Prof. R. C. Kedzie (Rep. Mich. Bd. Agr. 1877, p. 350,) the average of sixteen analyses of Michigan winter wheat flour gave 10.54 per cent. albuminoids (principally gluten), with a maximum of 12.25 and a minimum of 8.94 per cent. According to the same authority, the average of five samples of Kansas spring wheat flour showed 12.58 per cent. albuminoids, with a maximum of 13.56 and a minimum of 11.37 per cent. Let us now see how these figures compare with the amounts of gluten and starch in the grain before grinding. I shall use the term albuminoids rather than gluten in making

these comparisons, because "albuminoids" include all the nitrogenous portion of the grain, while "gluten" should properly be restricted to that portion of the albuminoids which is insoluble in water. Inasmuch, however, as gluten forms by far the largest part of the albuminoids, it is frequently used as including, in opposition to "starch," the nitrogenous part of the grain.

Now, the average amount of albuminoids in forty-nine samples of American winter wheat (Rep. Conn. Agr. Ex. Station, 1880,) was 11.71 per cent., with a maximum of 14.47 and a minimum of 8.40 per cent. The average of six analyses of the spring wheat was 12.67 per cent. of albuminoids, with a maximum of 15.4 and a minimum of 8.14 per cent. According to König (*Die Menschlichen Nahrungs und Genussmittel*, 11,273,) the average composition of two hundred and fifty samples of European wheats was 12.42 per cent. albuminoids and 64.07 per cent. starch. Is there any support given by these figures to the statement that three-fourths of the gluten is removed from wheat in its conversion from grain into flour? The popular notion that there is an almost entire removal of gluten in the process of milling, is a wide-spread fallacy. The assertion by Dr. Cutter that three-fourth of the gluten had been removed in making the flour examined, really means that his microscopic examination was utterly inadequate to find it. Almost all the gluten originally present in the grain was in the flour, but by the microscope he could find only twenty-five per cent. of it.

Whilst I relied principally upon chemical analyses in conducting these inquiries, and assigned to microscopic and physical examination a secondary place, yet the results thus attained are in close accord with those arrived at by Dr. Fowler, who relied chiefly upon the microscope, and those of Dr. Richardson, who depended upon physical separations merely. The conclusions arrived at by the former are thus summed up: "*Simple microscopic inspection, unaided by chemical means and physical processes, is wholly unreliable and inadequate in determining the composition and nutritive worth of farinaceous substances.* * * * I am prompted to thus repeat and insist upon these points, because I see that so reliable an authority as Dr. Jacobi* has accepted and enthusiastically endorsed the conclusions aimed at by Dr. Ephraim Cutter, * * * who relies altogether upon the absence or presence of gluten-cells in estimating the nutritive value of farinaceous preparations. I must, with all respect, protest against Dr.

* Infant Feeding and Infant Foods, *Med. News*, Feb., 1882.

Cutter's method, his conclusions and his physiological arguments, as well as the remarks of his editor, Dr. Gailleard."

Equally strong language is used by Dr. Richardson. He says: "Dr. Cutter asserts that the opaque, oval or rounded cells (constituting the fourth coat of the wheat grain, according to Prof. Parkes,) afford most of the gluten, and hence on their presence the chief strength of the food depends." He therefore declares that a large number (fourteen) of the food-stuffs he examined, and found under his microscope to display none of these so-called "gluten-cells," "contain no gluten," (page 9), and broadly intimates that they are consequently frauds upon the public. But the fact is, these so-called "gluten-cells" (denominated by Payen, *oleiferes*,) probably include in their substance starch, phosphates, fatty matters and coloring materials, containing only part, perhaps, but a small part, less than one-seventh, of the gluten which exists in wheat. Thus, Peligot, as a mean of fourteen analyses, gives the percentage of gluten in flour (whence "gluten-cells" are removed) at 12.8, while in bran (containing nearly all the "gluten-cells") it is only 10.84, and other observers confirm his statements. If my friend, Dr. Cutter, or any of his disciples, would like to satisfy himself that he has made a lamentable mistake in this matter, let him take say ten grams of one of the fine flours he asserts "contain no gluten," mix it with water into a dough, let it stand for half an hour and then stir it in a porcelain capsule, with successive portions of water, until the starch is washed away, and the adhesive fibrillated gluten is left nearly pure, in the proportion, after drying, of from seven to twelve per cent. (*Vide* Parkes' Practical Hygiene, fifth edition, 1878, p. 224.) The small starch-corpuscles and granules, left by this process entangled among the threads of gluten, can be beautifully differentiated by adding a drop of iodine solution, which affords the usual deep-blue reaction with the starch, but dyes the gluten filaments of a yellowish-brown tint.

Inasmuch as I have not been able to analyze all the great variety of health, invalid and infant foods in the market, I shall discuss only those to which my attention has been directed, and shall classify these, for the sake of convenience, in the following manner. The amounts of ash and saline constituents were not determined:

A. *Wheat.* Not previously cooked or baked, including: 1. Diabetic Light, and 2. Dark Gluten. 3. Gluten Flour. 4. Fibrine de Gluten Conor. 5. Fine Granulated Wheat. 6. Franklin Flour. 7. Arlington Wheat Meal. 8. Arlington Mills Graham.

B. *Wheat.* Previously prepared by cooking or baking. 9. Hazard's Graham Farina. 10. Blair's Prepared Wheat Food. 11. Hubbell's Prepared Wheat Food.

C. *Barley.* 12. Imperial Granum. 13. Ridge's Food.

D. *Oat Meal.* 14. Baby Sup, No. 1. 15. Baby Sup, No. 2.

E. *Mixtures of Various Cereals.* 16. "A. B. C." Cereal Cream. 17. "A. B. C." Cereal Milk. 18. Robinson's Patent Barley. 19. Farwell & Rhine's Gluten Flour. 20. Savory & Moore's Best Food for Infants.

F. *Milk Foods.* 21. Nestlé's. 22. (*a*) Anglo-Swiss. 22. (*b*) American-Swiss. 23. Gerber's.

G. *Liebig Infant Foods.* 24. Mellin's. 25. Hawley's. 26. Horlick's.

Non-farinaceous. 27. Keasbey's and Mattison's.

A. *Wheat, not previously cooked or baked.* My attention was more particularly drawn to this class of health foods by the request of my colleague, Prof. Robt. H. Thurston, who had been using the preparations of the N. Y. Health Food Co. for years in his family, and who was startled in common with many others who had been habitually using them, by the statements above alluded to of Dr. Cutter that these foods contained no gluten. Nos. 1, 2, 3, 5 are preparations of the New York Health Food Co. No. 4 is the French gluten so much prescribed by physicians to diabetic patients. Nos. 6, 7 and 8 are flours and meals recommended by Dr. Cutter, on the strength of his microscopic examinations, as of superlative richness in gluten. No. 6, the Franklin flour, being pronounced by him the best flour examined, and a reliable infants' food.

	Moisture.	Sugar.	Starch.	Albuminoids.
1. Diabetic light gluten	11.90	3.67	49.53	23.18
2. Diabetic dark gluten	11.89	4.09	49.43	23.18
3. Gluten flour	9.23	2.12	43.17	28.24
4. Fibrin de gluten Conor	11.10	5.32	53.38	21.98
5. Fine granulated wheat	10.75	4.77	60.95	13.62
6. Franklin mills flour	11.00	3.72	65.23	8.55
7. Arlington wheat meal	11.99	.....	.....	7.79
8. Arlington mills graham	13.23	.....	.....	7.09

It is important to invalids to note that the American gluten has less sugar and starch and more albuminoids than the very expensive French preparations. The Franklin flour contained not only little gluten, but so much bran that, when used for infants' food, it was soon abandoned on account of resultant diarrhœa.

B. *Wheat, previously prepared by cooking or baking.*

	Hazard's Graham Farina.	Blair's Wheat Food.	Hubbell's Wheat Food.
Moisture	9.12	9.85	7.78
Fat	0.81	1.56	0.41
Grape sugar	2.19	1.75	7.56
Cane sugar	2.49	1.71	4.87
Starch	69.68	64.80	67.60
Soluble carbohydrates	6.35	13.69	14.29
Albuminoids	8.48	7.16	10.13
Gum, cellulose, etc.	5.56	2.94	undet.

9. *Hazard's Graham Farina.* It is claimed that this preparation is made out of the choicest Genessee white wheat; that it is baked twice, so as to be ready for immediate use without further cooking, and that by the processes employed the starchy and fat-generating substances are removed, whilst all the phosphates, etc., and nutritive qualities are retained.

This farina has a dry, rather flat taste, like ground crackers. When cooked according to the directions, it has a brownish-yellow color, with the smell and taste of crackers. It is palatable, but not so much so as either of the other two preparations included in this subclass. The percentage of gum, cellulose, etc., is very large. The amount of starch is greater than in either of the other two, whilst the soluble carbohydrates are much less. These differences account for the less palatability of this preparation.

10. *Blair's Wheat Food.* It is claimed that this is prepared from choice wheat in such a manner as to retain all the nutritive constituents and reject those which are irritating or otherwise objectionable. Moreover, that by thorough cooking, such physical and chemical changes have been brought about as to facilitate mastication and the subsequent action of the fluids of the stomach, thereby rendering the food more easily digested. It is stated to be especially beneficial in intestinal-like dysentery, cholera infantum, etc.

Uncooked, this flour has a sweet, pleasant taste. When cooked according to directions, it forms a very smooth paste with a faint tinge of color, resembling arrowroot in its flavor and quite palatable without the addition of salt, sugar, milk or other accompaniment.

11. *Hubbell's Wheat Flour.* Claimed to be made from wheat alone, floured, and carefully baked from eight to ten hours, at about the temperature of boiling water. "It includes all the flesh-forming constituents, earthy and saline elements of the grain, with only a portion

of the starch and none of the silicated coating. It keeps without change."

This flour is quite sweet and palatable even in its uncooked form, and when moistened with the saliva is more pasty than the Blair's Wheat Flour. When cooked it forms a perfectly white, smooth paste with a very delicate flavor. It is more starch-like in consistency than Blair's, a difference due in part to the larger percentage of starch, and less pronounced in flavor, this being probably due in some degree to the smaller percentage of fat. In both Blair's and Hubbell's the percentage of gum, cellulose, etc., is extremely small, in the latter case so small that it was not determined. In nitrogen Hubbell's is much richer than either of the other two preparations, and its value for purposes of nutrition correspondingly greater. The reaction of the Graham Farina, of Blair's Food, and of Hubbell's, is in each case neutral.

The excess in the amount of saccharine matter in Hubbell's Food above that contained in ordinary wheat flour induced me to write for the particulars of the process used, and to institute an analysis of the original flour from which the food was prepared, in order to discover the nature and the extent of the change it had undergone. The process, I was informed, is as follows: A large baker's oven is heated to about 340° to 360° F. The flour, contained in shallow Russia-iron pans, is then put in, the fire having meantime been withdrawn, the oven closed, and the flour left there about twenty-four hours. When the oven is re-opened the temperature will have fallen to 100°, and after sieving, the prepared flour will be ready for use. The flour used is the best grade as made by the roller process, the second grade containing more starch, less gluten, being that bought and used by bakers.

The change in composition produced by this process will be seen by an examination of the same flour before and after baking.

	Wheat Flour.	Same Baked.
Moisture	9.02	7.78
Fat	1.01	0.41
Grape sugar	2.34	7.56
Cane or inverts sugar	2.46	4.87
Starch	76.07	67.60
Soluble carbohydrates	5.66	14.29
Albuminoids	6.40	10.13

It will be seen that the flour has lost moisture in baking and also a portion of its fat. These changes, however, are of little moment com-

pared with the considerable decrease of starch and its conversion into saccharine bodies. The soluble carbohydrates are considerably more than doubled, and this change is one of the greatest value and importance, so far as the dietetic value of the prepared food is concerned. The considerable increase in the percentage of albuminoids I am unable to account for.

C. *Barley.*

	Imperial Granum.	Ridge's Food.
Moisture	5.49	9.23
Fat	1.01	0.63
Grape sugar	trace.	2.40
Cane sugar	trace.	2.20
Starch	78.93	77.96
Soluble carbohydrates	3.56	5.19
Albuminoids	10 51	9.24
Cellulose, gum, etc	0.50	.....

12. *Imperial Granum.* It is stated to be "in composition principally the gluten derived by chemical process from very superior growths of wheat—a solid extract." Dr. Fowler states as the result of his microscopical examination, that if the material from which this preparation is derived contains any gluten at all, the "chemical process" resorted to in order to extract it, has at the same time either destroyed it or so altered its character as to render it no longer recognizable by the usual tests. This is an excellent illustration of the difficulty which is encountered in deciding with the microscope upon the constitution of a cereal after treatment, for whilst Dr. Fowler's statement of the microscopic appearance is correct, yet as a matter of fact the Imperial Granum contains 10.51 per centum of albuminoids. On the other hand this is not sufficient by any means to bear out the statement that the Imperial Granum consists principally of gluten. According to Dr. Fowler it is simply coarse barley flour.

13. *Ridge's Food.* It is advertised as prepared from carefully selected winter wheat, reduced to an almost uniform fineness. The product is then thoroughly cooked by a steam-baking process, which gradually changes a large proportion of the starch into dextrine, excluding only the woody fibre. It is afterward rendered a little sweet and slightly alkaline.

Dr. Fowler states that the Ridge's Food is apparently barley flour finely ground, and that the odor, dough and microscopic appearance indicate no other ingredients. I have accordingly so placed it,

although both in this case and in that of the Imperial Granum my own observations would have included them among the wheat preparations. Both of these foods when cooked are very palatable. Both have a neutral reaction. Both have a considerable percentage of albuminoids, that of Imperial Granum, in the two samples analyzed, being the higher, and both have a very high percentage of starch.

It should be very carefully borne in mind that wheat flour after careful baking is extensively altered, and that the albuminous bodies become considerably more soluble in water. A wheat flour which in its original condition would yield a very considerable amount of crude gluten, on washing, after baking, will leave a much smaller amount of gluten, and for this reason the percentage of crude gluten in baked flours cannot be roughly estimated by washing and drying. For the same reason a baked wheat flour may be mistaken for barley flour, which gives a non-glutinous dough.

D. *Oatmeal.*

	Baby Sup, No. 1	Baby Sup, No. 2.
Moisture	5.54	11.48
Fat	1.28	0.62
Grape sugar	2.20	2.44
Cane or invert sugar	11.70	2.48
Starch	61.99	51.95
Soluble carbohydrates	14.35	22.79
Albuminoids	9.75	.....
Cellulose, gum, etc	7.09	.....

No. 1 is advertised as an excellent substitute for mother's milk, in case of infants under four months of age. It is a very sweet, partly crushed whole oatmeal, very palatable even before cooking and dissolving readily in the juices of the mouth. It is prepared from malted oats, and after the conversion of the starch has gone as far as it is thought it will proceed, the oats are carefully hulled, only a residue of the coat being left in the crack of the grain. The analysis shows the lowered percentage of starch and the increase of saccharine bodies due to this treatment.

Baby Sup, No. 2, consists of wheat flour, malted barley and potassium bicarbonate in the proportions given in Liebig's formula. In its dry state the mixture has but little taste, but becomes thin, sweet and palatable on cooking. The analysis gives but a partial result of this change, because the food was cooked only five minutes before the analysis, whilst the directions call for a half hour's cooking. But

already much of the starch had been converted into dextrin. These foods are most commendable efforts to carry Liebig's views into practice, and it is to be regretted that a certain amount of care and time is requisite to properly cook them, and for this reason they will probably have only a restricted use.

E. *Mixtures of various cereals.*

	"A. B. C." Cereal Milk.	Robinson's Patent Barley.	F. & R. Gluten Flour.	S. & M.'s Best Food.
Moisture	9.33	10.10	.....	8.34
Fat	1.01	0.97	.....	0.40
Grape sugar	4.60	3.08	.....	20.41
Cane sugar	15.40	0.90	.....	9.08
Starch	58.42	77.76	.....	36.36
Soluble carbohydrates	20.00	4.11	.....	44.83
Albuminoids	11.08	5.13	.....	9.63
Cellulose, gum, etc	.....	1.93	.....	.....

16. *"A. B. C." Cereal Cream.* Stated to be "prepared from the most nutritious and digestible parts of the choicest wheat and barley, with all impurities removed." It appears to be a coarse meal of wheat and barley, but I did not analyze it, the box which I purchased being musty, mouldy and dark colored at the time it was opened. It presently became a living mass of maggots and was thrown away.

17. *"A. B. C." Cereal Milk.* "Prepared by a scientific admixture of the nitrates and phosphates of wheat with the whole of barley; and, after adding the required sugar, we have secured an analysis almost identical with human milk. The wheat is first cleansed, then hulled, coarsely ground and the surplus starch removed, leaving the nitrates and phosphates. The barley is hulled, crushed and mixed with a proper proportion of the wheat nitrates and phosphates. The mixture is cooked by steam, dessicated, ground into fine flour, specks bolted out and the requisite amount of sugar added."

The statement that this food corresponds nearly with human milk in its nutritive ingredients is untrue, as will be seen by comparison with the following analyses of human milk, the first giving the average composition with the natural percentage of water, the second the same composition reduced to agree with the percentage of water present in "A. B. C" Cereal Milk.

	Woman's Milk.	Same Reduced.	Cereal Milk.
Water	89.00	9.00	9.33
Fat	3.00	24.82	1.01
Sugar	5.00	41.36	20.00
Starch	none.	none.	58.42
Albuminoids	2.65	21.93	11.08
Salts	0.35	2.89	undet.

Instead of one-fifth its weight in fat, it has but one-twentieth this amount or one-hundredth. Instead of that peculiar modification of sugar especially adapted to infants' needs, milk sugar, it has a mixture of grape and cane sugar, and these in a very different proportion. Whilst milk has no starch, this consists of more than one-half starch. And apart from the fact that the albuminoids of the cereal milk are entirely different in character from the readily assimilable albuminoids which are present in human milk, their percentage is but half so great. In fact, this cereal milk does not contain so large a proportion of albuminoids as average winter wheat. It appears to contain a larger percentage of barley than of wheat, but there is nothing to show that there is a corresponding dietetic advantage. The mode of preparation is very objectionable, in so far as after steam-cooking it must be thoroughly dessicated in order to render it fit for handling in commerce. If it is not thoroughly cooked and dessicated, the animal life may not be destroyed and it may mould and putrefy as in the sample of cereal cream examined. If it is thoroughly dessicated after steam-cooking, as it would be by long-continued heating in dry air at 150°, it loses a large portion of the flavor and odor on which the palatability of the cereals depends, and its digestibility is so far diminished as to render it liable to pass through the intestines without digestion. If the cereal milk could be, as its name implies, a cereal brought by cooking into a state fit for immediate use, it would not be open to this objection, but the indigestibility connected with the subsequent dessication is a matter deserving of serious attention.

18. *Robinson's Patent Barley.* Patent barley, technically, is ground pearl barley. Yet this preparation, while possessing most of the characters of what it purposes to be, is somewhat unlike pure barley flour. Its dough is more adhesive, and the white color, together with the mild barley odor, suggests the admixture of wheat flour. No gluten-cells are seen, but there are numerous granules unaffected by iodine and turned red by carmine (albuminous matter.) The microscopic examination shows starch granules free and in bundles, held

together by the cellulose. The larger corpuscles are probably those of wheat. I have adopted this description of Dr. Fowler, although I am inclined, from my own observations, to regard the preparation as merely barley flour.

19. *Farwell & Rhine's Gluten Flour.* "A gluten flour, substantially free from starch. For dyspeptics, diabetics and invalids." This flour has evidently been prepared with much care, and the result is a very low percentage of cellulose, gum, etc. The amount of starch has not been diminished nor that of albuminoids increased to the extent aimed at by the manufacturers, though the results are all in a favorable direction. There is no matter about which manufacturers are more apt to form exalted hopes than concerning their laborious endeavors to increase the relative percentage of gluten in flour. And the discrepancy between the claims put forth and the results actually obtained, I am persuaded, is not due, as some would have us believe, to a general lack of honesty on the part of the manufacturers, but to the difficulties in effecting an elimination of the starch by the processes employed.

20. *Savory & Moore's Best Food for Infants.* Claimed to be the only food specially prepared for the use of infants, and to be far superior to the ordinary kinds of Liebig's food in promoting the healthful growth of children. These are false claims, and the use of Liebig's name in connection with this food appears to be unwarranted. It bears no resemblance to Liebig's food in its composition, containing, as it does, over 36 per cent. of starch. I have placed it with the foods prepared from a mixture of cereals, containing, as it does, both wheat and barley. When viewed as a prepared meal, it is worthy of commendation, inasmuch as the percentage of soluble carbohydrates representing the dextrine, cane and grape sugar is high, the percentage of starch about half that present in ordinary wheat flour and the percentage of albuminoids not far below that of ordinary wheat flour.

F. *Milk Foods.*

	Nestle's.	Anglo-Swiss.	Gerber's.	American-Swiss.
Moisture	4.72	6 54	6 78	5.68
Fat	1.91	2.72	2.21	6.81
Grape sugar	6.02	23.29	6.06	5.78
Cane sugar	32.93	21.40	30 50	36.43
Starch	40.10	34.55	38.48	30.85
Soluble carbohydrates	44.88	46.43	44.76	45.35
Albuminoids	8.23	10.26	9.56	10.54

On account of various objections to Liebig's Food, the attempt was made to supply a food which should contain the constituents of milk to a certain extent and yet should be free from the objections to which condensed milk is open. The attempt was first made by H. Nestlé, in Vevey, Switzerland, but at the present time many milk factories are in existence, including one in our country at Little Falls, New York, under the management of Dr. N. Gerber. All of these milk foods consist of cereals specially prepared in combination with milk. The preparation of the Anglo-Swiss Milk Food is stated to be as follows: Twenty parts of Russian wheat flour and twenty parts of oat-meal are made into a dough and baked. The biscuit is then ground fine, mixed with sixty per cent. of condensed milk, dried by a slow heat at 120° to 130°, ground and sufficient wheat gluten added to bring up the percentage of albuminoids to the same amount as that present in human milk. It is evident, that apart from giving a general idea of the method of manufacture, this statement cannot be regarded as correct, inasmuch as the percentage of fat in the Anglo-Swiss Milk Food analyzed is much less than that which would be imparted by sixty per cent. of condensed milk. The percentage of albuminoids likewise makes it doubtful whether any albuminoids in addition to those present in the milk and flour have been added in the form of specially prepared wheat gluten.

According to Dr. N. Gerber, (Milk Analysis, p. 70,) the various milk foods in the market vary in composition as follows:

		Average.
Water	5.0 to 10.0 per cent.	7.50
Salts	1 5 to 3.0 "	2.25
Fat	4.0 to 7.0 "	5.50
Albumen	9.5 to 18.0 "	13.25
Soluble carbohydrates	35.0 to 55.0 "	45.00
Insoluble "	15.0 to 35.0 "	25.00
Cellulose	0.5 to 1.0 "	0.75

It will be noted that Nestlé's Food departs farther from the average than any of the other preparations, and the American-Swiss approaches most nearly. The percentage of fat in the latter is much larger than in the other preparations, and the percentage of the albuminoids is likewise the greatest. On preparing these various brands, the Nestlé's, Anglo-Swiss and Gerber's were very palatable and delicate in their flavor, more so than the American-Swiss, which had a slight rancidity, connected, no doubt, with the large percentage of fat

and fatty acids. Under the microscope various milk foods had a similar appearance, exhibiting agglomerations of starch granules, globules of milk. They all gave the starch and dextrine reaction with iodine, the reaction for dextrine being stronger in the Gerber's than in the Anglo-Swiss. All had a faintly acid reaction except Nestlé's, which was slightly alkaline.

All of them have the same points in their favor, a high percentage of albuminoids, fats and salts, this being especially true of the American-Swiss. The conversion of the starchy matters into dextrine by previous baking, gives to this class of infant foods the advantages of that class of prepared cereals which have been rendered easily assimilable by a process of previous torrefaction. The addition thereto of condensed milk has both advantages and disadvantages. The advantages are, that the condensed milk is milk in a pure and safe form. Instead of being coagulated in large cheesy masses in the child's stomach, as would be liable to be the case if the condensed milk, after thinning with water, were given alone to the infant, the admixture of dextrine and torrefied milk keeps the caseine divided and causes it to form in small flakes more nearly analogous to those forming from woman's milk. The condensed milk likewise adds a noteworthy percentage of fat, which is conspicuously absent from the other infant foods. It also adds a certain amount of milk sugar and increases the percentage of albuminoids and valuable saline matters, more especially the phosphates. The principal disadvantage is, that condensed milk is preserved with the aid of cane sugar, its analysis being as follows:

Water	20.0 to 30.0 per cent.
Salts	1.5 " 3.0 "
Fat	8.0 " 12.0 "
Albuminoids	10.0 " 13.0 "
Milk sugar	10.0 " 15.0 "
Cane sugar	30.0 " 45.0 "

Cane sugar, therefore, being relatively by far the largest constituent, there soon arrives a point in the manufacture of milk food when the addition of condensed milk must cease, otherwise the percentage of cane sugar, which, like other carbohydrates, is very objectionable when it takes the place of a proper amount of albuminoids, would become excessive and indigestion thereby be induced in the infant using such food. The remedy, it appears to me, would be found by using a condensed milk preserved without the use of cane sugar, and since this

can now be successfully effected by means of Appert's method, the preparation of a milk food not open to the above objection should be soon satisfactorily accomplished. In that case we should have an infant's food with a very high percentage of albuminoids and a low percentage of carbohydrates. The sugar would be present in the form of milk sugar derived from the milk and as grape sugar derived by a process of torrefaction from the meal. The last, in its turn, would not have to be present in larger amounts than what are requisite to supply the starch and dextrine, which are of use to prevent coagulation of the caseine in large flocks.

G. *Liebig's Infant Food.* It is not necessary to discuss here the evidence by which physiologists have established the fact that in the earlier stages of infancy only very small amounts of starch can be digested. But, accepting this fact, it is our present purpose to discover how far the difficulty has been overcome in the case of any of the infant foods. In so far as the starch was rendered soluble and converted into glucose and dextrine, the various baked farinaceous preparations were commendable. But inspection of their analyses shows that even in the most successful cases this conversion is but partial. In order to render it complete, Baron Liebig proposed to resort to a chemical process and to transform the starch into saccharine under the influence of the diastase contained in malted grain.

The following is the best way of preparing this food: Half an ounce of wheaten flour and an equal quantity of malt flour, seven grains and a quarter of bicarbonate of potassium and one ounce of water are to be well mixed; five ounces of cow's milk are then to be added, and the whole put on a gentle fire. When the mixture begins to thicken, it is removed from the fre, stirred during five minutes, heated and stirred again till it becomes quite fluid, and finally made to boil. After the separation of the bran by a sieve, it is ready for use. By boiling for a few minutes it loses all taste of the flour. (*London Lancet*, Jan., 1865, quoted in Diseases of Children, Dr. J. L. Smith.) The objections to this formula are that while it requires no more skill and practical knowledge than parents should have, yet, as a matter of fact, many mothers are lacking in both, and the operations of straining and of heating to a proper temperature, which, as a matter of fact, should not exceed 150° F., about which temperature diastase undergoes decomposition, would either not be properly performed or the necessity of resorting to the labor would effectually deter the nurses from preparing Liebig's foods. For these reasons its prepara-

tion has fallen into the hands of manufacturers, and it is claimed by them that the husk is carefully freed from the malt and the malt finely ground, that the wheat flour is lightly baked prior to use and the conversion of the starch, under the influence of diastase, is watched with the aid of a thermometer. The composition of the three varieties of Liebig's Food principally sold in this country, is given in the following table:

	Horlick's.	Hawley's.	Mellin's.
Moisture	3.39	6.60	5.00
Fat	0.08	0.61	0.15
Grape sugar	34.99	40 57	44.69
Cane sugar	12.45	3.44	3.51
Starch	none.	10.97	none.
Soluble carbohydrates	87.20	76.54	85.44
Albuminoids	6.71	5.38	none.
Insoluble residue	2.62	.....	9.41

All of these are dry foods in brown or yellow masses and very sweet, the Mellin's food looking and tasting very much like pulverized molasses candy. Their aqueous solutions, besides this sweet, had an after taste of alkaline salt. Under the microscope, Horlick's food exhibited very few starch granules, some cellulose, hairs of wheat, but mostly dark bundles of entirely unrecognizable granular matters, probably converted starch. Mellin's food goes almost entirely into solution and I failed to recognize under the microscope the minute irregular granular matter left behind. The materials sent to me by the manufacturers of Horlick's food, as representing their regular consumption, consisted of fine white wheat flour not baked, good barley malt and pure bicarbonates of potash and soda. Singularly enough, the reaction of the Horlick's food analyzed was acid. That of the Hawley's food was acid likewise, while the Mellin's food was alkaline.

The analyses reveal certain striking points in connection with these Liebig's foods. The percentage of fat is extremely low, that of grape sugar very high. In Horlick's and Mellin's there is no unconverted starch, in Hawley's 11 per cent. In Mellin's there were no albuminoids and in both the others the percentage was very low, that in Horlick's, the larger, being but 6.71 per cent. I fail to understand the entire absence of albuminoids in Mellin's food, the only ready explanation, which is that neither wheat nor barley malt was used in the preparation, being one which I am loath to entertain. From its

analysis, it would appear to contain but little else except 46 per cent. of sugar, nearly as much dextrine, saline matters and insoluble residue.

The objectionable feature in all this class of foods is their extremely low percentage of albuminoids as compared with the carbohydrates. This objection would be fatal to their continued use, unless when accompanied by a sufficient amount of milk to change entirely the relative proportion of their ingredients. This being the case, and the required amount of milk being large, their quality as food would largely depend upon the quality of the milk used in connection with them.

UNCLASSIFIED.

27. *Keasbey's and Mattison's.* The advertisement states that this is an extract prepared from malted grain, consisting of grape sugar, dextrine, alkaline phosphates, etc., and that it is perfectly free from starch. It does not resemble the various preparations of Liebig's foods in the market, although in composition most nearly approaching them. It has, as the advertisement states, no starch, but at the same time does not contain any albuminous matter, and this is inexplicable in case malted grain were used in its preparation. The amount of grape sugar contained in it is very large. It gives the reactions for dextrine and has a very sweet taste, resembling both in taste and appearance some variety of molasses or syrup. Its reaction is neutral. It contains:

Moisture	27.95 per cent.
Fat	none.
Grape sugar	36.75 "
Cane sugar	7.58 "
Starch	none.
Soluble carbohydrates	71.50 "
Albuminoids	none.
Insoluble residue	0.55 "
Salts	0.92 "

ANALYSES OF INFANTS' FOOD.

	Moisture.	Fat.	Grape Sugar.	Cane Sugar.	Starch.	Soluble Carbohydrates.	Albuminoids.	Gum, Cellulose, etc.	Insoluble Residue.	Total.	Reaction.
Baby Sup, No. 1	5.54	1.28	2.20	11.70	61.99	11.35	9.75	7.09	.....	100.00	Neutral.
Baby Sup, No. 2	11.48	0.62	2.44	2.48	51.95	22.79	7.92	5.24	.....	100.00	Slightly alkaline.
Gerber & Co.'s Milk Food	6.78	2.21	6.06	30.50	38.48	44.76	9.56	.....	.....	101.79	Slightly acid.
Ridge's Food for Infants	9.23	0.63	2.40	2.20	77.96	5.19	9.24	.....	.....	102.25	Neutral.
Victor Baby Food	7.49	1.62	0.62	19.92	63.45	20.54	8.87	.....	.....	101.97	Slightly acid.
Anglo-Swiss Milk Food	6.54	2.72	23.29	21.40	34.55	46.43	10.26	.....	.....	100.50	Slightly acid.
Horlick's Food for Infants	3.39	0.08	34.99	12.45	none.	87.20	6.71	.....	2.02	100.00	Slightly acid.
K. & M. Infants' Food	27.95	.....	36.75	7.58	none.	71.50	none.	.....	0.55	100.00	Neutral.
Nestlé's Milk Food	4.72	1.91	6.02	32.93	40.16	44.88	8.23	.....	0.08	100.00	Slightly alkaline.
Hawley's Liebig's Food	6.60	0.61	40.57	3.44	10.97	76.54	5.38	.....	.....	100.10	Slightly acid.
Hazard's Graham Farina	9.12	0.81	2.19	2.49	69.68	6.35	8.48	5.56	.....	100.00	Neutral.
Cereal Milk	9.33	1.01	4.60	15.40	58.42	20.01	11.08	.....	.....	100.16	Slightly acid.
Mellin's Food	5.00	0.15	44.69	3.51	none.	85.44	5.95	.....	3.46	100.00	Slightly alkaline.
Blair's Prepared Wheat Food	9.85	1 56	1.75	1.71	64.80	13.69	7.16	2.94	.....	100.00	Neutral.
Savory & Moore's Infants' Food	8.34	0.40	20.41	9.08	36.36	41.83	9 63	0.44	.....	100.00	Neutral.
Hubbell's Prepared Wheat Food	7.78	0.41	7.56	4.87	67.60	14.29	10.13	undet.	.....	100.21	Neutral.
American-Swiss Milk Product Co.	5.68	6.81	5.78	36.43	30.85	45.35	10.54	0.77	.....	100.00	Acid.
Wheat Flour for Hubbell's Wheat Food	9.02	1 01	2.34	2.46	76.07	5.66	6.40	.....	.....	.....	Neutral.
Imperial Granum	5.49	1 01	trace.	trace.	78.93	3.56	10.51	0.50	.....	100.00	Neutral.
Robinson's Patent Barley	10.10	0.97	3.08	0.90	77.76	4.11	5.13	1.93	.....	100.00	Neutral.
Farwell & Rhine's Gluten Flour	12.67	0.84	2.23	1.42	68.36	7.23	10.39	0.51	.....	100.00	Neutral.

CONCLUSIONS.

It will be manifest, I think, from the foregoing results and remarks that I have arrived at conclusions quite different from those authors who would severely condemn all the very numerous kinds of infants' foods at present manufactured, and who would stigmatize the manufacturers as dishonest in their representations and in their goods. Neither am I able to agree with the statements found on so many of the labels, that certain foods are the only or the best possible infant foods. I am impressed with the very great amount of study and labor which most of these manufacturers have expended, and what I have to say in the way of objection is based not so much upon the shortcomings of manufacturers as upon certain imperfections unavoidable in particular classes of foods. To recapitulate, these classes are three in number: The prepared farinaceous foods, the Liebig's, and the milk foods. The first variety are in no case, and cannot be by any process of cooking or baking at present known, so far altered in composition that the largest portion of their starch is converted into sugar and dextrine. They are, of necessity, mainly starch, and for this reason are not well adapted for infant food. The Liebig's foods are very deficient in albuminoids. Two of them are entirely without albuminoids, the Mellin's and the Keasley & Mattison's, and they should be made better to conform to Liebig's standard. The Liebig's foods are excessive in the amount of carbohydrates, and this excess of saccharine matters, etc., must still exist even after the addition of milk. They cannot be made in this way to exhibit such a ratio of carbohydrates to albuminoids as exists in human milk. The third class, the milk foods, has about half the amount of starch which is present in the first class and about the same amount of albuminoids. It is open to the great objection that its ratio of saccharine matters to the albuminoids is still too high. Whilst the market supplies us many more or less excellent infant foods, one not open to these objections and entirely satisfactory has yet to be made.

REPORT OF WILLIAM K. NEWTON, M. D.,

ANALYST AND MILK INSPECTOR.

Dr. E. M. Hunt, Secretary State Board of Health:

DEAR SIR:—I herewith transmit my third annual report:

The law for the prevention of the adulteration of milk was very much changed by the Legislature this year, and was revised and passed under a new title. The alterations made in the law of 1881, by the new act, are as follows: The mark on cans containing skimmed milk was required to be of metal and the letters thereon to be at least two inches high; the standard of total solids was reduced from thirteen per cent. to twelve per cent.; the method of making complaints and conducting trials was defined and made clear; the Inspector was authorized to appoint assistants at a salary of not more than five dollars a day. The most important change, however, was the introduction in the law of a plan for disposing of the samples of suspected milk before a complaint was made against persons violating the statute. This plan is as follows: the Inspector is required to take a sample, seal it up in a suitable vessel in the presence of a witness and transmit it to a member of the Council of Public Analysts. This takes all responsibility away from the Inspector and the burden of proof of adulteration lies with the chemist.

The new law has worked well but less rapidly than the old one; many cases have been passed over because of the difficulty of obtaining persons willing to act as witnesses to the sealing of the sample, and I have been compelled, in a number of instances, to require the dealer to be a witness.

I have appointed but three assistants, under the law, for the following reasons: my desire has been to keep the running expenses of my

department at a minimum, and I did not want to open the door to a long list of salaried assistants; and thoroughly honest and capable men, who are willing to do the work in a proper manner, are hard to obtain.

In Newark, Mr. Henry Negles was commissioned an assistant, without pay, and placed under orders from Dr. F. B. Mandeville, health officer of that city. Mr. Negles was well drilled by me in the duties of milk inspection, and when I deemed him competent was placed in charged of the work in Newark.

At no place outside of New York city has such a vigorous warfare been waged against dealers in impure milk as that carried on in Newark. At least seventy complaints have been made in that city and Mr. Negles is to be congratulated on his success and the city of Newark may well be proud of so efficient and capable an officer.

Dr. Edgar Everhart, of Hoboken, was appointed assistant for Hudson county, on a reasonable salary. He has done telling work in Hoboken and Jersey City.

Mr. Peter Vandegrift was commissioned for the southern and western part of the State, and is at work under my orders and to aid the local authorities.

I have personally visited nearly all the dairy sections of the State, but as a detailed account of the work done would be a repetition of my last report, I do not think it necessary to lengthen this report by relating it.

Eighteen complaints against persons engaged in selling impure milk have been made by me and they have been disposed of as follows: seven persons have been discharged by the courts on account of mitigating circumstances, they paying all costs of court; six have been fined fifty dollars each; five cases are still pending in the courts.

The arrangements made with analysts have been very satisfactory, and the terms agreed upon are advantageous to the State. The fees accepted by these gentlemen are so low that love for the work, and a desire to aid the authorities, must have been the only motives.

The law has proved of great value to the milk producers of Sussex, Hunterdon, Passaic, Morris, Essex, Somerset and Middlesex counties, and has assisted them in making better terms with the dealer and consumer. As the enforcement of the law has kept out of market large quantities of impure and impoverished milk, the pure article has been able to command a better price. In the above-mentioned counties, I am assured by all honest dairymen that the law has been a great

boon to them, and, as at least two-thirds of the milk produced in the State and used as food comes from these counties, we may claim that the majority of producers are satisfied with and are in favor of the law. I am sorry to say that the producers in the western section of the State are not yet satisfied with the statute and still think it harsh in its operation. Hardly a complaint is made against an offender in that part of the State without the cry of oppression being raised. I can only account for this dissatisfaction by assuming that there are false prophets or ill-advised agitators misleading the dairymen.

I may be pardoned for re-opening the discussion of the vexed skimmed milk question, if the importance of that question is understood. The section in our law allowing the sale of skimmed milk, if the cans are properly marked, was thought by some to settle the matter and to prevent fraud, but the tag or label is now used by shippers to mislead inspectors. Large quantities of impoverished milk are sent to market in legally-marked cans and sold to consumers as pure milk. Permission to sell this fraudulent article is but permission to defraud the public. I venture to say that the sale of skimmed milk would be reduced to a very small quantity indeed if the public knew what it was purchasing. I can see no method of checking fraud in our milk supply and at the same time enabling our farmers to get a living profit out of the milk they raise, if skimmed milk is allowed to be sold; and I am fully persuaded that the radical measures adopted in New York are the best for the public.

I will in closing reiterate what I have many times written in reference to our milk law, and that is, I am of the opinion that the food adulteration law is fully competent to cope with the adulteration of milk, and the Inspector should be required or authorized to make his complaints under that law.

Paterson, December 28th, 1882.

Respectfully submitted,

WM. K. NEWTON, M. D.,

State Inspector of Milk.

CIRCULARS AND LAWS SINCE JANUARY 1, 1882

CIRCULAR F (XXVI.)

As to Contagious Diseases of Animals.

In addition to diseases already noted in the five former circulars of this Board, a few others have attracted our special attention because of their occurrence to a greater degree than usual in this State.

DISEASES OF HORSES.

An epizootic, or general influenza among horses, has prevailed at various times in different countries. It has never prevailed so extensively in this country as it did in 1872–3, when, like a traveling epidemic, it commenced in Canada and proceeded with quite equal pace toward the south until it extended over the entire United States and Mexico. While its origin is unknown, its communicability seemed to be established from the fact that horses escaped on those islands to which others were not brought from the mainland, and that animals kept away from others and not brought out of their stables, sometimes escaped. The best account of the epizootic and of its methods of treatment, is to be found in the history of it by Dr. A. B. Judson, Professor Andrew Smith, and Professor A. F. Liautaud, as contained in Vol. I. of the "Reports and Papers of the American Public Health Association," pages 88–109, and in the paper of Prof. James Law, as contained in the Report of the Department of Agriculture (U. S.) for 1872.

There was a slight recurrence of the disease in some parts of the United States in 1881–2, and in localities in this State it was quite common, although generally in a much milder form. It is a disease which has great variations in severity and in its class of symptoms

and lesions. From the fact that the mucous membrane of the eye, in sympathy with that of the pulmonary organs, is often pink with a tinge of brown or yellow, it is frequently know as "pink eye." This was its more common name as it prevailed with us the last season. About the same time it prevailed extensively in Glasgow and other parts of Scotland. The following outline and treatment of the disease as given by W. M. Anderson, Jr., before the Scottish Metropolitan Veterinary Medical Association will serve as a valuable guide:

"The disease presents itself in several forms, which may be classified under four heads, viz., Catarrhal, Œdematous, Rheumatic, and Irregular. In all four forms the primary symptoms are alike, namely, dullness and languidness, then loss of appetite. At this stage we can, as a rule, determine what form the disease will assume. If Catarrhal, the animal has a slight cough, tumefaction of the submaxillary glands, with watery discharge from the nostrils, and the usual febrile symptoms, namely, increased temperature and rapid pulse; the conjunctiva has a yellowish appearance, and all the mucous membranes visible are injected. The pulse is seldom over eighty, more frequently ranging from fifty-five to sixty-five, the temperature varying from 101°–105° Fahr.

"I consider the disease takes four days, as a rule, to mature, at which stage the foregoing symptoms are increased. The previously injected mucous membranes become yellow; the animal gets very weak, in fact, staggers greatly; rapid emaciation sets in, still there is no inclination to feed, and it seldom lies. This state of matters generally continues for two or three days before convalescence sets in. The first convalescent symptoms are the eye brightening up and the animal showing an inclination to feed. It is astonishing how soon the patient recovers after convalescence sets in; the symptoms disappear as rapidly as they appeared, and in a few days the animal is apparently in good health. The fatal terminations of this form of the disease are generally due to pleurisy or gangrene of the lungs. When the disease assumes the Œdematous form, after the primary symptoms the eyelids swell, then the legs—more especially the hind ones—tumefy considerably, and the sheath, as a rule, is greatly swollen. There are the usual febrile symptoms, with quick, weak pulse, and urine high colored, and often, but scantily, passed.

"The mucous membrane is infiltrated with a yellow fluid; there is great thirst, but no inclination to feed; rapid emaciation sets in, and in a number of cases diarrhœa is present. This form of the disease also takes about four days to mature. The eyelids are then completely closed, the pulse generally ranging from eighty to one hundred, the temperature from 102° to 105°. As a rule several days elapse before convalescence sets in, and recovery is much slower than in the preceding form. Should death take place, it is generally through sheer prostration.

"In the Rheumatic form, which I must say is the most peculiar, we have loss of appetite and the mucous membrane injected; there is great lameness in one or more limbs, oftenest in the off fore, without any apparent cause. The animal has an anxious look, as if suffering acute pain. The febrile symptoms are present, accompanied by an intermittent pulse; the lameness sometimes changes from one limb to the other; the back is in some cases 'roached,' and when the animal is moved it generally inclines to one side or the other. There is a difficulty in micturition, and the urine is highly colored. This form takes about ten days to run its course; and often the lameness continues for several days after the other symptoms have disappeared.

"The fourth form, which I have called 'Irregular,' includes all the complicated forms of the disease. The usual symptoms of fever and jaundice are present, but in some cases we have diuresis accompanying them, in others partial paralysis, again in others colicky pains, all of which require different treatment, according to their respective symptoms. I cannot say much regarding the *post-mortem* appearances of this disease, as I had only one opportunity of witnessing an examination of a horse which was said to have died from the disease, and from all appearances emaciation was the cause of death. However, the mucous membrane all along the intestinal track was infiltrated with a yellow fluid, and the liver was enlarged. My treatment for this disease of course varied according to the symptoms present; but in every case in which fever existed the first thing I did was to rub the whole surface of the body with *acetic acid and water*. If the animal had a fine skin I mixed one part of the acid with two of water, but with draught or coarse-skinned animals I used equal parts. After rubbing the body and legs with this mixture, I ordered the animal to be well wrapped up in several blankets, from the head backwards, and the limbs to be bandaged; I also put half an ounce of nitrate of potash and fifteen mimims of Fleming's tincture of aconite in half a pailful of cold water, and allowed the animal to drink it as he pleased. After the blankets had been on an hour I had them removed, and usually found the animal perspiring profusely. Having had him rubbed dry, and applied soap liniment to his throat and region of the liver, dry blankets and bandages were put on, and he was removed to a comfortable box or stall. The only food I allowed him was a few *sliced carrots*, mixed with some wet bran, and a handful of oats three or four times a day. In the Catarrhal form I generally applied the liniment to the throat twice a day, and in a few cases had to blister the throat with cantharides. I kept water with aconite and potash constantly before him, allowing him three to five doses in the twenty-four hours. However, after the first administration I limited the dose to two drms. nit. potass., and ten mims. aconite. If the fever continued, without showing signs of abatement, twenty-four hours after my first visit, I again applied the acetic acid and water.

"When I feared the disease extending to the chest I applied a counter-irritant, and gave sulph. ether two ounces, and camphor two drms., twice daily. In the Œdematous form, besides applying the acetic acid and water to the body, and the liniment to the throat and region of the liver, I ordered his legs to be rubbed with mustard and water, the strength being one-quarter pound of mustard to a gallon of water, and then bandaged. I also gave mineral tonics in the form of balls.

"In the Rheumatic form I gave two drms. salicylic acid twice daily and applied acetic acid to the affected limb or limbs. In the Irregular form my treatment, of course varied. When diuresis was present I substituted carbonate of soda for nitrate of potash, and gave plenty of mashed linseed, also occasionally giving two drms., iodide of potassium. When partial paralysis presented itself, I gave sulph. quinine and nux vomica. My opinion regarding the treatment of this disease is, that good nursing and comfort have more to do with the recovery of the patient than all the medicine we may prescribe."

PREVENTION OF CONTAGIOUS DISEASES.

Two points in respect of the contagious diseases of animals still need to be urged upon farmers and dealers. Because they are animals the

laws of their well-being are definite and precise. If they are badly reared, ill-fed, badly kept, and if allowed to live amid their own filth, when it is in a state of decomposition or putridity, or to drink of water that is polluted, it is to be expected either that they will not thrive or that pestilences will occur. With swine especially, it is now quite well known that most of their diseases are primarily the result of enforced filthiness, and some of the diseases of other animals have a similar origin. Next, it is to be remembered that most of these communicable diseases among animals are transportable, and so arise by contact with diseased animals or with their secretions. As droves of cattle in course of conveyance, or while kept in city stock yards are greatly *exposed, it is never wise to place unknown and newly purchased animals with the general herd or flock, or in adjacent stalls until at least thirty days have elapsed. Even longer where any contagious disease prevails.*

INOCULATION FOR PLEURO-PNEUMONIA.

Within the last year an important paper has appeared on inoculation as a preventive of pleuro-pneumonia by R. Rutherford, M. R. C. V. S., of Edinburgh, which seems greatly to encourage the hope that some former risks are removed, and that when properly performed, we possess in it a means of limiting the prevalence of this destructive disease. His paper is contained in the June and July numbers (1882) of Fleming's Veterinary Journal. He states his conclusions in the following summary: 1-10, *see page* 30, *Veterinary Journal, July*, 1882.

"1. Inoculation is based upon the theory of pleuro-pneumonia being an eruptive fever.

"2. Inoculation is the application to a healthy animal of the virus of pleuro-pneumonia.

"3. Inoculation does not produce pleuro-pneumonia.

"4. An inoculated animal does not infect another animal.

"5. An inoculated animal cannot contract pleuro-pneumonia.

"6. The time occupied by the operation is from four to eight weeks.

"7. Inoculation in the case of milch cows does not materially interfere with their milking.

"8. Inoculated animals thrive better after the operation, and are stronger and freer from other ailments than those not inoculated.

"9. The loss arising from the operation need not exceed two per cent.

"10. From the fact that an inoculated animal is exempt from the disease, and that the average time required to develop and mature an inoculation is from fourteen to twenty-one days, that period may be accepted as the time required to arrest an outbreak."

He insists upon exact methods of procuring, preserving and inserting the lymph. His success fully justifies the provisions of our present law, while it shows the inadequacy and danger of the operation in unskillful hands.

In the April Veterinary Journal of 1882, its editor, George Fleming, F. R. C. V. S., says:

"By a long-continued series of experiments on animals, Dr. Willems, of Hasselt, Belgium, has succeeded in perfecting a method of protective inoculation, which is certain in its results. Further experiments with the cultivated germs of the virus are now being carried on with a view of obviating troublesome accidents which sometimes accompany the inoculation, and with every prospect of success."

The same distinguished authority, in reply to an inquiry addressed to him by this Board, says:

"Inoculation as a protective measure for bovine contagious pleuro-pneumonia, has been, and is now most extensively practiced on the continent of Europe and in this country, and there is no evidence that inoculated animals, while suffering from the immediate effects of the operation, can communicate the disease. There is only one such instance recorded (it is given in the Vet. Sanitary Science and Police,) but the circumstances attending it throw great doubts upon its correctness. I, myself, discredit it. I have absolute faith in the effects of the operation as a prophylactic measure, and would most certainly counsel its adoption where the disease prevails, subject, of course, to suitable precautions as to the time and manner of performing the operation. This should be as carefully attended to as vaccination is with children."

ANTHRAX OR SPLENIC FEVER.

Since the cases of *malignant anthrax*, or splenic fever, in Salem county, a few similar cases are thought to have occurred in Hudson county. The seriousness of the disease is shown by its ravages in some European countries, and especially in Russia. Prof. Tyndall informs us that in the single district of Novgorod, in Russia, between the years 1867 and 1870, over 56,000 cases of death by splenic fever among horses, cows and sheep were recorded. Nor did its ravages confine themselves to the animal world, for during the time and in the district referred to, 528 human beings perished in the agonies of the same disease. The causes and cure of the malady are well summed

up by Prof. Law in an article in the second report and papers of the A. P. Health Association, page 467: "The most universally acknowledged causes of the malady in animals are plethora, or a state of blood highly charged with organic elements, an impervious soil or subsoil for pasturage, a very rich surface soil, inundations, a period of heat and dryness, calculated to foster decomposition of organic matters to a great depth in the ground, and a great contrast between the night and day temperatures. * * * While this affection is communicable to animals by inoculation, it can scarcely be said to spread in any other way, and is, therefore, to be looked upon as essentially an enzöotic disease. We must go to such places as the inundated margins and deltas of large rivers, dried-up lakes and marshes, or the rich and pestilential Russian steppes, to find any approximation to the disastrous outbreaks in man and beast which blacken the history of past ages." What was done in the cases reported by Prof. Law to check the disorder, remains to be noted. One hundred of the best steers were turned on a higher pasture with a gravelly subsoil. The remainder were, of necessity, left in the higher of the two meadows formerly occupied, but were fenced out from the swamps and low meadows where the clay approached near to the surface. Antiseptic methods of treatment were used, and most of the cattle recovered. In the cases occurring in Salem county, the bacillus anthracis was detected.

TEXAS, OR SOUTHERN CATTLE FEVER.

This is generally regarded as allied to anthrax or splenic fever. Its classification cannot be said to be settled. It is not believed that it has the same law of contagion as the malignant anthrax of Europe, or as similar outbreaks which occasionally occur in this country.

The disease, although communicable, is not regarded as contagious in the general sense. D. E. Salmon, D. V. M., a veterinarian of the National Agricultural Department, says:

"The real danger exists in the pastures or other grounds over which Southern cattle, whether sick or well, have traveled." If other cattle are turned in the same pastures or go along the same roads, they are liable to contract the disease. The sick animal does not, because of his sickness, impart the disease, but the apparently well Southern cattle seem to carry the contagion of the disease, and will impart it to the pastures in which they feed, or the roads on which they travel, although, even afterward, not showing it in themselves. It is even claimed that a sick Southern animal does not infect the

pastures, while those from the South, which have sickened by pasturage or by driving on fields or roads infected by apparently well Southern cattle, do infect them. This would suggest the idea that it is only at a certain stage that the infective particle is transmissible. Also, it is believed that Northern cattle, which have contracted it through road-driving or pasture, will not impart it to other cattle, either directly or by means of pastures. We cannot yet regard the history of this contagion as so definitely settled. Two outbreaks, confined to Texas cattle brought into this State, have occurred this year—one in Salem county and one in Burlington county. No extension of the disease has occurred. It is therefore important to state what is to be done in such case, both so as to exercise due precaution and to avoid unnecessary alarm.

The sick Southern cattle should be "quarantined upon the infected pasture," where they cannot come within one hundred feet of other animals. They should be securely fenced upon the infected pasture until after a killing frost. Such as die should be buried beyond the reach of dogs. The question of slaughter must be left to local authorities, but, by most, this is not considered necessary in order to check the extension of the disease. Until more settled views are entertained, we recommend the same course in case of native cattle which may have contracted the disease. It is not necessary to quarantine all the cattle, but only those sick and the fields in which they are. Purchasers of Southern cattle should not allow other cattle, until after severe frosts, to be upon or go over the same ground on which they are left. It might become necessary for a township to prohibit the bringing in of any cattle from districts infected with Texas fever. The danger is the more insidious from the fact that the ground over which they pass or the excretions they leave upon it impart the disease. The "ticks" which are found upon the cattle may help in determining whence they came, but they have no relation to the disease.

There is no specific treatment known for the disease. The usual course of veterinarians is to give oils or mucilaginous drinks and nitre, or some other form of diuretic, to relieve the dryness of the fourth stomach and the congested state of the alimentary tract, the congestion of the liver or spleen, and the bloody urine. Where there seems to be much pain, opium is freely administered. Many recover, but the relation of treatment to their recovery is not always known.

The meat of any animal affected with the disease is not fit for use. It shows putrefactive changes so marked as not even to be classed with the meat of some of the more diffusive contagions.

The former circulars of the Board contain information as to all the other communicable diseases which have occurred in the State for the past year.

NOTE.—Copies of all these circulars, in pamphlet, can be had by postal addressed to State Board of Health, Trenton.

Trenton, January 4th, 1883.

CIRCULAR XXVII.

As to Sanitary Instruction and Training in Schools.

At its last session, the Legislature of the State of New Jersey, in Chap. CLXV., Sec. 2, enacted the following provision:

And be it enacted, That the State Board of Health shall be directed to confer with the trustees of the State Normal School as to definite instruction to be given in the practical care of the health of teachers and pupils, and as to provisions for such instruction.

At a meeting of the New Jersey State Board of Health, held at Trenton, the subscribers to this circular were appointed a committee to endeavor to secure in the public schools of this State such instruction in Physiology, Hygiene and Sanitary Science and Practice as shall most efficiently carry out the objects for which the Board was established, viz., the health, the happiness and the prosperity of the people of the State. To this end, we appeal most earnestly to all who are interested in the educational work of this State. State and local Boards of Education, trustees of the State Normal School, of colleges, academies, seminaries and of local districts, State, county and city superintendents, principals and teachers in all our institutions of learning are asked to consider most seriously and aid most effectually in instituting and carrying out a scheme for such instruction as we have indicated.

We would call your attention to the fact that the primary object of the public school system of the State is to secure good citizenship. There can be no complete citizenship without a knowledge of and obedience to the laws of one's own being and the laws of society—civil, sanitary and social. With these, it is safe to say, we shall secure among all classes of the community the best health, the highest productivity—moral, intellectual and physical—and the greatest amount of well-being and happiness. We would remind you that,

hitherto, the laws of one's own being and those of communities, constituting the great body of facts known as hygiene and sanitary science, have been very much neglected in the usual course of public instruction in this State. Thus the young have been permitted to grow up exposed to all the dangers to life and health, which follow inevitably the disobedience of nature's laws.

Is it not practicable that some of the time now spent in teaching branches of knowledge indirectly or remotely serviceable to the learner might, more profitably to the pupil and to the State, be devoted to imparting such knowledge as must needs be practically useful every day and hour of one's life?

Is it not equally evident that the kind of knowledge which contributes directly to the maintenance of health and vigor of body and mind, the prolongation of life and the fullest development of all the faculties in a complete and perfect manhood and womanhood, must be second in importance to none other?

If this be true, is it not equally clear that instructions in such should be as systematically and thoroughly given in all grades of schools as upon any other subject? Admit these propositions, and you will agree that we need to modify, as speedily as possible, our scheme of education.

It need hardly be said that the change, to be effectual, must be radical. Teachers must be, themselves, taught. Should not the Normal School begin this work soon and thoroughly? Teachers' institutes should make it a prominent part of each meeting. State, county and city superintendents should unitedly bring to bear all their influence to secure it a place in the regular course of study in the schools under their charge, and to stimulate the teachers to give their best efforts to make it as thoroughly practical, as it will be intensely interesting when properly pursued. Boards of trustees, upon whom now devolves the duty of determining the studies to be pursued in their respective districts, should at once take steps to introduce this, the most important of all, into the course, and by faithful oversight see that it is adequately and properly taught. Not by occasional lectures here and there before bodies of teachers, not by bits of advice to pupils on the part of well-meaning and well-informed teachers can this work be properly done, but only by systematic, oral and text-book instruction, as faithfully and persistently pursued as possible, and adapted to the ages and capacities of the pupils. It need hardly be said that the subject is broad enough and deep enough to

engage the profoundest thought of the foremost scientific minds of the world; yet, its facts are the facts of every-day life, many of them so simple, so clear, as to be readily taught and practiced.

With this instruction, so adapted to all ages and capacities, we would combine physical exercises, varied, beautiful and practical, fitted to develop the bodies and strengthen the minds of the growing pupils. Thus they will secure, as the limited time they have been under training will allow, knowledge immediately serviceable in the battle of life, and bodies well fitted to put it to practical use.

The Board will cheerfully furnish names of text books suited to various grades of schools, by means of which a beginning in these subjects may be made, and when once introduced, the demand for adequate instruction will, as in England, produce multitudes of works from which the teacher may select those best suited to inculcate this needful knowledge and to train pupils in its practice.

Trenton, August 21st, 1882.

L. DENNIS,
F. GAUNTT,
E. M. HUNT,
Committee.

CIRCULAR XXVIII.

Sanitary School Circular of the New Jersey State Board of Health.

The State of New Jersey in its free school system makes it obligatory upon all children, between five and eighteen years of age, to attend school. It claims that the public and social welfare of the State demand this provision for the education of its children, and, in order to assure attendance, provides for it free of charge.

It may be claimed, as an axiom, that a State which thus assembles its children from day to day in public buildings which it provides, should see to it that these are divested of all avoidable unwholesome circumstances. In other words, the children in this enforced assemblage, for the State's good and for the good of its children, should not be subject to any preventible cause of disease. This means a great deal, both for the child's future and the future of the State. We cannot here discuss it in detail, but only seek to summarize what it does

mean, and what it is the duty of the State, of trustees, of teachers, of local authorities and of parents to seek to secure.

Adaptation.—It is ever to be remembered that the question of healthfulness is relative in all its parts. It is first a question of the adaptation of location and construction for the purposes designed. It is next a question of how the building is to be used in carrying out the design. Many a building well designed is only partially utilized for health, because the teacher does not understand the methods of adaptation. An overcrowded room may, in a half hour, disturb the equilibrium of a system of ventilation perfectly adapted to the school for which it was designed.

Management or the executive administration is often the essential in which there is failure. The most perfect mechanism does not run itself. Nor is it run by the good intention of the overseer. It is only knowledge of how to manage it, and faithful quickness of perception to manage it aright, that secure the satisfactory results. Therefore, nothing can take the place of knowledge and attention on the part of teachers, janitors and other officers. But as these should not be embarrassed in their efforts by structural defects, we notice:

I. BUILDINGS, THEIR LOCATION, CONSTRUCTION, ETC.

Location should have reference to the kind of ground, as to whether it is sterile or full of organic matter; the latter, while good for plants, is not needed for school children.

Next, is it sandy, gravelly, clayey or rocky? Is it wet, swampy or dry? Well drained or ill drained?

In this respect school-houses are best located on dry ground, or such as has been made so by thorough drainage. If the ground is such that a cellar would be likely to be damp, the building is better to be placed on a foundation raised from the level sufficiently to admit of free circulation of air beneath. The contour of the ground should be made slightly to decline in all directions from the building. Water from the building should not be allowed to run off and soak in the ground adjacent thereto.

The school-house should not be closely surrounded by trees or by buildings on the sides where there are windows, because light and not shadow is needed. Excessive sunshine within the building must be guarded by outer or inner blinds. As a rule, the sunlight is best distributed when the corners conform to the four cardinal points.

Construction.—The material for construction is the same as that adapted for the best houses. But, as for two days in a week, or at vacations, the building is not occupied, and only for part of the day at other times, heating and ventilation are less regular, and dampness is more apt to occur than in well-managed private dwellings. If brick or stone is used, the damp-proof layers are often important, as well as wainscoting and a little deeper furring than usual.

Thirty-eight by twenty-three feet is about the model shape of rooms, according to the best authorities, with not less than twelve feet of ceiling. These dimensions are determined by laws as to light, sound and capacity. This size would be adapted to about forty scholars at most.

Windows need to be set with reference to the size and shape of school rooms, and, if wrong, should be altered in buildings already erected.

Windows should reach nearly to the ceiling, and may come within about three and a half or four feet of the floor. It is best to have the light diffuse itself from above the level of the pupils. The upper part of the windows and the ceiling serve to send down the light. Porticoes or projecting roofs or window-ornaments should not be placed on the outside so as in the least to obstruct the light.

Inside blinds or shutters are convenient, as these may be adjusted to keep out the rays of the sun or to regulate the light. Ceilings should be white, as they thus help to reflect the light. The walls are best of gray or some neutral tint.

Light should not enter directly in front of where the pupil sits. As the right hand and side are used most in writing, drawings, etc., for many purposes light from the left side is better. The Germans so insist upon this as to build school rooms with windows on the left side only. Light can also be let in from above. Blackboards or slates between windows receive the light unfavorably. Eyes and eyesight are often imperceptibly injured in our school rooms.

Doors should be wide and open outward. As they often connect with entry-ways, and when wide open cause draughts, they are not so safe for ventilation as windows. A transom window over the door is better for ventilation. They should generally be self-closing.

Stairs should be of easy rise and with platforms rather than spiral. School-houses should seldom be over two stories in height. Frequent stair climbing is, for many, not good exercise, and those in the upper rooms, in order to avoid it, often remain in at recess.

Entries should be roomy. Often there is need of an extra hall and

stairs or other fire escapes, since, in alarm or panic, children cannot be expected to have deliberate forethought.

Hard finish is generally the best for walls. They should be very smooth, as dust clings to rough surfaces. Paper is too absorbent for school walls.

Rooms in which outer garments or wet clothing, baskets, etc., are kept, should have ventilation, and pegs or shelve-pockets should be so arranged as not to crowd any soiled or wet clothing.

A small wash room, with hand basin, is needed in most school-houses, and would greatly promote cleanliness. The Chinese towel, or other towel paper, obviates the necessity of a towel in common.

School Desks.—These should be arranged with reference to the places where light or heat enters, and to the positions of teachers. They should not be against walls. Children with defects of hearing or seeing should be located with special reference thereto. Each pupil should be able to touch the floor or a foot-shelf easily with the feet. The seat should have its edge on a line with the lower edge of the desk. This preserves the best posture. When the child is sitting erect, and the elbows hanging freely by the sides of the body, the part of the desk next to him should be two inches above the line of his elbows.

The slope of desks should be at an angle of about 10°, or slightly varying from it. It is better if this admit of slight variation, according to the preference of the pupil or the directions of the teacher. The usual arrangements of desks, by which the seat is attached, is somewhat constrained, and does not admit of that change of posture and successive rest of muscle which is desirable. Until there is some change in this respect, so as to admit of more comfortable seats, the chief dependence must be on that change of posture which comes from recess, from recitations or from a five minutes exercise in calisthenics at the close of each hour. Desk seats that fold up are to be preferred. The number of desks in a room should depend on the number of pupils, as even the smaller ones should not be left all the time without this aid.

PURITY OF AIR, ETC.

The capacity of a school room as to numbers, after some general indications arising from laws of light, sound, floor space and height of ceiling, is to be determined by our ability to furnish air of proper

purity, temperature and moisture for the length of time required. These, it is true, vary in some degree by varying circumstances. The purity of air is not only affected by numbers, but by the condition of the persons. It is not merely the amount of carbonic acid that may be given off from the breath. Unhealthy or dirty children contaminate the air more rapidly than those that are cleanly. A school in a tenement-house population needs greater exactness of provision and administration. Children ill clad or sickly are more susceptible than those of average health on certain days. When the atmosphere is very dry or saturated with moisture the usual laws of capacity are disturbed. Yet there is a law which is quite generally correct. The air is said to be pure when it approximates nearly to the standard of the outside surrounding air. It is regarded as sufficiently pure when the impure air being produced is being uniformly diluted by fresh air "to a certain standard of relative purity." It is found that the amount of carbonic acid in the air is one of the tests of its relative purity. Thus pure air contains 4–10,000 of carbonic acid gas. If human breath is added to it, up to 7–10,000 or 8–10,000 or more, it is sensibly close to most persons. If beyond what this indicates, the persons are giving off more than a usual amount of effete organic matter from the breath, skin, etc., the air becomes still more rapidly deteriorated.

Of all the impurities of air, that which stands highest in the scale of injury to health is organic matter. The amount of carbonic acid present is an approximate test of this. Careful examinations have established the rule that when air contains over six ten-thousandth parts of carbonic acid, it is too impure for continuous healthy breathing.

The problem is this: What is the greatest number of persons that can be, for a given time, in one and the same room, and for whom there can be introduced an amount of pure air sufficient to preserve the standard, without causing a *draught* such as might give rise to colds or discomfort?

Careful practical experiment and allowances for insensible sources of air "show that arrangements which appear to provide for a volume of air much less in amount than that obtained by calculation, will keep the room in a fair condition. These results have pointed to about 1200 cubic feet of air to be admitted per hour for each person in rooms occupied by persons in health." This gives an average admission of 20 cubic feet per minute for each person. This, in a room for fifty scholars, would be 1000 feet per minute, even without

any allowance for stoves or other sources of contaminated air or incidental variations that may occur. To supply this requisite amount in a room 25x32, with ceilings 12½ feet high, the entire air of the room must be changed *six times* each hour. We cannot, by ordinary means, move the entire air in a room oftener than three times per hour without draught. (See our 1st Report.)

The velocity of the air as it flows in and out of a room, as measured at the openings for admission or exit, should not exceed one foot or, at most, two feet per second; firstly, in order to prevent a sensible draught being felt, and, secondly, because low velocity is favorable to the uniform diffusion of the incoming air through the room.

Air should be introduced and removed at such parts of the room as not to cause sensible draught. Air flowing against the body at or even somewhat above the temperature of the air of a room will cause an inconvenient draught, from the fact that as it removes the moisture of the body, it causes evaporation or the sensation of cold. Air should not, as a rule, be introduced near the floor level. The openings would be liable to be fouled with sweepings and dirt. The air, unless very much above the temperature of the air of the room, would produce a sensation of cold to the feet. The orifices at which air is admitted should be above the level of the heads of persons occupying the room. The current of inflowing air should be directed toward the ceiling and should be as much subdivided as possible by means of numerous orifices.

When the outside air is of the right temperature, or a nearer approach thereto than we can secure by any indoor arrangements, it is wise to trust to openings between the room and the outside air for our supply. Hence, it becomes a study what these openings shall be and how they shall be regulated. Windows are among the most valuable. It is a great practical art of the teacher to know how to regulate their use. Air may often be admitted near the ceiling or between the two sashes, or be directed upward by a hood or cowl and so diffused in the room, when its direct admission would cause draught or be too cool. A strip of board under the lower sash serves to keep out direct draught and opens a space between the upper and lower sash, and so is a simple device often applicable. A wire screen, fitted in windows, admits air while diminishing draught. Openings in the side walls, such as the Sherringham's ventilator, introduce outer air and incline it upward, or such as Tobin's, receive it near the ground and inlet it above the head level.

Much can be done for the natural ventilation of school rooms by their management when unoccupied. They should be thoroughly flushed with air before and after school. This does not mean the opening of a single window, but such general opening of all outlets to out-of-doors as will allow an entire flushing of the room. At recess the same can be partially or completely done. Sometimes the opening, on account of temperature, may have to be momentary. It may often be made just after the room is vacated. Windows may be lowered during gymnastic or calisthentic exercises, even when the air would be felt too cool for a sitting posture.

ARTIFICIAL VENTILATION.

There are so many forms of artificial ventilation that it is very necessary that, where these are relied upon, teachers make themselves fully acquainted with their mode of action and so come to have judgment in their regulation. They do not take the full place of natural ventilation by windows, etc., but are of chief advantage when these cannot be used.

Artificial ventilation consists in certain forms of apparatus for bringing pure air in and getting impure air out. The chief necessity for any such arrangements arises from the fact that the prevalent temperature of the outer or pure air needing to be brought in is not comfortable, and that the impure air within has not the chances for escape or diffusion it would have outside.

Rooms, at some seasons of the year, are almost entirely ventilated by *flues*. Of these, the chimney flue and the open fireplace are the most ancient and still often very valuable. "Few people," says Dr. D. F. Lincoln, "are aware how small a quantity of air is actually drawn out of apartments by ordinary flues for ventilation. By 'ordinary,' I mean the old-fashioned sort, of the size of one or two bricks, 4x8 inches or something about that, with a close grating, called a register, to obstruct the current at the bottom, a sharp angle at the foot, the inside roughened by protruding mortar and with only an accidental opportunity of getting warmed by contact with a smoke-stack. You stand in front of it with a light pocket-handkerchief; the cloth is gently drawn toward the opening; it deviates a couple of inches; you say 'it draws' and are satisfied. 'The thing is working.' Probably, in such a case, the rate at which the current moves is something like a foot per second. The flue is drawing out a

quarter or a half of a cubic foot of air per second—enough, perhaps, for *one person's* requirements."

The one question as to a *flue* is, does it draw, or do the combined flues of a room draw sufficiently or unitedly and alternately to remove the foul air? Their drawing depends upon (a) position, (b) upon direction, (c) upon smothness internally, (d) upon relative warmth, (e) upon free exit to the outer air. As heat is the motive power, if the flue is so located as to be very cold, or if, while heated at its lower part, it is very cold at its upper part or exit, the draught will be much diminished. Different states of the air make great differences in the actual draught, and a flue that does not draw is worthless. The flue needs to be warm all along its course. Its position, its connection with a chimney in which there is a constant fire, or a gas or other light or coils somewhere near or in the tube of flue can accomplish this. Flues in outside walls generally lose heat too rapidly. Stovepipes entering chimneys near a ceiling not only heat the flue and help to cause upward draught, but, if left with slight openings around the pipe as it enters the chimney, aid in ventilation.

If the shaft or flue opens into the upper part of a school room, the air drawn out is several degrees hotter than if it opens near the floor. The draught is, therefore, more powerful. Still, it is best to carry the shaft nearly to the floor, where its effect is to stimulate the circulation of the warmed air in a downward direction and to increase the heating power of the stove. No draught will usually be felt from it by a person sitting at the distance of four or five feet. We need not be influenced by any theoretical considerations as to the level where carbonic acid is most abundant—there is no great and constant difference between different levels; but we shall not fail to find sources of impurity of air more frequent at or near the floor than higher up.

HEATING, ETC.

Both because of the need of heat and of the relation of heating to ventilation, we need closely to consider the modes of heating school rooms. Every school room should have a thermometer, and the teacher's record should tell the temperature at 9 A. M., at 12 and at 2 o'clock each day, so that the trustees may have a report of the actual changes. The practical idea, which forms our model, is somehow to get into the room air of right temperature and moisture from the outside, or to bring it to a right temperature before is is introduced into the room or is breathed by the children. If, for instance, you could

have a stove with flues all around it connected at the bottom with the outer air, so that the cold air could flow up through them to the top of the stove, and from thence be diffused through openings into the room, if all other sources of air-supply could be removed, you would thus have a constant inflow of warm, pure air for breathing purposes. Or, if such air is allowed to flow over heated coils, either of dry air or steam, it can be warmed in this way. Or if, in any way, the walls and floors of the building can be kept warm so that pure air flowing in or through them or brought in contact with them is warmed, the same object is accomplished. Most of these constructions must be left to the architect or engineer, but the mere mention shows what the intent involves. Even where construction is perfect, regulation is important. As an engine, in its running, depends on the engineer, so does most heating apparatus depend much on the skill of the operator. Both teacher and janitor need to understand this fact. The warmth needs to be such as to secure an average heat of about 70°. This suits the greatest number of children in our climate. But it is to be remembered that children are more susceptible to colds than adults, and that they vary much in their impressibility. Continued chilliness is never healthy, and hence chilly persons should have better access to heat, or by more frequent exercise or more clothing should be fortified against cold.

If heat is derived from registers through the floor, there are two disadvantages. There is apt to be foul air from the space or room beneath, and those sitting near the register receive more heat than they need. Where registers have to be used for school rooms, they should not open near desks and should be so numerous as to distribute the heat at different portions of the room near to the walls.

Where stoves need to be used, they should be such as are well started before assemblage, and as will not need to be filled up during school hours.

In order to equalize the heat, and in order to secure pure air from without, it is best to provide stoves with a jacket or metal screen. A sheet-iron screen or cylinder, about four to five inches outside the stove, is placed around it and "the edge fastened to the floor." A pipe of about six inches is then carried through the floor, under the stove, and led through the house-wall. This pipe should have a wire screen at its entrance. Through this outside air is drawn in to be heated by the fire in the stove and to be diffused through the room at points far enough above the entrance for it to have become enough heated.

The jacket may extend all around the stove, access to it for supplying fuel or removing ashes being arranged for by a movable part, or it may be tightly fastened around the stove just above the cylinder, and lead up the warm air by pipes or opening for distribution.

Grates and fireplaces have been constructed on the same principle, so as to admit fresh air on the back or sides for warming and then causing it to be directed into the room. The whole idea in either case is that the air to be warmed for breathing should not be air already reduced in purity by use in the room. Pure air should thus have a mode of ingress.

The air in the room which has been contaminated is thus replaced by good, pure air, and, at the same time, draught made, and its removal through windows, flues or other artificial ways facilitated. Flues are better not to begin too near the floor and near the ceiling and near the sides of buildings, because an outflow near the floor aids the circulation of the air through the room as well as removes its portion of foul air, while the hotter air already breathed and so having some organic matter, is carried upward near the ceiling and needs to be removed. As organic matter tends to cling to surfaces, and as air, like water, tends to flow along surfaces, these withdrawing openings for exit need to be at the sides or near surfaces.

Air as related to moisture is important, but so far as artificial heat is concerned, we need only to say here that open basins of water, and the steam and evaporation therefrom, help to make the air more agreeable for breathing purposes. It is certain, says Briggs, from all experience, that from five to ten per cent. of moisture can be added to air after it is heated, certainly with much relief, especially to the eyes, with apparently little harm, although such addition may make the occupant of a heated room a little delicate as to out-door exposure. Moisture may, to some small extent, be abstracted by the means of heating, especially when the heating is by stoves or hot-air furnaces; at all events the presence of a sheet or surface of water over which the heated air is allowed to pass, is now a recognized means of supplying a small quantity of aqueous vapor to air of ventilation. But the quantity supplied in this way is very small in comparision with what is needed for complete "hydration," or even for what can be denominated "hydration" at all, in the sense of a summer condition. From an estimate based on several winters' experience, a vaporization of water which supplied a half grain of vapor per cubic foot of air introduced, when an increment of four to six grains for the same volume of

air would be requisite to get the summer condition of humidity corresponding to the internal temperature, has proved sufficient to give a sensibly pleasant air, while the absence of this supply was at once perceptible in the house.

Whatever may be the facilities afforded by construction, it is to be remembered that administration is a study by itself, with which the teacher needs to be acquainted. The care of the room, like that of a good housewife, must be personal. The janitor is but the assistant. Although in large buildings all work must devolve upon him, the oversight must belong to the teacher. He may also need the emphasis and aid of the trustees. Most thorough cleanliness and the proper aids for securing it must be provided. This is not only a necessity for health but a part of true education.

PERSONAL CARE OF THE CHILD.

Besides the right which every child has to find a suitable room, with proper regulation thereof, it is the right of the teacher, the trustees, and of every other child, that no child should be an avoidable cause of discomfort or disease. Because of this, all that relates to the personal cleanliness and habits comes under jurisdiction of the teacher. Uncleanliness of body or of dress are always grounds of complaint. It is not difficult for a teacher to establish a standard as to these; to make clear the distinction between plain clothing and soiled clothing, and to make it popular with the children to be cleanly. The first step toward it is a thoroughly cleanly teacher. Every school should have rules, which should be read every month to the pupils, among which should be one that when any contagious disease is known to exist in a family, no scholar shall attend therefrom, except by a certificate from the city or township physician or attending physician. Cases may sometimes be so separated as that other members of the family have not had and will not have exposure, but a special certificate should affirm this. A board of trustees may need sanction by a general law to say what time after sickness shall elapse before children are returned to school. Where a teacher finds a child unwell, or has reason to suspect exposure to contagion, he should, at his discretion, send the child home and report the fact to a trustee, the city or township physician, or to the family physician. The registry should show if any have not been vaccinated, and the trustees should not permit the attendance of non-vaccinated children.

If children bring food with them it should be eaten at an appointed time, under such conditions and directions as will secure comfort and deliberation. Habits of rapid eating are often learned at school. Study and play, and relief by alternations of kinds of study and play, should be provided for. While the teacher has to deal with the school or with a community subject to general laws, he also needs to recognize the individual far more than is usual in any other class, and to adopt laws and modifications to those who differ in physical or mental or moral capacity.

CIRCULAR XXIX.

Circular as to Charitable and Penal Institutions.

A law recently passed has directed the State Board of Health to an inquiry into the sanitary condition of charitable and penal institutions of this State. The need of such inquiry has been made fully apparent in the experience of other States and countries. All such institutions have to deal with classes whose cleanliness and sanitary welfare are only secured by the most thorough administration, and by careful attention to the details of a personal and intelligent oversight. The duties of the superintendents, if well performed, are far more arduous and responsible than is generally appreciated. Successful care depends upon proper buildings and grounds; proper structural arrangements as to water-supply, sewerage, heating and ventilation; upon a proper supply of food, raiment and work; upon special provisions for those who are sick or feeble, and such personal attention by officers and assistants as unites capability and faithfulness.

In prisons and jails, most of the inmates are to return to society. The greatest care is needed that during detention there should be no habits acquired nor influences exerted which will tend to make the person worse than before. A hopefulness of promoting reform should be entertained and provided for.

In alms-houses, there should be a constant effort to limit those habits which cause pauperism, and to prevent its continuance either by custom or inheritance. Statistics prove that by wise planning the State has great capacity for limiting dependency, and that physical care enters largely into consideration when we would better the condition of such

classes. Every State has a wide duty in provision for this portion of its population, and in seeking to limit the pauperism, sickness or crime of those who have become its wards. Were it only a consideration of economy, it is to be remembered that these classes levy the heaviest tax that is paid for State, city, county and township expenses.

Asylums are so multiplying in our counties, in addition to our two State asylums, that all of them need the most careful supervision, since success of care and treatment so largely depends upon hygienic conditions.

It is easy for stewards for the poor or for the managers of institutions, to fall into routine methods, or, by want of vigilance, to allow various evils. Others have no appreciation of what proper sanitary care requires, and so approve their own plans, simply because they do not know of others which are far better. This Board, with its other duties, can only offer co-operation with local authorities in all that relates to the hygienic welfare of these classes. By comparing one with another, we shall find some that serve as models, while others will come to realize their defects. Already we have been able to suggest and aid in alterations and reforms which have met with ready response from local officers. The fourth Report of this Board can be had by addressing by postal, State Health Board Trenton, N. J. It contains—pages 89–112, pages 260–265, and pages 305–310—important suggestions for all public institutions. Local Boards of Health, as well as the immediate officers of institutions, are to remember that the sanitary condition of public buildings located in their districts is subject to their inquiry, if there is ground to suppose negligence.

Some of the most serious defects, as thus far noticed, are—

I. *As to Buildings.* (*a.*) Too little air space for living and sleeping apartments, especially in winter.

(*b.*) Too little care as to cellars and as to dampness around the dwelling.

(*c.*) An alms-house smell, only to be corrected by frequent house-cleaning and whitewashing.

(*d.*) Want of arrangements for the proper disposal of all excretions and refuse.

(*e.*) Absence of good ventilation, which, even if dependent on windows, would be much freer of draught if the windows extended near the ceiling, and if air was let in when needed by raising the lower sash and placing a strip of board all along under it, so as to make the place for the air to come in between the two sashes.

(*f.*) Stoves which bake the air and over-heat a small space about them, but do not furnish an even temperature for rooms.

(*g.*) Absence of sufficient stairs or arrangements for escape in case of fire.

II. *As to Persons.* (*h.*) Absence of accommodations for the first reception of inmates. No person should, as a rule, be received to any public institution without first having a general bath, a cropping or cleaning of the hair, and proper examination and change of clothing. As a precaution against contagious diseases, the person should be kept two weeks apart from the inmates. Vaccination is often required. Neglect of such precautions has recently cost a county in this State over five thousand dollars.

(*i.*) Absence of arrangements or of a system of thorough washing. All charities should have provisions and administration by which at least a weekly bathing is secured, unless some very special conditions of ill health forbid.

(*j.*) Absence of accommodation for special cases of sickness. A small building, separate from the rest, should always be at command for cases of malignant or eruptive fevers or other special cases that may occur.

III. *As to Managers, Committees, etc.* (*k.*) There should be monthly or quarterly inspections by directors, overseers or township committees, which should fully certify as to sanitary conditions. This not only prevents investigating committees, but prevents oversights, and is an aid to stewards and superintendents in their work. Generally, it is best to have a schedule of questions as a guide and to fill out accurate answers. As far as proper, inmates should be personally seen.

(*l.*) It is very desirable that a book be kept by every institution that will show the time of entrance of inmates, their previous history, their ages, social condition, the causes of sickness and death, and other items such as are now always registered in well-ordered institutions. That is a narrow view of a public charity which makes it a mere receptacle or retreat. Such records come directly within the line of that care of population which these are meant to subserve. One record or one year may not show much, but series of records through series of years point to methods of prevention or limitation too important to be overlooked.

(*m.*) We send with this circular a blank form of institutional inquiry, with the request that it be accurately filled out, so far as the superintendents, overseers or physicians of any State, city, county or

township institution can fill the same, and be returned within one month, by mail, to State Board of Health, Trenton. Add whatever may need to be said as to any special defects.

We are glad to furnish any information in our power, as to proper sanitary arrangements and care. So far as other duties will permit, we will, when desired, co-operate with local authorities in correcting defects or meeting special emergencies which may arise.

N. B.—The city clerk, assessor or Board of Health to which this circular is sent will please see that it promptly reaches the county or township or city alms-house or other charity for which it is intended and ask its return to us in due time.

By order of the Board.

Trenton, N. J., June 1st, 1882.

EZRA M. HUNT,
Secretary.

CIRCULAR XXX.

The observations of sanitarians in other countries and in a few of our States have led to the belief that the occurrence and the fatality f many diseases depend much upon geological structure, soil, topography, elevation and exposure, rain-fall, relations to seas or other bodies of water, density of population, and other local conditions not determined by the latitude or longitude of the locality. Thus, districts, or even small precincts, have their climate, which bears relations to the vitality of the people and governs the causes and courses of disease. It is for this reason that sanitary survey and topography have attracted the attention of the national government, and may well concern a State which presents diversities already so recognized by common observation as to have led to preferences and selections of resorts in adaptation to different kinds and phases of diseases. While these general observations are valuable, it is only by the close and confirmatory observations of experts and the tabulation of closely-noted facts that we arrive at well-sustained conclusions. It is fortunate for this State that its geology and topography are so well mapped as to afford an excellent basis for this kind of observation. After a conference with Prof. George H. Cook, the State Geologist, this Board found it feasible to supply at original cost a sufficient number of maps to a sufficient number of observers to make this kind

of observation practicable. It is proposed, in connection with medical societies and other scientific societies or individual observers in the State, to place this map in the hands of some chosen observer, who, up to the year 1885, will collect from the township or city in which he resides such data as shall enable him to estimate the relation of his particular locality to disease. The areas chosen will be townships and cities, and, of the larger cities, wards, or some more natural divisions, with a map of reference pointing out the relations of each locality, with the facts from time to time furnished by our reports and vital and meteorological data, we shall hope to give fixedness of attention and uniformity of system to the observations. Much will depend upon the choice of an observer who is painstaking, and who has some skill in accurate methods of observation.

He would first study with care the locality with which he has to deal in all its tellurial conditions. He would inquire how it varies as to degrees and moisture, how far the wells and river-beds indicate its usual and varying water-level, how the relations of valley, hills and bodies of water affect the degree of heat it receives and how prevailing winds indicate its local changes or result from its adjacent relations.

He would seek from the assessor or city clerk the deaths in the district, with age, date and place of residence in order to see whether for these years the relations of these to the general or precise locality could be discovered, and note explanatory views. To some degree as in rheumatism or consumption, he would seek to know how far locality produced or influenced the progress of the malady. If a part of his township or ward had marked diversity from that in which he lived or over which he rode, he would select some careful observer to afford such information as appertained to his valley or hill or water front. Often a few questions at the meetings of medical men would aid to give precision in place of the casual impressions too apt to be accepted from a very few cases. The laws of locality thus become informatory as to disease. If, for instance, every house in a township could give the history of every case of disease that has occurred in it the last fifty years, and one skilled in etiology and classification could handle the data, he would come to know what significance to give to cases and learn from them to unriddle causes far better if he can be a living witness and investigator, and so have sources for comparing and correcting observations. Thus, not only the records of death, but of disease and the personal experience of local practitioners is secured

A map can be had by each president or reporter of a county or city society, as the property of the society, in order that views may be compared. A physician, who has lived and practiced many years in one locality and whose note-books can remind him with exactness of cases and circumstances, has really very much information as to climatic or other local causes which he can give and which ought not to die with him.

Short notes, made at the end of each month as to its characteristics and diseases and summed up the end of each year, would aid much in the final summary. So soon as a full list of observers is secured, a very brief yearly report will be asked, so as to assure a full return at the end of the period. For the small expense incurred in correspondence, it is hoped provision will be made. As localities and the methods of individual observers are so diverse, no precise form will be given unless asked for. The design is rather to get the mature judgment of the observer, formed in his own way, except that it should depend upon the careful study and analysis of closely-noted facts and be formed on expert and continued investigations and reflections. It should be the observation of precise methods rather than the promiscuous methods of unskilled observers. We hope by the time of the semi-decennial census to be able to get a sufficient number of data to give valuable guidance. The effort is to get in connection with vital returns, the personal testimony of some competent observer. That experience is most valuable, which, either by statistical or other methods, classifies knowledge, and so has breadth of view and system of analysis in making conclusions.

When the physicians of any locality come to study accurately the deaths of each year, the diseases of each year, to compare vital statistics with their own observations, when they acquire the habit of being observers on a system to such a degree that their conclusions are arrived at not as hasty generalizations or from a few recent cases, but as the record of an analyzed experience, we always secure most valuable facts as to public health and the prevention of disease. Carefully collected statistics and carefully collated experience are the two factors of information upon which the State care of the health of the population must rely. We therefore ask societies and individuals to aid in this work, and all the more, because it is not less vital to the progress and success of medical science and art than it is to social and sanitary progress. Any physician, who thus on a system files away his observations each three or six months, will have no difficulty at

the close of each year, or at longer periods, in furnishing valuable data as to the diseases of his locality and suspected impairments to the general health.

By order of the Board.

Trenton, Feb. 15th, 1882.

EZRA M. HUNT, M. D.,
Secretary.

SLIPS SENT HEREWITH.

TRENTON, April, 1882.

To the County Medical Reporter:

DEAR SIR:—Inclosed please find circulars, and one of each please mail, with a postal inclosed, in a circular envelope, to such person in each city or part thereof, and in each township of your county, as you may choose, to aid in this work. Write your own name in one corner on the outside of the envelope. On hearing from them, I will send map and inform you.

Respectfully,
E. M. HUNT,
Secretary.

To Local Health Reporter:

DEAR SIR:—In accordance with the circular herewith inclosed, we have appointed a physician of your county to have oversight of the work proposed. It is his and our desire to have you act as a reporter to, or occasional correspondent with him in furthering the objects of this inquiry. If you will favor us by so doing, a map will be sent you and arrangements be made for the small expense of correspondence. Be pleased to reply by postal to State Board of Health, Trenton, at your earliest convenience. If for any reason you cannot serve, please give the name and address of the physician whom you would recommend.

E. M. HUNT,
Secretary.

CIRCULAR XXXI.

Circular as to Petroleum, Kerosene, etc.

The Legislature of New Jersey, at its last session, passed a law in reference to the use of "petroleum or coal oil for lighting and illuminating purposes," (see ch. 168, Laws of 1882.) In the Second Report

of the Board of Health (1878,) pages 16–22, and the Fourth Report, (1880,) pages 25–28, and the Fifth Report, pages 22 and 106, the need of legislation upon the subject is illustrated. These are but items in the records of destruction of human life which has occurred from a substance which is safe and valuable for lighting purposes, if properly prepared. A careful estimate has placed the number of deaths from kerosene in the United States as high as 6000 in a single year. Fire and destruction of property often result. The law which has been passed is the extreme limit of leniency, and its value depends on its rigid enforcement. We have the assurance of the co-operation of many of the manufacturers, and only need the aid of local Health Boards and retail dealers to make it fully operative.

It will be the duty of all local Boards of Health to see to it that the people in their respective districts are protected in the manner and to the degree which the law provides. Besides the notice given by the State Board of Health and in the newspapers, it will be wise for local Boards to send copies of this circular, which can be had on application by postal to us, to all venders of or dealers in illuminating oil in their respective districts.

Section first of the act holds all dealers responsible that the oil which they are selling for household illuminating purposes, shall be proper for use as certified by the test and method of testing herewith adopted. Any person who can prove that he has bought oil of a less grade "for inside light" may bring suit. Sections fourth and fifth give, in addition, the power to those named therein to enter and procure the oil for the special purpose of test. In such cases the vender "*may* be enjoined and prohibited" by special notice, but this does not prevent action without notice by those who have purchased for actual use for lighting purposes. Purchasers of oils to be sold in this State, should have the guaranty that the oils purchased are such as will answer the test herein given, and should not, when purchasing from refiners outside the State, rely upon the brand, but ask the written guaranty of the dealer.

If imperfect oils are brought into this State, not in accord with this law, we shall do all in our power, by exposure and prohibition of sale, to expose this wrong against human life.

The following are the means of ascertaining whether or not petroleum or kerosene to be sold for lighting or illuminating purposes, is of the character required by the act; and as such, is hereby declared

by the Board of Health of this State, together with the Council of Analysts appointed by it, to be the means of determination.

"Saybolt's Electric Tester" shall be used both for determining the fire test and the flash test as indicated by section three of the act, (see ch. 168, Laws of 1882.) And the instrument shall be operated in accordance with the instructions for using the "Saybolt Tester," adopted by the New York Produce Exchange, which took effect August 1st, 1879, but with this difference: that for oil of 110° fire test and upwards the oil shall (after the first flash) be flashed at 95, 100, 104, 108, 110, 113, 115.

We give the following modified instructions for using the Saybolt Electric Tester for ascertaining the flash and fire test of petroleum and kerosene; and as adopted by the State Board of Health and the Council of Analysts of New Jersey.

DIRECTIONS FOR USING THE ELECTRIC TESTER.

Fill the metal bath with water, leaving room for displacement by the glass cup.

Heat the water until the bath thermometer indicates 100° Fahrenheit, at which point remove the lamp.

Fill the glass cup with oil to top line, indicated by the rim surrounding cup, which is one-eighth of an inch below top edge of the cup.

See that there is no oil on the outside of the cup, nor upon the upper level edge, using paper to clean cup in preference to cotton or woolen material.

See that the surface of the oil is free from air bubbles before first flash is produced.

Lift the cup steadily with left hand and place in the bath.

Suspend the thermometer with the bulb of same immersed just from view under surface of oil.

Adjust the flashing bar, with the stamped side of the bar facing the operator, immerse the battery zincs in fluid, and when so immersed during the operation they should not come in contact with the carbon plates.

Try for first flash every degree until the same is obtained.

Attain flash by producing spark with one stroke of the key.

The stroke on the key should be such as in telegraphy is used to produce what is called a dot, that is, a short quick stroke.

When the thermometer in the oil indicates 90°, introduce lamp under the bath, and do not remove it until the operation is finished.

The temperature of oil when placed in bath, should not be lower than 55° nor higher than 70° Fahrenheit.

The flashing bar must be free from oil before adjusting for tests.

Drafts of air must be excluded from the apartment wherein tests are made.

Oil of 110° and upwards, shall (after first flash) be flashed at 95, 100, 104, 108, 110, 113, 115.

Oil of 120° and upwards, after first flash, 100, 105, 110, 115, 118, 120, 122, 125.

Oil of 130° and upwards, every five degrees after first flash until burning point.

The strength of the battery should be regulated by the zincs to produce just sufficient power to obtain continuous sparks.

The vibrator at the left-hand side of the induction coil is adjusted by means of a set-screw, and should be set so that a continuous spark is the result when the battery is working. Further details can be had of the manufacturers, 62 Beaver St., New York City.

An oil which flashes at 113° *without taking fire is to be regarded, in accordance with these instructions, as having stood a burning test at least as high as* 115°*; it may have stood a higher one.* In general, the fire test of the oil is the degree whose number (in these directions) next follows the degree at which the last flash without ignition of the oil itself took place.

Thus, for oil of 120° and upwards, if the flash at 118° was not followed by ignition of the oil, while the flash at 120° set fire to the oil, the oil would be regarded as having attained a fire test of 120°.

In case of any accident occurring from the *actual explosion* of any lamp or can containing oil, the Local Board of Health should at once procure specimen and evidence as to its source and have the same tested by some competent chemist. Even where accident has resulted from the improper use of oil, as in lighting fires, the rapid explosion has resulted from gas present in the can or the intense inflammability of the oil.

All cities should employ a local inspector, who, if need be, can be duly authenticated by this Board. Besides the oversight of local Boards, we shall use proper methods for discovering the qualities of kerosene offered in the market and the sources from whence it comes.

It is to the interest of all that a safe kerosene be used. Heretofore the production of a poor article has made an unfair competition, which it is hoped to overcome, since life and health are endangered and fair dealing is prejudiced thereby. The following is that portion of the law which relates to the qualities of oils and the penalties:

"An act to regulate the sale of petroleum and its products.

"1. *Be it enacted by the Senate and General Assembly of the State of New Jersey,* That hereafter petroleum, or any of the products thereof, may only be sold for use in this State under the following regulations and restrictions, viz.: (*a*) benzole, gasoline, naptha and benzine must be sold under their true names respectively, and such names must be plainly shown upon the barrel, can or vessel in which the same are sold or offered or exposed for sale respectively, or upon a label securely fastened thereto; (*b*) petroleum or kerosene which will inflame at a less temperature than one hundred and fifteen degrees Fahrenheit, fire test, or flash at a less temperature than one hundred degrees Fahrenheit, flash test, must have plainly designated upon the barrel, can or vessel in which the same is sold or offered or exposed for sale, or on a label securely fastened thereto, the number of degrees Fahrenheit fire test below which the same will not inflame; (*c*) only such product of petroleum as will not flash at a less temperature, or flash test, than one hundred degrees Fahrenheit, or such as will not inflame at a less temperature than one hundred and fifteen degrees Fahrenheit, may be sold for lighting or illuminating purposes, except where the same is to be used in street-lamps or open-air receptacles, or in gas machines, in which case (as to petroleum or kerosene) there shall be plainly marked on the barrel, can or vessel in which the same is sold or offered or exposed for sale, or on a label securely fastened thereto, the words 'not for inside light;' provided, that this act shall not apply to petroleum or its products sold in tanks used for transportation.

"2. *And be it enacted,* That if any person shall sell or offer or expose for sale, for use within this State, except in the manner permitted by this act, any petroleum or product thereof, he shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine not exceeding five hundred dollars, or imprisonment at hard labor or otherwise for a term not exceeding one year, or both; and any sale in quantity less than one barrel shall be presumed to be for use within this State."

The law goes into effect July 1st, 1882. The notices thereof, as

required, have been given in the circular of April 20th, and the county notice of June 20th, 1882.

By order of the Board.

Trenton, June 20th, 1882.

EZRA M. HUNT,
Secretary.

CIRCULAR XXXII.

To Local Boards of Health of Cities and Townships.

The importance of a care of the public health on the part of local authorities is now generally recognized in this State. The value of a local Board consists in its readiness to meet sudden perils to the public health; to prevent nuisances or abate those which exist; in its ability to impart information, and its power to enforce laws where other methods fail. "The Circular to Local Boards of Health" and the "Suggestions to Boards of Health and References to Sanitary Laws," to be found in the Fifth Report (1881,) pages 181–188, should be carefully noticed by all Health Boards. In addition, important legislation has been added to that of previous years. We herewith send a printed slip of a law just passed as to local Boards. It extends and fully corrects all defects of power in such Boards of Health as have been organized under the laws of 1880 and 1881. (See ch. 155, Laws of 1880; ch. 135, Laws of 1881.) It applies to all townships and to all cities that had not special Health Boards under their charters previous to 1880, and by the law of 1881 may be adopted by these. Some have already adopted it, and the three or four that remain should do so without delay.

It can now be claimed that in most respects sufficient provision has been made for the efficiency of local Boards so far as they can or ought to be empowered by law. It is to be borne in mind that under common law, as well as under these special provisions, there is remedy for many nuisances hazardous to the public health. These Boards, both by virtue of their own powers and by virtue of other rights accorded for the protection of health, ought to be able, when necessary, to control or abate flagrant evils, and to do very much in preventing the causes of disease. In all cities and towns there should be regular

meetings of the Boards; and in all townships at all regular meetings of the township committee, they should recognize this as a part of their service. The work appropriate to local Boards is already outlined in the circulars of this Board, to be found on pages 184–187 and page 207 of the Fifth Report. In addition, there are circumstances which often give special importance to the consideration of prominent local evils. Each Board should realize that it has as much to do in preventing evils, and in instructing the people how to avoid nuisances, as in abating existing nuisances.

In securing a more perfect return of marriages, births and deaths it can be of essential aid to the city clerks and assessors. We must know the ages and conditions of population in order to study the significance of death rates. Besides, it is the legal right of each person to have such record made. Hereafter neglect must lead to stringent action on the part of local Boards and of the State Board.

The new milk bill which has been passed can be made of great service as a protection to the health of children and invalids.

The new law as to illuminating oils makes it a misdemeanor to sell any dangerous oil. Local Boards should be watchful over this evil, and report any infringements.

The bill as to adulteration of food is also in full force.

All cases of contagious diseases of animals need to be carefully watched, and report made to this Board if necessary. In cities more care should be exercised as to the keeping of animals and as to nuisances arising therefrom.

If, hereafter, any local Board fails to recognize the care of the public health and the prevention of insanitary conditions as a part of its duty, the fault will not be with the laws of this State. There will be no lack of earnest co-operation on the part of the State Board. We ask that the reports and circulars of the Board be carefully studied, and that in all other respects you will feel both the duty and the privilege of aiding in the securement of health and the prevention of the avoidable causes of disease.

E. M. HUNT,
Secretary.

P. S. If in any township, there is no Board of Health as required by law, the assessor will, on receipt of this, please send us postal containing name and P. O. address of the members of the township committee.

Trenton, April 1st, 1882.

CIRCULAR XXXIII.

Circular to Local Boards of Health as sent out with Annual Blanks.

All local Boards of Health need to make their annual return to the State Board of Health during the month of October.

All Boards which were constituted under the law of 1880-1881 are permanently in existence. The law of itself constitutes the township committee, the assessor and the township physician, if there be such an officer, as the Board of Health for each township; and also provides as to Boards of Health in cities.

In some cases, complaint is made that local Boards do not seem to know their precise duties under the law. The general law is to be found ch. 155 of the Laws of 1880.

On pages 272–282 of the Fourth Report of the Board (1880) is an explanatory circular as to the law and the duties of Health Boards. Pages 184–188 of the Fifth Report (1881) have further directions and references. If, in any instance, any Board has failed this year to consider the health matters of its town or township, it should at once be called together. It is satisfactory to know that most of the Boards realize the importance of this oversight of the public health. Some, however, take it for granted that no avoidable causes of disease exist, and, by their unintentional negligence, add to the sickness and deaths of their locality.

We ask each assessor or town clerk to state to us any failure on the part of the local Boards.

Blanks are furnished similar to those of last year. (See Fourth Report, 1880, page 281.)

A list of Boards which have reported is to be found on pages 119–179 of the Fourth Report (1880), and pages 123–165 of the Fifth Report (1881.)

Boards which have reported heretofore will not need to report the items in the schedule under A, B, E, F, G, I, L, M, N, O, P, Q this year, unless some special new fact exists.

Under C, we ask full statements as to the sources and conditions of water-supply; as to objections made to it; as to any asserted or proven sickness or deterioration of the general health resulting therefrom; also, what plans of remedy are used? also, if cisterns or driven wells are used and found satisfactory? also, if filters, and if so, what kind are relied upon? Has the lowness of the streams and wells the last three months seemed to affect the quality of the water-supply?

Under D, we inquire as to any natural or artificial defects in drainage and as to any sickness attributed thereto by physicians. How has the amount of malarial fever, so called, compared with that of last year? Are there any serious interferences with natural water-courses? Has the State law as to drainage or the special one in addition as to the drainage of cities been applied to any case in your section?

Under D, as to sewerage, specify what town or parts of towns have sewers, with their size, construction, material, etc. Has the town a sanitary map, showing its underground structures, its contour, etc.? To what extent are brooks or streams made to carry sewage matter and have any evil results been felt?

Under H, report the situation of water-closets in relation to water-supply and the modes of disposal of excreta, of refuse and of slop-water. Also, cases in which inside water-closets or slop or kitchen sinks are connected with the outside privy-vault or with cesspools. Also, as to the common mode of emptying privy-vaults and cesspools.

Under J, give particulars as to diseases of animals; especially those regarded as contagious.

Under K, state whether slaughter-houses and abattoirs are situated near to private houses.

Under L, state what trades or factories cause a nuisance, and whether by smoke or refuse.

Under R, report any sanitary improvements of the past year and any in contemplation.

Under T, state any known causes of the spread of disease or any neglect of vaccination.

Under W, add a general report as to prevalent diseases from July 1st, 1881, to July 1st, 1882, and make a separate noting as to any especial sickness from July 1st, 1882, to this date.

Assessors and town clerks, in addition, should personally report, as is their duty, any neglect in returns of vital statistics, and by whom; since the records of the last three years already show how important is exact knowledge as to the marriages, births, deaths and causes of death in each division of the State. Many other matters of importance will no doubt occur to local Boards, on which report should be made.

We should be glad to have brought to our notice any alleged defects in existing laws. Except that defects of close study of the laws and of judicious enforcement or administration of law are not to be attributed to the laws themselves.

Indifferent attention to duty, dilatory dealing with undoubted nuisances or promiscuous doubts where legal advice would clearly point out the methods, are not to be taken as defects of law. It is found that the calm judgment of courts and juries is against nuisances prejudicial to the public health; that present laws are applicable to such nuisances, and that where reason and persuasion will not avail, the execution of sanitary law has as good a chance of being sustained as has any other form of necessary litigation.

Note especially the law, ch. 155, Laws of 1882, which corrects some defects in former laws.

Let town clerks and assessors see to it that all circulars sent them are read before the Board of Health or township committee, and copies fastened in the Health Book.

By order of the Board.

Trenton, October 1st, 1882.

E. M. HUNT,
Secretary.

CIRCULAR XXXIV.

As to Vital Statistics.

[See page 255.]

CIRCULAR XXXV.

General Circular as to Duties under the Laws Relating to Vital Records and Statistics.

TO CLERGYMEN, JUSTICES OF THE PEACE, ETC.

It is not only a breach of law, subjecting you to penalty, but a risk to the personal rights of individuals, to neglect the return, within thirty days, of a marriage certificate to the assessor of the township or city clerk of the city in which the event occurs. Blank forms can be had of the assessor or city clerk, or through postal addressed: Bureau of Vital Statistics, Trenton, N. J.

TO PHYSICIANS, ETC.

Returns of births are not only required by law, but essential to that right of record which is thus secured to every child. Birth rates and death rates need to be compared in order to know sanitary conditions. The returns to assessor or city clerk, must be made each month. Your promptness will greatly aid us in comparisons. Blanks can always be had of assessors or city clerks, or through postal addressed: Bureau of Vital Statistics, State House, Trenton; or a small handbook when preferred.

N. B.—See law that physicians must have their diplomas on record in office of county clerk.

TO UNDERTAKERS.

You are aware that the *burial* of any person by you without a permit is contrary to law. A failure to find the record often obscures legal claims, and may subject you hereafter to great risks. Where the *death and burial* are in a township outside of city limits, the certificate of death answers as a permit. Delay to obtain the certificate until after death, and burial without a permit must not occur. Assessors, clerks and local Boards of Health must report any negligence to Bureau of Vital Statistics, Trenton, N. J. Keepers of cemeteries and churchyards must see certificate of death or permit.

City clerks will please note ch. 81, page 119, section 4, Laws of 1879.

TO CITY CLERKS AND ASSESSORS.

This bureau has sent notices, to secure prompt returns, to all physicians, clergymen and undertakers. Under the law, any negligence, with the name and address, must be reported to us. Ch. 155, page 207, Laws of 1880, gives full power, also, to local Boards. These returns are essential as records, and for the study of local evils, and of the means to protect the life, health and welfare of our population. The full success of some cities and townships shows that local defects in returns are not the fault of the law, but result from negligence or want of judicious oversight.

Order blanks of Bureau of Vital Statistics, Trenton, N. J., *before* you are out, so that none may complain.

CIRCULAR XXXVI.

STATE OF NEW JERSEY.

Department of State and Bureau of Vital Statistics.

The necessity of a State record of every marriage, birth and death, the legal rights of those concerned, and the penalties for neglect of returns are such that omission to obey the law may at any time cause you both difficulty and expense. We shall hereafter take it for granted that all know the law. Returns should be made in ink and care used as to dates. All city clerks and assessors can, at any time, supply blanks or any needed information, or a postal directed "Bureau of Vital Statistice, Trenton, N. J.," will bring reply.

Trenton, January, 1883.

By order of

HENRY C. KELSEY,
Secretary of State.

CIRCULAR XXXVII.

As to Exhibition of Sanitary, Household and Ornamental Articles and Appliances.

In the practical application of sanitary science, it has become necessary to use very many appliances, both for convenience and to guard against evils incident to household and city life. These inventions have become far more numerous and useful than is generally known. To afford the people a better opportunity to become acquainted with their merits, both by personal examination and by the opinion of experts, the Agricultural Society of New Jersey, the State Board of Health and various sanitarians throughout the State have united to produce an exhibition of sanitary appliances.

Although the first of the kind attempted in this country, it has been so highly successful the past three years as to have led them to make it a prominent feature at this great annual gathering of our citizens. This fair is held for a week each year, only a few miles from New York City, at Waverley, near Newark, on the direct route to Philadelphia and the South and West. Many thousands of visitors from this and other States every year examine this display, and it

affords the best opportunity for familiarizing the people with valuable improvements.

It opens this year on September 18th. A special building for the sanitary department, supplied with water, is provided, and the actual working of house systems, ventilators and various other appliances can be shown. It is intended to make this exhibit an attraction at our annual fairs, so that all may become acquainted with the best sanitary arrangements and inventions, and dealers have a good opportunity for comparing and testing apparatus. When necessary, the judges will order trial, and postpone award until satisfied. Articles of any class may be sent either as competing for premium or for exhibit. Every article should bear a descriptive label, containing detailed information respecting its construction, use, wholesale and retail price; they must also bear the name of the owner or agency exhibiting.

MUSEUM.

The State Board of Health has commenced at Trenton, the capital of the State, a museum of sanitary appliances, to which any owner or manufacturer may present the articles exhibited as the property of the State, for permanent examination and exhibit. Specimens of all new sanitary inventions are solicited and may be sent care of E. M. Hunt, M. D., Trenton, N. J.

The following is an abbreviated summary of leading articles that are classed in sanitary department of fair; various other articles will properly come in this department and be subject to award.

DEPARTMENT L.

SANITARY AND MEDICAL, HOUSEHOLD AND ORNAMENTAL.

Class 43—*Domestic and Hospital Architecture, Planning, Construction and Decorative Material.*

	PRIZE.
Planning, Construction, Ornamental and Decorative Material.	Diploma.
Wall Paper, Window Blinds, Carpets.	Medal.
Samples of Building Stone, Concrete or other Building Material.	Diploma.
Pipes, Tile, Sanitary Pottery, &c.	Medal.

Class 44—*Ventilation, Lighting and Warming.*

	PRIZE.
Warming Houses by Flues, Steam or Hot Water—best system of each.	Medal.
Steam and Gas Cooking Apparatus.	Medal.
Stoves for Heating or Cooking, so as to avoid gas and dust.	Medal.
Chimney Cowls and Caps.	Diploma.
Specimen Ventilators of all kinds.	Diploma.
Oil, Gas, Electric and other Lighting Materials and Fixtures.	Diploma.

Class 45—*Drainage, Water-Supply, Specimens of Soil, &c.*

Drainage Plans and Sanitary Maps.	Diploma.
Specimens of Soil and Organic Matter, from New Jersey Experimental Station.	Medal.
Water-Supply Apparatus, as Cisterns, Flush Tanks, Filters, Refrigerators, Sinks, &c.	Medal.

Class 46—*Bathing Apparatus and Plumbers' Supplies.*

Bath Tubs and Connections.	Diploma.
Best Water Traps and Grease Traps.	Medal.
Dry Earth Closets.	Medal.
Best Pan, Hopper and Plunger Water-Closet.	Medal.
General Assortment of Plumbers' Work and Materials.	Diploma.

Class 47—*Druggists' Supplies and Sundries, Foods, Medical and Surgical Instruments, Appliances used in Teaching.*

Pure and Adulterated Drugs, Disinfectants, Deodorizers, Mineral Waters, Yeast Powders, Dietetic, Preserved, Condensed, Babies' and Adulterated Foods.
Galvanic and Magnetic Instruments.
Appliances used in Teaching and School-room Furniture.
Obstetric Instruments.
Ophthalmic "
Dental " and Work.
Aural "
For selection of each article in class, Silver Medal, Medal or Diploma.

Class 48—*Sanitary Apparatus, Best Modes of Destroying and Preserving Animals, Improvements in Preparing Food.*

	PRIZE.
Excavating and Odorless Apparatus.	Medal.
Best Means of Removing Vermin.	Diploma.
Models for Care and Protection of all Living Creatures.	Medal.
Best Mode of Destroying Animals for Food.	Diploma.
Improvements in Mode of Cooking Food for Men and Animals.	Medal.
Other exhibits of Sanitary Appliances may have Medal or Diploma as award.	

Class 49—*Apparatus for Developing Strength and Saving Life, Machinery for Saving Labor, Appliances and Apparatus for the Sick and Wounded.*

Life Saving Apparatus, Fire Escapes and Extinguishers.	Medal.
Life Boats, Preservers and Life Rescue Apparatus.	Medal.
Ambulances, Invalid Chairs, Beds, Mattresses and other conveniences for the use of the Sick and Wounded.	Medal.
Hygienic Clothing.	Diploma.
Health Lifts, Gymnasium Apparatus and Improvements in Labor-Saving Machines.	Diploma.

NOTE.—In 1884, a National Exhibit will be held in Washington, D. C.

Trenton, N. J., July 1st, 1882.

REFERENCES TO CIRCULARS OF THE STATE BOARD OF HEALTH.

Circular I., Third Report, 1879, page 158. Explanation of parts of the acts as to marriage, birth and death returns. (See also Circular XXIV.)

Circular II., Third Report, 1879, page 163. As to assessors, town clerks, etc.

Circular III., Third Report, 1879, page 167. As to vital statistics.

Circular IV., Third Report, 1879, page 168. As to town clerks and assessors.

Circular V., Third Report, 1879, page 169. As to sanitary organization of cities.

Circular VI., Third Report, 1879, page 224. As to sanitary appliances.

Circular VII., Fourth Report, 1880, page 255. As to protection to bathers.

Circular VIII., Fourth Report, 1880, page 260. As to householders, city authorities, Board of Health, etc.

Circular IX., Fourth Report, 1880, page 265. As to sanitary appliances.

Circular X., Fourth Report, 1880, page 272. Circular explanatory of recent laws.

Circular XI., Fourth Report, 1880, page 281. As to local boards and as to yearly reports with schedule annexed.

Circular XII., Fourth Report, 1880, page 282. As to law regulating the practice of medicine and surgery.

Circular XIII., (*a.*) Fourth Report, 1880, page 287. To farmers and dealers in stock.

Circular XIV., (*b.*) Fourth Report, 1880, page 291. As to contagious diseases of animals.

Circular XV., (*c.*) Fourth Report, 1880, page 293. As to contagious diseases of animals.

Circular XVI., (*a.*) Fourth Report, 1880, page 297. As to milk supply.

Circular XVII., Fourth Report, 1880, page 300. To local Boards as to vital statistics.

Circular XVIII., Fourth Report, 1880, page 301, as to small-pox (I.)

Circular XIX., Fourth Report, 1880, page 305. Schedules for institutional sanitary inquiry.

Circular XX., Fifth Report, 1881, page 178. As to small-pox (II.)

Circular XXI., Fifth Report, 1881, page 181. As to duties of local Boards under new laws.

Circular XXI., Fifth Report, 1881, page 184. Suggestions to local Boards of Health as to their duties.

Circular XXII., Fifth Report, 1881, page 188. As to exhibit of sanitary and household appliances.

Circular XXIII., Fifth Report, 1881, page 191. To local Boards as to yearly reports.

Circular XXIV., (*d.*) Fifth Report, 1881, page 193. As to contagious diseases of animals and law.

Circular XXV., (*e.*) Fifth Report, 1881, page 197. As to contagious diseases of animals.

Circular XXVI., (*f.*) Sixth Report, 1882, page 213. As to contagious diseases of animals.

Circular XXVII., Sixth Report, 1882, page 220. As to sanitary instruction and training in schools.

Circular XXVIII., Sixth Report, 1882, page 222. Sanitary school circular of the New Jersey Board of Health.

Circular XXIX., Sixth Report, 1882, page 233. As to charitable and penal institutions with accompanying slips.

Circular XXX. Sixth Report, 1882, page 236. As to sanitary survey, topography, etc.

Circular XXXI., Sixth Report, 1882, page 239. As to petroleum, kerosene, etc.

Circular XXXII., Sixth Report, 1882, page 244. To local Boards of Health of cities and townships.

Circular XXXIII., Sixth Report, 1882, page 246. To local Boards of Health.

Circular XXXIV. (Just re-printed and ready on call by postal and in next report.) As to vital statistics. To assessors, Boards of Health, clergymen, coroners, physicians, midwives, undertakers, etc.

N. B.—*This Circular may be referred to* on page 158, etc., of Third Report, 1879, where are also other circulars relating to vital returns. This and the two following circulars can be had for postal by all assessors, city clerks, or any whose duty it is under the law to make returns.

Circular XXXV. Sixth Report, 1882, page 248. As to vital records.

Circular XXXVI. Sixth Report, 1882, page 250. As to vital records.

Circular XXXVII. Sixth Report, 1882, page 250. As to exhibit of sanitary appliances.

REFERENCES TO LAWS RELATING TO THE INTERESTS OF PUBLIC HEALTH.

On page 143 of First Report, 1877, will be found a list of references to former laws bearing on public health.

As the scope and duties of the Board have since been extended

there should be added to this list as found in the *Revision of the Statutes of New Jersey*, 1709–1877, as follows :

I. "An act relating to the transportation of explosive and dangerous material." Approved March 17th, 1874. Page 263.

II. "An act to prevent the willful pollution of the waters of any of the creeks, ponds, or brooks of this State." Approved April 21st, 1876. Page 1297.

III. "An act to prevent the deposit of mud, earth, soil, ashes or refuse on the New Jersey shore of the Hudson river." Approved March 9th, 1877. Page 1297.

IV. "An act for the incorporation of societies for the prevention of cruelty to children." Approved April 15th, 1876. Page 1344.

V. "A further supplement to an act entitled an act to provide for the drainage of lands." Approved March 8th, 1872. Approved March 8th, 1877. Page 1352.

VI. "An act for the construction, maintainance and operation of water-works for the purpose of supplying cities, towns and villages of this State with water." Approved April 21st, 1876. Page 1365. (See also Chapter CLXXXII., Laws of 1880.)

VII. Supplement. Approved March 7th, 1877. Page 1368.

VIII. "An act to prevent the spread of glanders among horses." Approved March 31st, 1864. Page 24.

IX. "Protection against mad dogs." Approved March 28th, 1862. Page 25.

Additional Laws to be Found in the "Laws of New Jersey" since the Revised Statutes, 1709–1877.

1878.

I. "An act to provide for sewerage and drainage by incorporated camp meeting associations or seaside resorts." Chapter XL., page 65. (See, also, Chapter CLVII., Laws of 1880, etc.)

II. "An act to provide for the assessment and payment of the cost and expenses incurred in constructing sewers and making other improvements in townships and villages." Chapter LIX., page 70.

III. "An act relating to municipal or other authorities owning or managing works for the supplying of water to the public." Chapter LXX., page 92.

IV. "An act to prevent the pollution of the waters of any of the creeks, ponds or brooks of this State." Chapter CXL., page 211.

VIII. "An act for the formation of borough governments in seaside resorts." Chapter CLVI., page 232. (See page 237.)

IX. "An act for the protection of dairymen and to prevent deception in sales of butter." Chapter CCIII., page 317.

X. "An act concerning the registry and returns of marriages, births and deaths." Chapter CCXXXIX., page 355, (amended.)

XI. "An act for the formation of borough governments." Chapter CCLX., page 403.

LAWS OF 1879.

I. A supplement to an act entitled "An act concerning the registry and returns of marriages, births and deaths." Approved April 5th, 1878. Chapter LXXI., page 117.

II. A supplement to an act entitled "An act to enable cities to supply the inhabitants thereof with pure and wholesome water." Approved April 21st, 1876. Chapter LXXXVI., page 168.

III. "An act for the improvement of the sanitary condition of cities." Chapter CLXXI., page 276. (Applies only to Hudson county.)

IV. A supplement to an act entitled "An act to provide for the assessment and payment of the costs and expenses incurred in constructing sewers and making other improvements in townships and villages." Approved March 12th, 1878. Chapter CLXXV., page 287.

LAWS OF 1880.

I. A supplement to an act entitled "An act to prevent the willful pollution of the waters of any of the creeks, ponds or brooks of the State." Chapter LII., page 61.

II. "An act respecting sewerage and drainage." Chapter LVI., page 69.

III. An act entitled "An act concerning the protection of the public health and the record of vital facts and statistics relating thereto." Chapter CLV., page 206.

IV. "An act for incorporation of companies for draining and improving meadows and lands overflowed by tide-water." Chapter CLXIII., page 240.

V. "An act to render more effective the ordinances of county Boards of Health and vital statistics in the several counties of this

State and to define their powers and duties." Chapter CLXXXVII., page 279. (Applies only to Hudson county.)

VI. "An act to regulate the practice of medicine and surgery." Chapter CXCIX., page 296. (See also Chapter XLIX., page 52, Laws of 1881.)

VII. A supplement to an act entitled "An act to establish a State Board of Health." Approved March 9th, 1877. Chapter CCXX., page 322. (Refers to animals.)

LAWS OF 1881.

I. "An act to authorize municipal corporations to contract for a supply of water for public uses." Chapter CIV., page 118, Laws of 1881.

II. "An act relating to local Boards of Health." Chapter CXXV., page 160.

III. A further supplement to an entitled "A supplement to an act entitled 'An act to establish a State Board of Health.'" Chapter CLIV., page 190. (Relates to animals.)

IV. "An act to provide for drainage where the same is necessary to the public health." Chapter CLVIII., page 195.

V. "An act to authorize the abatement of nuisances in cities and to make the cost and expense of such abatement a lien upon lands wherein such nuisances exist." Chapter CLIX., page 202.

VI. A supplement to an act intitled "An act for the improvement of the sanitary condition of cities." Approved March 14th, 1879. Chapter CCIX., page 261.

VII. "An act for the improvement of the sanitary condition of counties in this State." Chapter CCX., page 265.

VIII. "An act to prevent the adulteration of foods or drugs." Chapter CCXVII., page 283.

IX. "An act authorizing the construction of sewers or drains in certain cities where necessary to preserve the public health, although the limit of authorized expenditure for public improvements in such cities would thereby be exceeded." Chapter CCXX., page 288.

LAWS OF 1882.

I. A supplement to "An act to prevent the introduction of malignant and other infectious diseases into this State." Approved April 6th, 1871. Chapter XIII., page 17. (Relates to quarantine.)

II. A supplement to an act entitled "An act to provide for the assessment and payment of the costs and expenses incurred in constructing sewers and making other improvements in townships and villages." Approved March 12th, 1878. Chapter XXXIV., page 37.

III. "An act to authorize cities to construct sewers and drains and to provide for the payment of the cost thereof." (See, also, page 235, Laws of 1882.) Chapter L., page 61.

IV. "An act to provide for the licensing and regulating of milk dealers and their agents in cities, incorporated boroughs or police, sanitary and improvement commissions and incorporated camp meeting associations or seaside resorts." Chapter LXXIV., page 87.

V. "An act to prevent the adulteration and to regulate the sale of milk." Chapter LXXXII., page 97.

VI. Supplement to an act entitled "An act to establish a State Board of Health, etc. (Relates to animals.) Chapter C., page 133.

VII. "An act to provide for the better security of life and limb in case of fire in hotels and other buildings." Chapter CX., page 142.

VIII. "An act relating to the improvement of streets and the construction of sewers in the cities of this State." Chapter CXXXV., page 190.

IX. A supplement to an act entitled "An act concerning the protection of the public health and the record of vital facts and statistics relating thereto." Approved March 11th, 1880. Chapter CLV., page 217.

X. "An act for the preservation of the health of female employees." Chapter CLIX., page 227.

XI. A supplement to an act entitled "An act concerning the protection of public health and the record of vital facts and statistics relating thereto." Approved March 11th, 1880. Chapter CLXV., page 233.

XII. "An act to regulate the sale of petroleum and its products." Chapter CLXVIII., page 236.

XIV. "An act to provide for the appointment of commissioners to determine upon plans for the storage of any of the waters of this State for the purpose of furnishing to cities and towns a joint water-supply." Chapter CLXXXIX., page 264.

Beside these references, there are some laws which, without formal repeal, are made obsolete by provisions contained in the laws enumer-

ated. There are also in many general laws, charters, etc., provisions which bear more or less directly on the health of the people and its preservation. As a rule, such laws as have not their execution especially provided for are inoperative, although, sometimes, (see chapter LIX., page 227, 1882, as a specimen,) they hold up a desirable model. Some are local in their application although made general in order to answer constitutional requirements. For all cities, the careful preparation and publication of ordinances to conform to laws is important, and not infrequently for townships, also. Until precedents under recent laws are fully established, Boards should be sure to act where action is necessary, but should clearly ascertain the various legal modes of dealing with conditions hazardous to the public health, and under skilled advice choose the method which is most likely to be successful. Every local Board in this State has a very important sphere of usefulness, and when they do not succeed by judicious warning, by convincement of offending parties by giving information as to the reality of evils, by moral suasion, or by proper warnings, between the powers of indictment, of injunction and of authorized summary proceeding under sanitary police provisions, they have great legal support.

REPORT

OF THE

BUREAU OF VITAL STATISTICS

OF THE

STATE OF NEW JERSEY

FOR THE

Statistical Year from July 1st, 1881, to July 1st, 1882.

DEPARTMENT OF STATE.

TO HON. HENRY C. KELSEY, SECRETARY OF STATE.

By EZRA M. HUNT, M. D., Sc. D.

Medical Superintendent of State Vital Statistics.

INTRODUCTION TO THE REPORT ON VITAL STATISTICS.

SIGNIFICANCE OF VITAL STATISTICS.

The increasing recognition which is being given to the value and availability of vital statistics, as indicating the essential conditions of population and as directing us to feasible methods of preserving life and promoting the social advantage of the State, has already been noticed in former reports. As legal records bearing on inheritance, on life insurance, on pensions and various rights of property and of life, they have long been valued. As a census of the vital movements of population, they have always been considered indispensable in the record of social statistics. Halley, bringing the science of numbers to bear upon celestial reckonings, was the first to predict the time of the return of a comet. He conceived that life has also its accurate laws, and that a study thereof, by the collection of facts, could as well determine as to health, disease and longevity. He and others have taught how errors which would affect small numbers, are eliminated, when, by a law, we come to reckon as to tens and hundreds of thousands of people. So he proposed the life tables which are now so much a basis in life insurance. The three great events of birth, marriage and death each have their ascertained laws, which not only affect, but determine the welfare of States and nations.

MARRIAGE.

Statistics as related to marriage fulfil most important objects. First of all, in a legal point of view, it is recognized that a relationship so important and so affecting the rights of property must at the time of its occurrence have such certification and record as to place the proof thereof beyond doubt. Questions of age, of relationship, and of the transfer of great material interests must ever claim a careful and authentic registry. Law concerns itself with more than this. It

defines degrees of relationship, because the welfare of the State is concerned in consanguinity. It specifies the ages of subjection to parental consent, because up to a certain time it must hold fast to the doctrine of parental control as a State interest. It designates the persons or societies who have authority to perform or authenticate marriage, because clandestine marriage or too great laxity as to the persons by or circumstances under which such union may be made, is destructive of good order and not for the social welfare.

The great interest which the State has in the marriage relation needs to be duly considered. Not the man but the family is the social unit. The State needs to know more about its families than it does about its individuals. One who examines the various laws of the European States bearing on marriage will perceive that they have their start and growth in that State care which is requisite to secure good citizenship. They are not any of them arbitrary interferences with personal choices, but intended to be only such regulation or restraint as is essential to a good constituency for a good government. The requirement of previous announcement, the prohibition of night marriages and many other conditions, were conservative of the State at the time, and are less needed now only because other guards avail. In some of the New England and Western States license or previous notice of marriage is required. Public attention has recently, by a series of well-studied statistics, been directed to some facts as to the decadence of marriage. An able editorial of the past year refers to the harm done by the influences which operate on both sexes to prevent marriage. "We do not say to delay, but to prevent, for the alarming fact is not the numbers who delay to marry, but the numbers who believe they can achieve the ends and the happiness of life better without marriage. * * * The facts of sex are immutable. Since the world began but one method has been discovered to give sex its meaning without surrendering the race to the domination of passion. So fixed are these forces that the statistics of social vice follow in regular sequence the ratios of the married to the unmarried.

A bad state of morals is to be inferred from a low rate of marriage. However pure the considerations may be that hold individuals in both sexes back from wedded life, the result in the end is unfavorable to morals. The man has everything to gain in wedded life, which is implied in his civilization. * * * The woman, if possible, has even more to gain. It removes her from occupations which no regulation that has yet been devised has made safe and wholesome

for her, to another to which she is suited by nature. The large evil which threatens is back of divorce. There is something mandatory as well as permissive in the verdict of human experience, that the best social state is that in which one man lives with one woman as his permanent wife.

It is found to the interest of States to trace the ages at which persons enter wedlock; to compare the marriages of different nationalities; the relationship; the number of children; the effects of different occupations and social circumstances, and thus secure intelligent information as to the most material interest of the State—its population. These facts are to be accumulated and then tabulated, or kept on record ready for tabulation, until by numbers of facts we can perceive the forces, which, for good or evil, are affecting the condition of the people. It is not mere philanthropy or regulative morality, but governmental ethics, that demands this State care of population.

BIRTHS.

The study of the birth-rate of States and of cities as compared with country districts aids much in determining the variation of increase and decrease of population and the causes operating in either direction. However valuable a foreign immigration may be, children born after arrival here, or children of native citizens, are of a better average value to the State. It is even well when a State can present such inducements to its native born as to secure their settlement in it, or can cultivate a State love which is local as well as national in its attachments. With all that is said about the care and cost of large families, it is found that in all well-organized families of the laboring classes the children more than pay for themselves by the age of twenty-one. Indeed, the labor statistics of Massachusetts show the parents to be indebted to them for aid. The birth-rate is affected by discouragements to marriage, by improper practices and by decadence in health, especially that of mothers. While it is often difficult to analyze and state the proportion of limiting causes, even in seeking for them we get the value of a thoughtful consideration on the part of the people, as to the need of fostering parentage and infant life. We hear so much of our increase of population that we forget the small average of our population as compared with our unoccupied acres. A distinguished English statesman recently traveling in this country, when asked what was the greatest drawback to progress he had observed,

replied: "The absence of adequate population." A birth-rate of thirty-three per thousand does not represent a rapid increase. Any other than natural limitations to the birth-rate, or any causes which militate against families, are to be looked upon as evils, not less seriously by the statesman than by the moralist.

DEATHS.

The records of death and the requirements of a certificate before burial, have been found essential in many ways. It is not wise to permit life to be ended without some form of authentication of the cause and of the disposition made of the body. General Graham, as Registar-General of England, says: "Like the institution of the coroner's jury, this inquiry deters from crime, fosters a reverence for human life, and by discovering the causes of premature death in the various circumstances of the population contributes to the progress of the science of medicine, diminishes suffering and leads to the prolongation of life to its natural term." So invaluable have such records been in the study of the causes or occasions of disease that the progress of England in hygiene rests more on this basis than on any other. The government has proceeded on the basis which such statistics have furnished and has succeeded in averting death, in lessening disease and in lengthening life. Not only should the State have its general summary and give information and direction and that uniformity as to methods without which there cannot be adequate comparisons, but the local death-rates, and especially those of cities, need to be carefully watched from week to week and month to month. The sicknesses and deaths among the younger population are often the index of how far parents and older children are being subjected to insanitary conditions that embarrass labor or abbreviate life, even where no speedy sickness or demise follows. Dr. Farr once traced the ages, history, etc., of 100,000 decedents from birth to death, noticing the age at death and the causes. In various forms vital statistics seek thus to trace the life and death history of population. Thus it puts itself in the possession of a knowledge of causes, so as to limit their potency or entirely remove some of them. We refer to articles in our previous reports showing how these laws are to be studied and what are the best ascertained methods of conducting such vital statistics; vital not less to the State in its prosperity and numerical progress, than to persons and to families in health, thrift and happy citizenship.

The number of deaths that occur at the early ages of life is very significant as to the vitality of any particular community. While the number for a single year may depend on some local epidemic, the average through a series of years is a very correct record of the vigor of the population. So the ultimate capacity of a nation can quite accurately be foretold by a close study of its vital statistics through a series of years. Forewarned is forearmed, not less to society than to individuals. Through such records States must study their tendencies to decadence, and so check the progress or interpose compensating influences. It is the misfortune of insanitary conditions not only to kill multitudes at an untimely age, but so to enfeeble or reduce race-vitality as to lower the health standard of those that live. Thus the deaths measure the entailments to the living and to their ancestry.

An accurate knowledge of the relation of the death-rate to local conditions, aids very much in the diagnosis, the treatment and the prevention of illness.

Physicians are now watching, also, more closely the types of disease as they are modified by earth structure, topography, climate or by insanitary conditions in the person. We now fail not so much from deficiency in the aggregate of available and life-preserving knowledge, but in our personal possession of such knowledge, and not less in our ability to enforce what we do know upon the popular mind. We shall never attain perfect correctness of methods, but the two most forward steps thereto are to know what is correct and to obtain so far as State, municipal and other local governments are concerned, a power to execute so far as is feasible. The success which has attended other governments and States in this direction is the guaranty that our efforts in the same direction will be of service.

We are forced to study not only the vital but the social conditions of our population by the light afforded through the study of the forces which affect health and life. It is essential, if in one section of the State the population is dying at the rate of thirty to thirty-five per thousand and in another at only sixteen or seventeen per thousand, that we ascertain the causes of the difference. Especially as so many of these causes are to be found within the reach and duty of control. All the more because the epidemic originated or fostered by private or public filth does not stop amid its degraded beginnings, but invades the homes and the persons of those who have been personally careful. It is for this reason that no health administration is perma-

nently effective which does not secure the numerical statement of marriages, of births and of deaths, in order that it may have them as the record of actual results, as the guides to observation and as the indices of those preventive methods which limit or abate such devitalizing influences as enfeeble, demoralize and destroy the people.

COMPARATIVE FACTS IN CLIMATOLOGY AND GEOLOGY,

As Needed in the Study of Vital Statistics and the Causes of Disease.

BY THE MEDICAL SUPT. OF S. V. S.

In the study of the population of New Jersey, with a view of determining how the health of its inhabitants can be best maintained, we need to know something of its physical geography, its earth structure, its water systems, its atmosphere and its climate. In other words, we need to know its natural locality and its telluric or geological construction, so far as these influence health and life or produce or modify the diseases which occur. It is no longer doubtful that localities differ much in their healthfulness; that we are able to estimate the reasons of difference and often to improve or injure the vital force of the location by structural changes.

We desire here briefly to notice a few of those physical, geological and climatological facts that are of essential import in guiding us in the close local and comparative study of population as related to its locality.

The geological structure of New Jersey is such as to admit of quite distinctive study. As soil or surface depends chiefly upon the character of the formation beneath, we first find out what this is, then how far it has been modified.

Rock or earth structure is spoken of as *primitive* or of the (I.) azoic (eozoic) time or age, when there was no animal life on the earth; as of a transition or (II.) paleozoic time, when life in some forms began to appear; as of a (III.) secondary or mesozoic time, to which, among others, belong the triassic or new red sandstone and the cretaceous formations, and (IV.) the tertiary or cenozoic time, with its tertiary and recent formations.

Now, so distinct are these various formations in this State, that, with the exception of the azoic and paleozoic formations, occurring in the north of the State, they can be and are represented on separate

maps, while the first two, although on one map, are shown quite distinct.

The azoic rocks make up the mountain ranges or Highlands which cross the northwestern part of the State, and which are known by the names of Ramapo, Warwick, Hamburg, Pochuck, Schooley's, Mine, Musconetcong, Scott's, etc. They cover an area of about 772 square miles. The northeastern end of the belt in this State is rough and much of it still in forest. Of the southwestern end a considerable portion is cleared and in good farms. With this exception, it is somewhat sparsely inhabited.

The paleozoic rock is mostly of the silurian variety, composed of sandstones, limestones and slates. These formations occupy many of the valleys between the mountains of azoic rock and the whole of a belt of country 15 to 20 miles wide, northwest of and adjoining these mountains. The rich farming lands of Sussex and Warren counties are on the magnesian limestone, and the grazing and dairying lands are on the slates. The area covered by these formations is about 650 square miles.

The devonian rock, another division of the paleozoic, has a very limited exposure in New Jersey, along the Delaware, from the New York State line to the Walpack bend. The area included is about 40 square miles. There are some valuable limestones and some good soils, but much of it is encumbered with drift. Thus, then, the 772 square miles of azoic rock and the 650 of paleozoic rock are the only two that cannot be on separate maps, and these are thus sufficiently outlined for sanitary study. (For full details see the State geology and subsequent reports and maps.)

The secondary or mesozoic time has two prominent and distinct distributions, viz., the triassic or new red sandstone formation and the cretaceous formation. The triassic or red sandstone formation occupies the belt of country which crosses the State from northeast to southwest and is next southeast of the azoic region. It is about 20 miles wide and extends entirely across from the Hudson to the Delaware. Its area is 1507 square miles. Almost the whole of Bergen, half of Passaic, all of Essex, Union and Hudson, a part of Morris, most of Somerset and Hunterdon and considerable portions of Middlesex and Mercer counties are of it. Its southeast border is nearly on a straight line between Jersey City and Trenton. Its rocks consist of sandstone, shale and trap; the former two of sedimentary and the latter of igneous origin. Generally the shales disintegrate more rapidly than the sandstones. These two are characterized by their red color. Their surface is diversified by many abrupt mountain ridges of trap-rock.

The cretaceous formation is found immediately southeast of the red sandstone in a long, narrow strip that reaches from Raritan and Sandy Hook bays to the head of Delaware bay, near Salem. It is 90 miles long and from 12 to 15 wide, and has an area of 1491 square miles. It includes parts of Middlesex, Mercer, Monmouth, Ocean, Burlington, Camden, Gloucester and Salem counties. The white clays occupy the northwestern side of the belt and the green-sand marls the southeastern side.

The tertiary or cenozoic time is almost entirely limited to the southern portion of the State. These formations cover the counties of Atlantic, Cumberland and Cape May, and most of Ocean and Burlington; Camden, Gloucester, and Salem are partly occupied by them, and also a small portion of Monmouth. They consist of sand and clay covered with a thin soil, not very productive. Some of the clay has shells enough to be called marl. Extensive beds of white sand for glass-makers' use are common.

Still more recent formations of the same general character are sometimes known as *Post-Tertiary*. The glacial drift hereafter to be noticed, which covers much of the northern third of the State; the banks of sand gravel which in the form of terraces or level-topped hills, occupy much space in valleys; the alluvial deposits along the borders of streams, and the tide marshes and the sand beaches which border the State along the sea side, and on Delaware bay, are formations which belong to this division.

To this extent a knowledge of earth foundations is necessary in order to an intelligent survey of ground influence upon health; not only does it concern questions as to the level of ground water, and drainage, but the well water is modified, as, for instance, we know in limestone formations. While it is true that topography and forests and various other surface relations have their influence on climate and on constitutions, yet we are not to overlook the relations of the deeper structure. But especially "as soils are formed from rocks, they must necessarily have some qualities in common with the rocks." The usual designations of loamy, clayey, etc., are too indefinite. It is better to base the classification of soils on the geological structure of the particular district, and after to note such modifications as are produced by drift, by washing or by any change, natu-

ral, accidental or artificial, which has been made, and which tends to influence animal or human life.

The classification given by Prof. Cook, the State Geologist, based on geological origin, is as follows:

1. *Granitic.*—The soils on the azoic rocks, and which have evidently been formed from the decomposition or disintegration of the gneiss, hornblende and granite rocks of this formation. They are designated on the map by a crimson or carmine color.

2. *Limestone*—The soils which overlie the crystalline, magnesian, and Helderberg lime-rocks, and have been formed from these rocks by the solution and removal of most of the lime, leaving the earths and impurities of the stone for the soil. Each of these soils and rocks is designated by a blue color.

3. *Slate*—The soils which are on the Hudson river slate, the Oriskany sandstone, and the Cauda-galli grit, and have been formed by the simple disintegration of those rocks. These soils are usually more or less clayey. They are colored on the map of a neutral tint.

4. *Red Sandstone and Shale*—These soils have been formed by the disintegration of the rocks on which they are found. The color on the map shows their location.

5. *Trap*—Is the soil which is formed by the decomposition of trap-rocks, and is found on them. An olive-green color is used on the map to designate this soil.

6. *Clay and Sand*—Designates the soils which are found on the outcrop of the formations of white clays and sands of the lower member of the cretaceous period. These soils are designated by a yellowish color.

7. *Marl Soils*—Are those which are on the outcrops of the clay marls, lower marl bed, red sand, middle marl bed, yellow sand, and upper marl bed. They are marked by the green-sand in them; often sandy. On the map they are colored different shades of green.

8. *Silicious Soils*—Include all those in which quartzose or silicious matter largely predominates. They are designated on the map by a yellow color of different shades, and the following subdivisions are distinguished:

a. Quartz-rock—Soil which is on the conglomerate of the Green Pond mountain, and on the Oneida conglomerate and the Medina sandstone of the Kittatinny mountain. These lands are all in forest.

b. Pine-land—That soil which is found in portions of Southern New Jersey, and on which *only* yellow pine ever grows. It is formed from the glass-sand and the water-sorted, gravelly earth.

c. Oak-land—That soil which is found in portions of Southeastern New Jersey, and on which oak timber grows. It is the unsorted gravelly earth of the post-tertiary age.

d. Miocene—The soil found on the miocene marl of Cumberland county.

9. *Glacial-drift Soils*—Are found in all the northern part of the State, and north of the Terminal Moraine. These soils are somewhat like the rocks on which they lie, but their composition is changed by the addition of earth brought by the glaciers from the rocks farther north.

10. *Alluvial*—Is the name given to the soils which make the tide marshes—those which are along the borders of the uplands and only a few feet above tide-level, and also to those which make up river flats. They are designated to some extent on the map by fine-ruled black lines.

Some of these soils result from the modification of the original geological soils by deposits of various kinds which can be traced. As these surface beds or admixtures with the natural rock soil affect the soil and the flora, so also there is a modification of sanitary conditions. Sometimes it is in the organic character of the material itself and sometimes it is the change it makes in what would otherwise be the drainage or natural contour. This geology of the surface is, therefore, of much importance in the study of life and of its diseases.

These surface deposits have been referred to under the division of Tertiary or Recent Formations, but as they are still more recent than the Tertiary, geologists often designate them as belonging to a fourth class, known as the Post-Tertiary or Quaternary period. To fully exhibit these, it is only necessary to refer to the valuable article on surface geology marked V (pp. 14–97) in the annual report of the State Geologist for 1880. The effects of the glacial drift with its great terminal moraine and its moraines of recession, the modified glacial drift, the transported glacial drift, and the pre-glacial drift, are there fully outlined and described.

The lake basin of the Great Meadows in the valley of the Pequest; the glacial lakes, such as Green lake, and the transfer of its entire water-shed and drainage into the Rockaway river instead of the Pequannock; the thick drift in the Delaware river valley, and that of Flat brook and Mill brook; various alluvial deposits; the great temporary

lakes formed by the modified glacial drift, such as that thirty miles long and six to eight wide, now covered by towns, made by the ice of the receding glacier at Paterson and having final outlet in the valley of the Passaic; the transported drift along the Delaware river south of the terminal moraine, and the pre-glacial drift of the southern part of the State of so different a character; all illustrate a study of the greatest import in its bearing on questions of surface biology, of drainage for health, and on diseases as thus modified.

Our attention has been very closely called to a study of periodic fevers and malarial influences, under the guidance which these lines of demarcation furnish. Future students of the telluric or earth conditions which affect population, will be as successful in showing the economic bearing of such studies as have been the geologists in bringing order out of chaos and in defining the laws of industrial development. For our natural resources are as much in a preserved and healthy population as in the ground on which it treads.

In addition to these sanitary outlines of deep and of surface geology, we need also to bear in mind those surface changes which have been made by the upheavals and infillings of constructive art. Canals and railroads are so numerous as quite to have altered surface soil and surface contour in whole districts. The excavations of mines often make hills from the buried earth and valleys or pond holes of grave import to health. The iron, the marl, the glass sand, the clay and other industries that involve displacements of ground have made many such changes in this State.

Also, the fact that so many towns have sprung up near the outlets of rivers into tide-water, has caused many a marsh to be covered over without adequate drainage, sometimes by materials totally unfit for filling in. Any one who will study the sanitary map of Hudson county, as prepared under the supervision of this Board, or that of Elizabeth, will see the significance of these changes. Similar ones are being made in many of our sea-coast towns. All excavations for buildings also have their bearing on surface geology. It is for this reason that all basements and other like excavations, and especially those in cities, need to be carefully studied in relation to soil formation and drainage. The effect of such changes is often made apparent in the records of disease, and so the need of remedy indicated.

Having thus acquainted ourselves with the material earth on which we live, or which is adjacent to us, we need still more particularly to study the topography or contour of its surface. When we follow the

courses of its mountains and valleys, its rivers and lakes, and the bordering of bays and ocean, the student of physical geography is able to estimate with more or less accuracy the bearing of these on vegetable and animal life and especially upon that of human beings. Indeed, just as the flora and fauna of a district guide to its character, so the diseases often serve to describe the telluric conditions. As close observers and series of well-observed facts increase, the relations become apparent, and what is at first entertained as a working hypothesis, becomes an ascertained fact and a practical guide in conserving health. Now that we have a topographical map of Northern New Jersey and will have one for the whole State, we have great advantages for such inquiries. Besides the effect of earth structure and surface elevation, or of large bodies of water, we need also to know of the woods as great condensers, and of all vegetable and soil and earth-covering as modifying moisture or other elements of climate in a way admitting of approximate estimation.

But the most important modifying factor as to surface geology as related to health is that which depends upon the river system and the various water-sheds of the State. These are well presented in the river system of New Jersey as tabulated on pages 276 and 277.

RIVER SYSTEM OF NEW JERSEY.

ATLANTIC OCEAN.	Hudson River.	Wallkill.	Black Creek. Wallkill. Papakating River.
	NEWARK BAY.	Passaic River.	Pompton River. Passaic River. Rockaway River. Whippany River.
			Ramapo River. Wanaque Creek. Pequannock River.
		Hackensack River.	Saddle River.
	RARITAN BAY.	Raritan River.	North Branch. South Branch. Millstone River. Green Brook. South River.
			Black River. Lamington River. Stony Brook.
	Staten Island Sound.	Rahway River.	
	Sandy Hook Bay.	Navesink River. Shrewsbury River.	
	Shark River Inlet.	Shark River.	
	Manasquan Inlet.	Manasquan River.	
	Barnegat Bay.	Metedeconk River. Toms River. Cedar Creek.	
	Great Bay.	Little Egg Harbor, or Mullicas River.	Mullicas River. Wading River. Batsto River.
	Egg Harbor.	Great Egg Harbor River.	Tuckahoe River.
	DELAWARE BAY.	DELAWARE RIVER.	Flat Brook. Paulinskill. Pequest River. Pohatcong River. Musconetcong River. Assanpink Creek. Crosswicks Creek. Rancocas Creek. Cooper's Creek. Big Timber Creek. Mantua Creek. Raccoon Creek. Oldman's Creek. Salem Creek. Alloways Creek.
			Big Flat Brook. Little Flat Brook. North Branch. South Branch.
		Cohansey Creek. Maurice River.	

RIVER SYSTEM—CONCLUDED.

NAME.	Length in Miles.	REMARKS.	Drainage Area. Square Miles.
Black Creek	10	To the State line	
Papakating River	15	To the junction with the Wallkill	
WALLKILL	25	To the State line	203
RAMAPO RIVER	33	From the State line to the Pompton	47
Wanaque Creek	19	From the State line to the Pompton	89
Pequannock River	40		95
Rockaway River	38		165
Whippany River	19		59
PASSAIC RIVER	80		974
Saddle River	18	From the N. Y. line to the junction with the Hackensack	57
HACKENSACK RIVER	30	From the State line to Newark Bay	132
Lamington River	25	Including the Black River	135
North Branch	24		85
South Branch	50		280
Millstone River	35		280
Stony Brook	20		55
Green Brook	15		63
South River	30	Including Manalapan Creek	122
RARITAN RIVER	80	Including the South Branch	1000
RAHWAY RIVER	22		62
Navesink River	22	Including Swimming River and Hop Brook	88
SHREWSBURY RIVER	10		20
SHARK RIVER	11		
MANASQUAN RIVER	22		60
METEDECONK RIVER	22	Including the North Branch	100
TOMS RIVER	30		157
CEDAR CREEK	20	Including the East Branch	70
Batsto River	18		70
Wading River	28	Including the East Branch	140
LITTLE EGG HARBOR or MULLICAS RIVER	42		476
TUCKAHOE RIVER	26		100
GREAT EGG HARBOR RIVER	41		425
Big Flat Brook	14		
Little Flat Brook	9		
Flat Brook	10	From the junction of Big and Little Flat Brooks	50
Paulinskill	38		163
Pequest River	30		168
Pohatcong Creek	26		58
Musconetcong River	40		162
Assanpink Creek	21		105
Crosswicks Creek	25		151
Rancocas Creek	32	Including the North Branch	329
Cooper's Creek	17	Including the South Branch	55
Big Timber Creek	15	Including the South Branch	56
Mantua Creek	18		51
Raccoon Creek	29	Including the North Branch	53
Oldman's Creek	23		43
Salem Creek	34		109
Alloways Creek	18		285
DELAWARE RIVER	220	From Carpenter's Point to Delaware Bay, including large and small tributaries	2100
COHANSEY RIVER	31		100
Maurice River	45	Including Little East River	360

SUMMARY OF DRAINAGE AREAS OF NEW JERSEY.

The Hudson River receives through the Wallkill and its tributaries in New Jersey the drainage of	203	sq. miles.
The Hackensack River drains	130	"
The Passaic River drains	980	"
The Raritan River drains	1,000	"
The Delaware River drains	2,100	"
The Maurice River drains	360	"
The Mullicas or Little Egg Harbor River drains	476	"
The Great Egg Harbor River drains	425	"
Total	5,674	sq. miles.

The above-named rivers are the larger streams in the State, draining about seven-tenths of the whole area. The remaining three-tenths are drained by the numerous smaller streams that empty either directly into the Atlantic ocean, or into the bays which lie along the coast.

Classified according to the Atlantic and Delaware river and bay slopes we have the following result:

The Delaware River and Bay receives the drainage of	2,850	sq. miles.
The Atlantic Ocean	4,523	"
The Hudson River	203	"
Total area of the State	7,576	sq. miles.

Such lakes as Lake Hopatcong and Budd's lake, in the highest part of the Highlands, Greenwood lake, in Passaic county, or Green pond, and many other smaller sheets of water known as lakes or ponds, need to be studied in respect to adjacent drainage, and to the water and land area they represent.

The various bays along the coast not only have a sea and river connection, but amid the tide-marshes are various creeks, quite complete in their connections with each other and needing much to be studied in their bearing on the health of localities, and especially as to the indications whether or not to use them as conduits for sewage.

The rain-fall also needs to be borne in mind in its relation to water-courses, water-supply and drainage. This is not the measure of humidity, because the quantity of moisture in the air is subject to changes which are not always expressed by atmospheric precipitation, either in the form of rain or snow. As the humidity can be measured as well as the rain-fall, we have means of recording their relation to each other, to temperature, &c. The rain-fall of the State may in general be noticed as increasing in depth in going from north to south and from northwest to southeast. Before a station was established at Newton, Goshen, in Orange county, with an average of 33.82 inches for eight years, served as an approximation. Easton, Pa., gives a

record for five years of 45.56 inches. These mark the extremes of the azoic and paleozoic districts. Paterson has the average for five years of 60.69 inches, and has long been noticed for its excessive rain-fall, which is above the region it represents. Newark, for thirty-nine and eight-tenths years, has an average of 46.48 inches; New Brunswick, for twenty-nine years, of 45.42 inches; Freehold, for eight years nine months, 46.39 inches; Vineland, for seventeen years, 49.00 inches; Cape May, for eleven years six months, 47.30 inches; Sandy Hook, for nine years, 51.99. While it is well to have these general outlines, both humidity and rain-fall need to be studied by days and weeks in relation to temperature, to former or succeeding droughts, to freshets or sudden rain-falls in short periods, and so watched as affecting sudden increases or decreases of disease, the local and general tables of vital statistics being compared therewith.

It is very evident that, in the care of the public health, great attention must be given to the preservation of the natural drainage or to its substitution where, for any reason, the natural channel is interfered with. Also, to the multiplication of drainage channels where population is crowding into smaller areas.

Whether a given stream or part thereof is to be preserved wholly for drainage and water-supply, or whether it shall be made available for mill-dams or for the delivery of sewage, and if so, whether it can, in whole or in part, be used as a water-supply? These are questions so much depending upon locality, upon river-bed, upon course and rapidity of current, upon rain-fall and upon the relations of cities, that they need to be discussed specifically as regards each area, rather than to be decided by general statements.

A comprehensive study of health and of vital statistics must take all these into account as well as the sea front, the various bays and creeks and the tide-marsh, and closely consider those parts of the State which stand in need of extended drainage. English and American observation and medical experience so establish the connection of undrained localities or interrupted water-courses and forced vegetable decompositions with malarial fevers, with consumption and other lung diseases, as well as with zymotic diseases, resulting from dampness and filth and heat combined, that we must, in the interests of population, closely compare the results in the State as variously, but definitely, modified by local conditions.

CLIMATOLOGY.

Connected with this and partly as an outcome therefrom, is the study of CLIMATOLOGY as related to earth structure. It is "the science which treats of the causes which affect the climate of a particular place."

It is a mistake to regard climate as a mere question of longitude and latitude, with which we have no concern. Were this true we would study its laws, if definite, so as to adapt ourselves thereto, or to seek such as we needed. But, as besides this, climate is itself modified by local conditions and its effects upon us personally admit of being modified both by our mode of dealing with ourselves and our surroundings, we cannot lose sight of a certain causal or modifying relation thereto. If all diseases were, as some are believed to be, dependent on the presence of septic particles having specific vegetable life, yet as development or power for malignant harm depends "upon the abundance and kind of pabulum furnished," and upon winds, moisture or other climatological conditions, we need to know how to estimate each of these.

One of the first questions that addresses itself to the sanitarian is how far it is practicable to study climatology and the relation of the earth in seeking the prevention or mitigation of disease.

With very many there is an impression that most diseases are either a result of weather conditions, or that their mildness or malignity is very much determined thereby. There is enough of connection between weather and disease to give credence to this view. We know that seasons have diseases quite peculiar to themselves and that different degrees of heat or cold or humidity are very sure to increase or decrease the mortality from certain diseases. These may be called the more general influences.

"Catarrhal fever," says Prof. Pepper, "arises from the ordinary causes of catarrhal inflammation, of which atmospheric conditions and changes are by far the most common cause." If we associate with this the remark of Reindfleisch, that "the larger half of all the diseases to which humanity is liable, consist of catarrhal affections of mucous membrane, or of disorders complicated with them," we see that locality must rank as an important factor.

In another class of cases, the specific causes of disease are either atmospheric in their origin or are so conveyed by winds or by dampness as to be transferred from one locality to another. The westward movement of cholera, the advance of influenza, and the uniform progression of some of the epizootics are beyond controversy. The term "epidemic constitution of the atmosphere" does not mean precisely what was intended by it in its first use, but it does mean a condition of atmosphere either producing, or conveying, or favoring, the spread of a disease. But what is spoken of as "the epidemic constitution of the atmosphere," is often only potent because art has laden or modified the atmosphere; because abnormal local filth or decomposition, either in the person or surroundings, gives the prolific soil or stagnant moisture and accumulated heat force it into intense productivity.

It seems that contagious particles or the entities of various diseases have different relations to the atmosphere. Some cling to the surface of the ground or other surfaces. Some are more easily wafted hither and thither. This may depend on a varying specific gravity or other conditions which modify the laws of diffusion. For instance, we can conceive of particles so coated with a film of oil as not to be readily diffused in the atmosphere. We have evidences that a stratum of air sometimes moves through the other strata and seems to preserve an individuality that does not readily admit of dilution. In passing over hills or amid marshy lands, even where the same sunshine reaches us, or in riding the open country, we pass through strata of air greatly differing in temperature and in organic impurity. How the rapid removal of forests or the upheaval of soil affects humidity, rain-fall and general temperature and has modifying results on climate and health, is already known.

Admitting that human control over weather conditions is partial and inadequate, this would not prove that the study is not of practical sanitary usefulness. There still would remain that more essential and life-saving study of the especial local conditions which under specified states of weather cause the greatest disturbance of vital functions. Much of the prowess of a good sanitarian, like that of a great general, is in his genius for thwarting combinations. The divisions of the great army of destruction must not be allowed to join forces. The victory is in preventing the massing of the forces, and that victory means saved lives. It is by close record of the effects of the same climatic conditions upon varying conditions of population and their surroundings that we come to know what are the safest and what the most dangerous methods of life. The different records of city and country in the same vicinity, or of different blocks in the same city, may show both what conditions of weather are most fraught with

risk and just where and why the risk is greater at one point than at another.

It is by just such studies as these that we are able approximately to determine what conditions of weather or climate produce the most favorable or unfavorable results on disease. Already there are enough gleams of knowledge to show that the facts are discoverable, although for so many reasons difficult of discovery. This justifies the acumulation of the facts, but does not justify artificial combinations of the facts, or some generalizations in which we are slow to concur. The labors of such men as Mr. Glaisher, of England, and Professor Loomis, of America, show what progress is being made by those who study with closest accuracy, and give promise of results such as must have important bearings upon the prevention of disease.

The importance of the subject still more impresses itself upon our attention from the fact that so many varieties of climate can be found within the State. Our northern boundary is in great contrast with our extreme sonth; while from east to west and from mountain to seashore there are diversities of climate such as no other State in the Union can present. The southern and eastern portion of the State, a region about one hundred miles long from north to south, and thirty-five miles wide from east to west, is remarkable for the small extremes between the mean temperature of summer and winter. "In the *average daily range of temperature*, Cape May is more equable than *Aiken, S. C., Jacksonville, Fla., San Diego, Cal., San Antonio, Texas*, and many other noted health resorts. In fact, in the low range it comes near Key West. Of course its *minima* are lower than those of the above-named places—although the differences are not so great as differences of latitude would lead us to expect." By accurate and long records of the weather conditions of localities and of the effects of our various climates in various diseases, we shall come to know what changes of locality to advise and how the health of our citizens can thus be conserved. It is often quite interesting to notice how atmospheric conditions are modified by difference of exposure, by prevailing winds or protection therefrom, by ground moisture, by bodies of water, by woodlands, or of dry, loose, uncovered soils, or by the relations of mountain and valley, of lake and ocean. Thus the study of climatology, or of the weather, is not merely a study of meteorological conditions.

The facts as to climate are to be deduced from various records and observations accurately made and stated, and then alongside of these

a similar record of disease. This record does not fail to show ascertainable and often controllable relations.

It is of interest to note how within a few miles changes occur, and how real are the advantages which sometimes follow from changes that involve only short distances of travel.

Our comparative studies of climatology, or weather conditions, date from July 1st, 1878, when our present system of vital statistics commenced. As the meteorological observations cannot and need not be made in every township and city of the State, we give observations at points which fairly represent the natural geological and climatological districts into which the State is divisible.

I. Newton, Sussex county, will be taken to represent the Kittatinny valley, and the sandstone, slate and adjacent rock.

II. Paterson, located on trap rock, well represents some slight variations for the same general district, and so the two stand for Northern New Jersey, or that part mostly of azoic and paleozoic formation.

III. Newark will represent the eastern part of the red sandstone section.

IV. New Brunswick, Princeton and Trenton will represent the western red sandstone section.

V. Freehold, amid the sand and clay marls, will represent the cretaceous formation, as well as in general the inland portion of Monmouth county.

VI. The tertiary formations and the climate as varied by relations of land and water, will be shown by Vineland.

VII. Cape May, on a similar sandy formation, stands for the Atlantic coast of the extreme south, with the adjacent influence of Delaware bay. Here and at Barnegat we rely on the Signal Service report. That of Barnegat is the one at hand this year.

VIII. Either Middletown, Red Bank or Sandy Hook represents our northern Atlantic coast and the minglings of sand and of clay marls of cretaceous formation.

Other points of comparison are afforded by the records of the Signal Service. (See, also, page 284 of Fifth Report.)

The records at some of these points are slightly defective, but can be supplied by adjacent data in time for semi-decennial comparison. We have now perfected a system so as to secure reports from each of these points, which we believe will be permanent and reliable and much aid to sanitarians in their comparisons. Each city of over 5000 inhabitants should avail itself of weekly or monthly reports so as to study the immediate connection with varying death-rates.

The observers are as follows:
Newton, Miss E. Foster.
Paterson, J. S. Hilton, C. E.
Newark, Hon. Wm. A. Whitehead, or Arthur Ward, M. D.
New Brunswick, Prof. J. C. Smock.
Freehold, Chas. F. Richardson, A. M.
Vineland, John Ingram, M. D.
Middletown or Red Bank, Frank Osborn, C. E.
Barnegat, Cape May, etc., United States Signal Service.

Physicians or climatological observers, who will, at least every three years, furnish to this Board their judgment as to local causes of disease, will at any time, on notice by postal, be furnished with a geological map for comparisons.

NOMENCLATURE, OR THE REVISED CLASSIFICATION OF DISEASES.

"The *nomenclature* is of as much importance in this department of inquiry as weights and measures in the physical sciences. The superiority of a classification can only be established by the number of facts which it generalizes, or the practical results to which it leads.

"A statistical nosology, to throw the clearest light upon the health of a nation, should be founded upon the mode in which diseases affect the population."—*Farr.*

The great progress which has been made in medical knowledge has necessitated many changes in the names and orders of disease. These have been from time to time made with great care, as new discoveries in pathology have indicated. The one until recently in use in England, Scotland and Wales had been changed but little within twenty years. It had been reprinted in this country by the Hospital Marine Service and generally accepted by physicians and in all offices of vital record. In 1880, the National Board of Health invited a conference of the principal Bureaus of Vital Statistics in the United States. A similar recognition of the need of correction was entertained by the Registrar-General of Great Britain. Conferences were had with a committee appointed by the United States and a careful review of the nomenclature was instituted. This has resulted in the adoption of some modifications which are used for the first time in the English reports recently printed. While reference to the instructions and nomenclature, as published by this Board in 1878, is important, we herewith give the classification as now adopted:

LIST OF DISEASES REPORTED AS CAUSES OF DEATH ADOPTED IN THE NEW FORMS OF THE REGISTRAR-GENERAL OF ENGLAND.

[It will be understood that the names of the groups are provisional only. Asiatic cholera and yellow fever would be placed under miasmatic diseases.]

I.

SPECIFIC FEBRILE DISEASES, OR ZYMOTICS.

1. *Miasmatic diseases.*

Small-pox { Vaccinated. / Unvaccinated. / No statistics.
Chicken-pox.
Measles.
Epidemic rose-rash.
Scarlet fever.
Typhus.
Relapsing fever.
Influenza.
Whooping-cough.
Mumps.
Diphtheria.
Cerebro-spinal fever.
Simple continued fever.
Enteric fever.
Other miasmatic diseases.

2. *Diarrhœal diseases.*

Simple cholera.
Diarrhœa, dysentery.

3. *Malarial diseases.*

Remittent fever.
Ague.

4. *Zoogenous diseases.*

Hydrophobia.
Glanders.
Splenic fever.
Cow-pox and vaccination.

5. *Venereal diseases.*

Syphilis.
Gonorrhœa, stricture of the urethra.

6. *Septic diseases.*

Phagedæna.
Erysipelas.
Pyæmia, septicæmia.
Puerperal fever.

II.

PARASITIC DISEASES.

Thrush.
Other vegetable parasitic diseases.
Hydatid disease.
Other animal parasitic diseases.

III.

DIETIC DISEASES.

Starvation, want of breast milk.
Scurvy.
Intemperance. { Chronic alcoholism. / Delirium tremens.

IV.

CONSTITUTIONAL DISEASES.

Rheumatic fever, rheumatic heart.
Rheumatism.
Gout.
Rickets.
Cancer, malignant disease.
Tabes mesenterica.
Tubercular meningitis.
Phthisis.
Scrofula, tuberculosis.
Purpura, hæmorrhagic diathesis.
Anæmia, &c.
Diabetes mellitus.
Other constitutional diseases.

V.

DEVELOPMENTAL DISEASES.

Premature birth.
Atelectasis.
Cyanosis.
Spina bifida.
Imperforate anus.
Cleft palate, hair lip.
Other congenital defects.
Old age.

VI.

LOCAL DISEASES.

1. *Diseases of nervous system.*

Inflammation of brain.
Apoplexy.
Softening of brain.
Hemiplegia, paralysis.
Paralysis agitans.
Hydrocephalus (not acute.)
Insanity (general paralysis of insane.)
Chorea.
Epilepsy.

Convulsions.
Laryngismus stridulus.
Idiopathic tetanus.
Paraplegia and disease of cord.
Others, nervous system.

2. *Diseases of organs of special sense.*

Otitis, otorrhœa.
Epistaxis and disease of nose.
Ophthalmia and disease of eye.

8. *Diseases of circulatory system.*

Endocarditis, valvular disease.
Pericarditis.
Hypertrophy of heart.
Angina pectoris.
Syncope.
Aneurism.
Senile gangrene.
Embolism, thrombosis.
Phlebitis.
Varicose veins.
Others, circulatory system.

4. *Diseases of respiratory system.*

Laryngitis.
Croup.
Others, larynx, trachea.
Emphysema, asthma.
Bronchitis.
Pneumonia.
Pleurisy.
Other diseases of respiratory system.

5. *Diseases of digestive system.*

Stomatitis.
Dentition.
Sore throat, quinsy.
Dyspepsia.
Hæmatemesis.
Melæna.
Disease of stomach.
Enteritis.
Ulceration of intestines.
Ileus, obstruction of intestines.
Stricture and strangulation of intestines.
Intussusception of intestines.
Hernia.
Fistula.

Peritonitis.
Ascites.
Gallstones.
Cirrhosis of liver.
Others, liver disease.
Others, digestive system.

6. *Diseases of lymphatic system.*

Disease of lymphatics.
Disease of spleen.

7. *Diseases of gland-like organs of uncertain use.*

Bronchocele.
Addison's disease.

8. *Diseases of urinary system.*

Nephritis.
Bright's disease, albuminuria.
Uræmia.
Suppression of urine.
Calculus.
Hæmaturia.
Disease of bladder and prostate.
Others, urinary system.

9. *Diseases of reproductive system.*

a. Diseases of organs of generation.

Ovarian disease.
Disease of uterus and vagina.
Disorder of menstruation.
Pelvic abscess.
Perineal abscess.
Disease of testes, penis, &c.

b. Diseases of parturition.

Abortion, miscarriage.
Puerperal mania.
Puerperal convulsions.
Placenta prævia, flooding.
Phlegmaria dolens.
Other accidents of childbirth.

10. *Diseases of locomotor system.*

Caries, necrosis.
Arthritis, ostitis.
Others, locomotor system.

11. *Diseases of integumentary system.*

Carbuncle.
Phlegmon, cellulitis.
Lupus.
Ulcer, bed-sore.
Eczema.
Pemphigus.
Others, integumentary system.

VII.

DEATH FROM VIOLENCE.

1. *From accident or negligence.*

Fracture, contusion.
Gunshot wounds.
Cut, stab.
Burn, scald.
Poison.
Drowning.
Suffocation.
Otherwise.

2. *From homicide.*

Murder, manslaughter.

3. *From suicide.*

Gunshot wounds.
Cut, stab.
Poison.
Drowning.
Hanging.
Otherwise.

4. *By execution.*

Hanging (execution.)

VIII.

DEATHS FROM ILL-DEFINED CAUSES.

Dropsy.
Debility.
Atrophy and inanition.
Mortification.
Tumor.
Abscess.
Hemorrhage.
Sudden (cause unascertained.)
Not specified, or ill-defined.

CONDENSED

CLIMATOLOGICAL RECORDS,

FOR FOUR STATISTICAL YEARS,

Commencing July 1st, 1878, and ending July 1st, 1882, with Additional Records for the Six Months from July 1st, 1882, to January 1st. 1883.

Station, State Agricultural College Farm. Latitude 40° 21′ N.; Longitude 2° 20′ E. Height of Barometer Cistern above Sea Level, 225 feet.

OBSERVER, THEODORE WEST.

	BAROMETER. Reduced to 32 deg.			THERMOMETER.								
	Max.	Min.	Mean.	Max.	Min.	Mean.	Mean humidity.	Prevailing wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
1882.												
July	.....	.....	.....	91	59	70.7	.....	N. E., W. S. W.	3.04	.....	.....	.....
August	.....	.....	.....	93	54	69.5	.....	E. S. E., W. S. W.	3.20	.....	.....	.....
September	.....	.....	.....	90	50	64.7	.....	E. N. E., W. S. W.	15.52	.....	.....	.....
October	.....	.....	.....	78	41	56.2	.....	N. E., W. S. W.	1.42	.....	.....	.....
November	.....	.....	.....	71	16	37.2	.....	W.	1.60	.....	.....	.....
December	.....	.....	.....	45	4	27.8	.....	W. S. W.	1.91	.....	.....	.....

*Including melted snow.

Rainfall from P. V. Spader, Esq.; kept in city. 1882. Rainfall of summer showed a deficiency. Autumn, warm until November 14th. Storm of September 21st–24th heaviest rainfall on record. October was noted for its warmth and dull weather. November marked by heavy snow-fall on 29th. Frosts kept off until very late—until in November. A noteworthy high percentage of easterly winds in July, August, September and October.

Station, Lombardy Street, Newark, N. J. Latitude ° ′ N.; Longitude ° ′ E. Height of Barometer Cistern above Sea Level, feet.

OBSERVER, W. A. WHITEHEAD.

	BAROMETER.			THERMOMETER.			Mean humidity.	Prevailing wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1882.												
July	30.32	29.80	30.53	96½	55	76.82	.....	W. N. W.	3.57	.....	6	17
August	30.35	29.70	29.08	93¼	52½	73.31	.....	S. E.	1.31	.....	7	16
September	30.25	29.70	30.06	86	47	66.75	.....	N. E.	17.66	.....	13	14
October	30.45	29.90	30.14	72¼	41	57.05	.....	N. E., S. E.	2.00	.....	11	14
November	30.55	29.88	30.22	70	19	40.52	.....	N. W.	1.77	4	5	12
December	30.48	29.78	30.14	46¾	10¾	30.59	.....	N. W., S. W.	1.95	9	6	11

*Including melted snow.

Station, Middletown, N. J. Latitude ° ′ N.; Longitude ° ′ E. Height of Barometer Cistern above Sea Level, feet.

OBSERVER, F. OSBORN, C. E.

	BAROMETER. Reduced to 32 deg.			THERMOMETER.			Mean humidity.	Prevailing wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Maen.						
1882.												
July	.....	.....	.....	95	54	73.98	.....	.....	.....	.....	.....	.....
August	.....	.....	.....	91	55	71.16	.....	.....	.....	.....	.....	.....
September	.....	.....	.....	88	52	68.68	.....	.....	.....	.....	.....	.....
October	.....	.....	.....	79	39	57.11	.....	.....	.....	.....	.....	.....
November	.....	.....	.....	78	15	41.42	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	61	7	30.54	.....	.....	.....	.....	.....	.....

* Including melted snow.

METEOROLOGICAL SUMMARY FROM JULY 1st, 1882, TO JANUARY 1st, 1883.

Station, Dennis Library, Newton, N. J. Latitude, 41° 2′ 45″ N.; Longitude, 2° 19′ 48″ E. Height of Barometer Cistern above Sea Level, 660 feet.

OBSERVER, MISS E. FOSTER.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean humidity.	Prevailing wind.	Rain (inches.)*	Snow (inches.)	Days when precipitation equaled 0.01.	Cloudy days.	Rainfall on days.	Thunder and lightning on days.	Snowfall on days.	Fog.	Hail.	Frost.	Lunar halos.
	Max.	Min.	Mean.	Max.	Min.	Mean.													
1882.																			
July	29.576	28.829	29.263	94.7	53.3	74.16	74.41	S. W.	2.40	trace.	8	3	9	2	1	.....	.....	.....	.....
August	29.603	28.868	29.298	96.1	50.0	72.06	79.28	S. W.	3.68	.....	8	11	10	3	.....	8	.....	.....	.....
September	29.533	28.912	29.313	86.0	40.2	65.11	87.0	N. E.	9.36	.....	12	12	18	5	.....	4	1	.....	1
October	29.623	28.981	29.343	74.0	36.0	55.51	88.66	N. E.	2.595	trace.	13	14	15	.....	1	12	.....	2	5
November	29.780	28.880	29.376	68.2	18.2	39.25	80.41	N. E.	1.20	13.0	4	10	5	.....	5	1	1	7	6
December	29.677	28.963	29.302	48.0	6.9	29.19	70.43	N. W.	1.85	3.3	8	15	7	.....	9	3	.....	4	5
For the half Year	29.632	28.889	29.315	77.83	34.10	55.88	80.03	.....	21.095	15.3	53	65	64	10	16	28	2	13	27

* Including melted snow.

REMARKS.—July, 1882, had a greater range of temperature and a higher humidity than that of 1881; remarkable for the absence of cloudy days and fogs; auroras were frequent; snow fell on the 5th; diphtheria was prevalent near the middle, and seldom near the latter part, of the month. August had an excess of dews, fogs and mists; from the 1st to the 8th, winds were from points between N. E. and S. S. E., and with an increasing temperature and heavy, oppressive night atmosphere; several cases of diphtheria took a fatal form. September was more equable; all the general rains were accompanied by thunder and lightning; no sickness appeared until after the excessive rainfall of the latter part of the month, then one death from consumption, and neuralgia on the increase. October was misty, foggy and dewy; from the 16th to the 18th dense fogs and heavy atmosphere characterized the nights and days; during that period there was one death from pneumonia, and diphtheria re-appeared; rainfall was deficient, though there were 94 hours of precipitation. November, first frost on the 3d; ground frozen on 3d and 4th; one case of malarial dysentery on 5th; snow covered the ground 10 days in latter half of the month; there was a marked presence of ozone previous to the snowfalls. Autumn, 1882, unusual prevalence of N. E. winds. December was a steadily cold month; mean (sheltered) temperature was nearly 10 degrees below the mean of December, 1881; there were 26 days when the minimum temperature was 32 degrees or less; snow on the ground 16 days; neighborhood unusually free of sickness; a mild case of diphtheria appeared on the 29th.

Tables of Climatology as arranged for Comparison with Vital Statistics and with Conditions Affecting Disease.

Station, Newton, N. J. Latitude 41° 2′ 45″ N.; Longitude 2° 19′ 48″ E. Height of Barometer Cistern above Sea Level, 660 feet.

OBSERVER, MISS E. FOSTER.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1878.												
July	.....	.....	.....	92.0	64.0	78.03	.....	S. W., N.	.....	.....	11	7
August	.....	.....	.....	85.0	58.0	73.69	.....	S. W.	.....	.....	9	8
September	.....	.....	.....	86.0	42.0	68.16	.....	S. E., E.	.....	.....	8	7
October	.....	.....	.....	78.0	36.0	41.95	.....	S. W.	.....	.....	11	6
November	.....	.....	.....	59.0	28.0	44.15	.....	N. W.	.....	2	10	13
December	29.742	28.138	29.223	62.0	9.0	28.96	75.11	W., N. W.	4.74	2	16	16
1879.												
January	29.714	28.779	29.273	49.0	5.0	18.18	75.25	S. W., N. W.	2.75	17	7	11
February	29.968	28.641	29.293	44.0	3.0	22.19	74.11	N. W., N. E.	2.56	3	12	13
March	29.936	28.638	29.361	60.0	9.0	33.18	77.50	N. W., N. E.	3.87	6	11	16
April	.....	.....	.....	80.0	26.0	50.25	.....	N. W.	.....	3	11	10
May	.....	.....	.....	84.0	45.0	50.66	.....	S. W.	.....	.....	6	6
June	.....	.....	.....	92.0	54.0	73.27	.....	S. W.	.....	.....	9	3
For the Year	29.840	28.549	29.287	72.58	30.75	48.55	75.49	.....	13.92	33	121	116

*Including melted snow.
1878, July—Hot, and frequent thunder-showers. August—Very humid. September—Warm and dry. October—Drouth. November—Rains and fogs. December—Cold, icy winds; very humid.
1879, January—Hazy and windy. February—Snow on the ground the entire month. March—Very humid. April—Northwest winds. May—Dry; seven frosts. June—Warm and dry.
There were nineteen fogs and thirteen thunder-storms during the year.

Station, Newton, N. J. Latitude 41° 2′ 45″ N.; Longitude 2° 19′ 48″ E. Height of Barometer Cistern above Sea Level, 660 feet.

OBSERVER, MISS E. FOSTER.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1879.												
July	.....	.....	.....	96.0	60.0	60.29	.....	S. W.	.....	.....	6	3
August	.....	.....	.....	92.0	56.0	72.18	.....	S. W.	.....	.....	7	7
September	.....	.....	.....	86.0	40.0	63.62	.....	S. W.	.....	.....	5	7
October	.....	.....	.....	84.0	30.0	61.58	.....	S.	.....	.....	3	7
November	.....	.....	.....	76.0	16.0	44.26	.....	N. W.	.....	5	9	7
December	.....	.....	.....	62.0	10.0	35.29	.....	N. E.	.....	8	10	14
1880.												
January	.....	.....	.....	60.0	10.0	39.79	.....	S. W.	.....	4	10	13
February	.....	.....	.....	66.0	5.0	37.78	.....	S. W.	.....	6	5	11
March	.....	.....	.....	72.0	18.0	38.68	.....	N. W.	.....	13	10	15
April	.....	.....	.....	78.0	34.0	51.72	.....	N. W.	.....	.....	7	12
May	.....	.....	.....	92.0	40.0	69.40	.....	S. W.	.....	.....	5	10
June	.....	.....	.....	91.0	50.0	72.90	.....	S. W.	.....	.....	6	5
For the Year	.....	.....	.....	79.58	30.75	53.95	.....	.....	.....	36	83	111

*Including melted snow.
1879, July—Dry and windy. August—Rains from northeast; hot sun; humid. September, October and November—Warm, dry and windy. December—Hazy; frequent mists.
1880, January—Very humid; nine days of fog. February—First part clear and cold; latter, hazy and warm. March—Very humid. April—Dry and windy. May and June—Hot and dry.
There were twenty-five fogs and five thunder-storms during the year.

Station, Newton, N. J. Latitude 41° 2′ 45″ N.; Longitude 2° 19′ 48″ E. Height of Barometer Cistern above Sea Level, 660 feet.

OBSERVER, MISS E. FOSTER.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1880.												
July	.....	.....	.....	90.0	62.0	74.73	.....	N. W.	.....	.....	9	10
August	.....	.....	.....	88.0	51.0	72.63	.....	S. W.	.....	.....	6	8
September	.....	.....	.....	88.0	48.0	66.53	.....	S. W.	.....	.....	6	11
October	29.681	28.750	28.965	77.1	29.8	50.99	70.3	S. W., N. W.	1.70	.....	9	13
November	29.944	28.851	29.459	67.3	10.5	36.67	67.1	S. W.	1.68	3.0	10	15
December	29.684	28.910	29.249	45.0	7.9	25.62	74.6	N. W., S. W.	2.73	15.7	12	21
1881.												
January	29.863	28.620	29.341	43.3	5.0	21.83	74.97	N. E., N. W.	4.06	20.25	9	18
February	29.937	28.639	29.068	56.0	6.0	28.82	68.25	N. W., N. E.	0.60	6.5	5	11
March	29.590	28.332	28.993	53.0	17.0	35.80	68.0	N. E., N. W.	.....	5.0	7	16
April	29.569	28.579	29.118	83.0	17.0	47.22	53.18	N. W.	.....	trace.	2	7
May	29.735	28.874	29.294	85.0	30.5	61.30	70.0	S. W., N. E.	.....	.....	8	9
June	29.421	28.910	29.017	88.7	40.3	65.17	70.38	N. W., N. E.	5.12	.....	16	13
For the Year	29.719	28.718	29.167	72.86	23.93	48.94	68.53	.....	15.89	50.45	99	151

*Including melted snow.
1880, July to October—Very dry and warm; ten frosts. November and December—Very cold and dry.
1881, January to March—Cold and humid. Very little rain from March to June.
There were nine days of fog and eleven thunder-storms during the year.

Station, Newton, N. J. Latitude 41° 2′ 45″ N., Longitude 2° 19′ 48″ E. Height of Barometer Cistern above Sea Level, 660 feet.

OBSERVER, MISS E. FOSTER.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1881.												
July	29.544	28.870	29.208	95.2	57.8	74.66	67.88	N. W., S. W.	2.005	.....	10	9
August	29.541	28.904	29.281	97.0	62.4	73.94	73.26	N. W., S. W.	1.48	.....	4	8
September	29.608	29.139	29.350	99.0	50.4	72.47	81.94	S. S. W.	2.20	.....	11	11
October	29.810	28.735	29.378	84.9	31.3	55.94	84.30	S. W.	4.70	.....	9	15
November	29.863	28.797	29.380	68.2	19.6	42.73	79.63	S. W.	3.23	2	12	12
December	29.805	28.552	29.352	63.0	17.0	39.09	76.80	S. W., N. E.	4.76	5	14	17
1882.												
January	29.983	28.578	29.338	48.8	6.8	26.81	74.20	N. W.	5.62	34	16	15
February	29.928	28.731	29.334	56.9	10.5	33.52	70.84	S. W., N. W.	4.11	13.5	9	7
March	29.864	28.775	29.296	67.0	16.0	39.37	65.04	N. W.	3.185	4.5	13	14
April	29.750	28.618	29.255	73.2	21.9	46.17	64.01	N. E., S. W.	2.09	2.5	12	14
May	29.671	28.703	29.229	85.0	30.2	54.57	70.66	N. E.	6.36	.....	18	16
June	29.520	28.712	29.145	94.9	46.0	70.05	66.05	S. W.	4.00	.....	11	3
For the Year	29.740	28.759	29.296	77.67	28.85	52.44	72.83	.....	43.74	61.5	139	141

*Including melted snow.
July to October—Drouth; heavy dews, fogs and mists throughout the Summer and Autumn. Dry wells and cisterns, brooks and ponds low in September. December—Very humid and variable. January—Mists and fogs. February—Cellars flooded with water from 15th to 25th. Spring months cold and backward April and May had low night temperature. June—Frequent thunder-showers, that on 19th accompanied by large hail-stones.
There were forty-one fogs, thirty-four frosts and thirty thunder-storms during the year.

Station, City Hall, Paterson, N. J. Latitude 40° 55′ N.; Longitude 74° 11′ W.
Height of Rain Gauge above Sea Level, 142 feet.

OBSERVER, JOHN T. HILTON, CITY SURVEYOR.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain, (Inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1878.												
July									4.01		10	
August									3.88		9	
September									2.45		7	
October									2.52		7	
November									4.93	1	11	
December									7.80	2	8	
1879.												
January									2.63	16	7	
February				43	9	28			2.32	12.50	10	
March				62	25	39			5.39	4.50	13	
April				70	28	50			3.99		10	
May				84	48	64			3.91		10	
June				88	55	73			3.97		13	
For the Year									47.80	36		

*Including melted snow.

Station, City Hall, Paterson, N. J. Latitude 40° 55′ N.; Longitude 74° 11′ W
Height of Rain Gauge above Sea Level, 142 Feet.

OBSERVER, JOHN T. HILTON, CITY SURVEYOR.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain, (Inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1879.												
July				98	61	76			5.18		11	
August				92	58	71			7.89		9	
September				80	42	63			3.38		8	
October				80	28	60			.32		5	
November				70	17	40			1.15	3.50	7	
December				60	16	34			5.55	7.25	11	
1880.												
January				62	11	36			2.90	3	9	
February				62	5	35			4.16	10.25	12	
March				62	19	37			6.73	14	14	
April				80	30	52			4.31		13	
May				88	92	72			.85		3	
June				97	59	76			2.90		8	
For the Year						52.67			45.32	38		

*Including melted snow.

Station, City Hall, Paterson, N. J. Latitude 40° 55′ N.; Longitude 74° 11′ W.
Height of Rain Gauge above Sea Level, 142 Feet.

OBSERVER, JOHN T. HILTON, CITY SURVEYOR.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (Inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1880.												
July				92	61	79			12.06		13	
August				93	52	74			6.92		10	
September				93	48	68			3.36		6	
October				69	33	53			5.57		9	
November				67	9	40			5.60	3.50	10	
December				47	—6	34			2.41	14	9	
1881.												
January				44	—3	25			7.33	18.25	8	
February				57	—5	26			6.95	10.25	11	
March				84	24	36			16.11	1.50	9	
April				82	24	46			1.74		4	
May				87	35	63			3.69		11	
June				86	49	66			11.74		14	
For the Year						50.31			83.48	48		

*Including melted snow.

Station, City Hall, Paterson, N. J. Latitude 40° 55′ N.; Longitude 74° 11′ W.
Height of Rain Gauge above Sea Level, 142 Feet.

OBSERVER, JOHN T. HILTON, CITY SURVEYOR.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (Inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1881.												
July				92	66	74			2.48		7	
August				95	60	77			1.13		7	
September				98	56	73			1.46		9	
October				84	31	57			2.76		9	
November				68	24	45			4.86	1	11	
December				57	16	37			7.87	.25	15	
1882.												
January				51	—5	30			4.59	24.75	14	
February				52	16	35			5.39	12	11	
March				24	8	38			5.80	.75	10	
April				73	30	45			3 39		11	
May				85	35	56			13.46		16	
June				95	56	66			8.50		10	
For the Year							53		62.69	38.75		

*Including melted snow.

Station, Newark, N. J. Latitude 40° 21′ N.; Longitude 2° 20′ E. Height of Barometer Cistern above Sea Level, 225 feet.

OBSERVER, W. A. WHITEHEAD.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1878.												
July	30.15	29.7	29.9	98.25	61.5	78.25	.....	N. W., S.	4.3	.....	12	10
August	30.19	29.73	29.96	90.5	55	73.09	.....	N. W., S. W.	8.06	.....	10	10
September	30.52	29.85	30.18	88	43.75	67.46	.....	N. E., S. E.	2.53	.....	10	12
October	30.40	29.62	30.01	76.75	35	56.40	.....	N. W., S. W.	2.82	.....	8	6
November	30.58	29.03	29.81	58	27	42.65	.....	N. W., S. W.	4.57	.....	9	9
December	30.50	28.85	29.68	57.75	13.5	31.82	.....	N. W., W.	4.68	.....	7	8
1879.												
January	30.52	29.36	29.94	46.75	—2	25.68	.....	N. W., S. W.	2.89	.....	11	6
February	30.78	29.45	30.11	49.75	10.5	27.68	.....	N. W., S. W.	2.53	.....	16	13
March	30.7	29.37	30.04	63	16 5	38.42	.....	N. W., S. W.	3.75	.....	17	10
April	30.4	29.43	29.91	76.25	24.5	67.96	.....	N. W., S. W.	4.76	.....	10	6
May	30.52	29.8	30.16	88.75	37.75	63.83	.....	N. W., S. W.	2.175	.....	6	5
June	30.3	29.22	29.75	93	48	71.55	.....	S. W., W.	3.04	.....	12	5
For the Year												

*Including melted snow.
1878—Snow on six days, 4.25 inches.
1879, January—Snow on eight days, 17.75 inches, and rain together, 2.89. February—Thirteen days of snow, 13 inches, and rain together, 2.53. March—Four days of snow, 1.25 inches, and rain together, 3.75. April—Snow on five days and rain together, 4.76.

Station, Newark, N. J. Latitude 40° 21′ N.; Longitude 2° 20′ E. Height of Barometer Cistern above Sea Level, 225 feet.

OBSERVER, W. A. WHITEHEAD.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1879.												
July	30.3	29.72	30.01	99.25	58	75.36	.....	N. W., S. W.	5.05	.....	8	7
August	30.2	28.85	29.52	90	54	71.75	.....	W., S. W.	9.12	.....	8	9
September	30.4	29.85	30.12	86.75	38.75	62.45	.....	S. W., W.	3.75	.....	3	4
October	30.7	29.50	30.10	82	26.5	50.36	.....	S. W., N. W.	.82	.....	7	20
November	30.5	29.50	30	71	17	41.76	.....	W., N. W.	1.94	.....	11	10
December	30.7	29.7	30.204	59	11.5	35	.....	S. W., N. W.	5.35	.....		
1880.												
January	30.67	29.71	30.24	60	13.5	37.64	.....	E., N. W.	2.59	.....	7	5
February	30.66	29.612	30.158	62.75	8	35.099	.....	N. W., S. W.	2.83	.....	7	6
March	30.55	29.61	30.127	67	16.5	37.45	.....	N. W., S. W.	4.9	.....	12	8
April	30.4	29.58	30.07	82	26.25	51.75	.....	N. W., S. W.	3.30	.....	12	7
May	30.3	29.71	30.07	96	35	68.38	.....	S. W., N. W.	.76	.....	6	2
June	30.32	29.68	30.07	94.25	49.25	73.69	.....	S. W., N. W.	1.18	.....	7	5
For the Year												

*Including melted snow.
1879, December—Snow on seven days to 7.5 inches.
1880, January had only one measurable snow, 2 inches. February—One day of snow to 6 inches. March—On four days to 10 inches.

Station, Newark, N. J. Latitude 40° 21′ N.; Longitude 2° 20′ E. Height of Barometer Cistern above Sea Level, 225 feet.

OBSERVER, W. A. WHITEHEAD.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1880.												
July	30.25	29.75	30.02	92	56.5	75.31	.....	W., S. W.	7.46	.....	14	5
August	30.44	29.75	30.09	96	50.75	72.25	.....	S., S. W.	4.68	.....	11	10
September	30.35	29.7	30.04	96	47.75	65.95	.....	N. W., S. W.	2.48	.....	6	6
October	30.37	29.54	30.09	76	31.75	52.7	.....	N. W., S. W.	2.1	.....	8	5
November	30.75	29.7	30.27	65	14.25	38.43	.....	N. W., S. W.	2.36	.....	6	6
December	30.5	29.8	30.08	44	—5	26.89	.....	W., N. W.	2.68	.....	9	10
1881.												
January	30.66	29.4	30.17	40.25	—5	24.44	.....	W., N. W.	5.05	.....	6	9
February	30.85	29.45	30.24	51.25	—3	27.94	.....	W., N. W.	4.64	.....	9	5
March	30.58	29.17	29.83	57	21.75	37.27	.....	W., S. W.	6.85	.....	11	9
April	30.31	29.5	29.94	80.75	22	48.53	.....	N. W., S. W.	1.72	.....	5	6
May	30.46	29.51	30.08	92.5	38	64.11	.....	N. E., S. E.	2.91	.....	13	6
June	30.2	29.65	29.42	90	49.5	66.75	.....	N. E., S. E.	5.04	.....	17	15
For the Year												

*Including melted snow.
1880—November had two days of snow, 3 inches.

Station, Newark, N. J. Latitude 40° 21′ N.; Longitude 2° 20′ E. Height of Barometer Cistern above Sea Level, 225 feet.

OBSERVER, W. A. WHITEHEAD.

	BAROMETER. Reduced to 32 degrees			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1881.												
July	30.25	29.65	29.44	93	59.25	75.07	.....	N. W., S. W.	1.34	.....	7	11
August	30.52	29.65	30.02	98	56.5	75.64	.....	E., W.	0.28	.....	5	2
September	30.35	29.9	30.13	100.5	50.75	73.72	.....	N. E., S. E.	0.87	.....	7	6
October	30.58	29.62	30.14	83	33.75	57.93	.....	N. W., S. W.	2.73	.....	17	5
November	30.65	29.63	30.19	68.71	22.25	44.10	.....	N. W., S. W.	3.07	.....	15	7
December	30.63	29.4	30.19	66.5	19.25	39	.....	N. W., S. W.	4.53	.....	10	5
1882.												
January	30.8	29.35	30.18	48	3	28.6	.....	N., N. W., W.	5.80	.....	10	8
February	30.75	29.54	30.19	53.5	11.75	33.61	.....	S. W., N. W.	4.73	.....	9	7
March	30.69	29.65	30.14	60.5	17.75	40.13	.....	N. W., S. W	3.19	.....	10	4
April	30.46	29.55	30.08	72.5	26	46.94	.....	N. W., S. W.	2.01	.....	10	6
May	30.48	29.54	30.05	82.25	34	55.23	.....	N. E., S. E.	5.69	.....	12	5
June	30.27	29.5	30.02	96	49.5	73.78	.....	N. W., W.	2.08	.....	6	7
For the Year												

*Including melted snow.

Station, Agricultural College Farm, New Brunswick, N. J. Latitude, 40° 29′ N.; Longitude, 74° 26′ W. or 2° 37′ E. Height, 115 feet.

OBSERVER, THEODORE WEST.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1878.												
July				93	63	75.2		S. W.	5.13			
August				87	54	70.9		W. S. W.	2.59			
September				86	42	65.2		E. N. E.	2.23			
October				78	35	56.1		W. S. W.	3.15			
November				59	22	41.9		W. N. W.	2.99			
December				60	13	31.4		W. N. W.	4.98			
1879.												
January				45	—8	23.6		W. S. W.	1.58			
February				56	8	25.7		W. N. W.	1.80			
March				66	20	38.6		W. N. W.	4.27			
April				70	27	45.1		W. N. W.	2.71			
May				93	41	61.5		W. S. W.	3.84			
June				95	50	68.3		W. S. W.	4.56			
For the Year				95	—8	50.1			39.83			

* Including melted snow.

1878—Summer warmer than average. July—Very hot month. Rainfall below mean. Autumn moderately warm and rains well distributed. September—Marked by easterly winds.

1878-9—Winter one of the coldest recorded. Steady cold weather, but no very low depressions in temperature. Deficiency in rainfall.

1879—Spring marked by great changes of temperature. Moderate rains throughout the season.

Station, Agricultural College Farm, New Brunswick, N. J. Latitude, 40° 29′ N.; Longitude, 74° 26′ W., or 2° 37′ E. Height, 115 feet.

OBSERVER, THEODORE WEST.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1879.												
July				98	59	73.3		W. S. W.	1.90			
August				91	58	70.6		W. S. W.	7.86			
September				86	43	62.3		W. S. W.	1.80			
October				84	29	58.9		W. S. W.	†			
November				72	14	41.1		W., S. W., S.	1.78			
December				60	9	35.6		W. S. W.	4.14			
1880.												
January				61	5	36.6		W. S. W.	1.92			
February				67	8	34		W. S. W.	1.45			
March				72	19	35.6		N. N. W.	4.80			
April				81	30	47.9		W. S. W.	1.56			
May				98	37	66.2		S. W.	.65			
June				97	49	71.9		W. S. W.	1.47			
For the Year				97	5	52.8			29.33			

* Including melted snow.

† .03 inches at Spader's house, New Brunswick.

1879—Summer, excepting July, average temperature. July—Marked by high maximum and slight rains. August—Large rainfall and rather cool.

Autumn dry and warm. September 7th to November 18th only very light and infrequent rains. A prevalence of southerly winds in November.

1879-80—Winter warmest recorded here. No extremely low temperature. Rainfall much below mean amount. No sleighing snows. No sudden changes. Winds, W. S. W. and N. E., former prevailing.

1880—Spring very dry. Drought in May, but one rain (30th), and month with extremely high temperature.

Station, Agricultural College Farm, New Brunswick, N. J. Latitude, 40° 29′ N.; Longitude, 74° 26′ W., or 2° 37′ E. Height, 115 feet.

OBSERVER, THEODORE WEST.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1880.												
July				95	61	76.8		S. S. W.	7.39			
August				90	59	73.0		S. S. W.	4.08			
September				89	47	65.0		S. W.	1.86			
October				79	33	51.9		W. S. W.	1.93			
November				63	11	36.7		W. S. W.	2.08			
December				47	—8	26.0		W. N. W.	2.46			
1881.												
January				45	—7	22.7		W.	7.35			
February				53	—1	36.7		W. N. W.	4.37			
March				58	23	34.4		W. S. W.	4.51			
April				75	21	43.4		W.	.43			
May				90	42	62.7		N. E., S. W.	2.53			
June				88	50	64.7		N. E., S. W.	5.94			
For the Year				95	—8	48.6			44.93			

* Including melted snow.

1880—Spring hot and dry. May—Characterized by Summer temperature, followed by Summer, which was warm. June—Had long-continued heat-periods, and drought continued into July. Months of July and August had frequent rains and no excessive heat. Autumn dry and cool.

1880-1—Winter began in November, and continued 153 days, of average temperature of 29.28° (November 22d, 1880, to April 23d, 1881.) The season was unusually steady and cold. Heavy snowfalls. Good sleighing for six weeks. Winter marked also by absence of sudden excessive changes.

1881—Spring cold through March and April. Light rains. May had wide range of temperature. June was delightful and low range. Rains frequent but not excessive. N. E. winds frequent in May.

Station, Agricultural College Farm, New Brunswick, N. J. Latitude, 40° 29′ N.; Longitude, 74° 26′ W., or 2° 37′ E. Height, 115 feet.

OBSERVER, THEODORE WEST.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1881.												
July				90	60	71.7		W. S. W.	.86			
August				99	60	72.1		W. S. W.	1.73			
September				103	59	72.4		S. S. W.	.94			
October				89	35	58.5		W. S. W.	2.25			
November				69	20	44.1		W.	3.13			
December				61	19	39.8		W. S. W.	3.92			
1882.												
January				48	—3	29.5		W. S. W.	5.49			
February				55	15	35.5		W. S. W.	4.24			
March				59	23	38.9		W. S. W.	2.62			
April				76	27	44.3		W. S. W.	2.83			
May				83	35	51.7		N. E., W.	5.29			
June				95	54	67.8		W. S. W.	1.48			
For the Year				103	—3	51.88			34.78			

* Including melted snow. Rainfall from records of P. V. Spader, Esq.

1881—Autumn was noted for its long and severe drought.

1881-2—Winter was remarkable for its mildness. Only one cold period, January 24th, when a temperature of —3 was observed. Rainfall in excess of average.

1882—Spring cold and backward. Frequent rains. Summer marked by warm waves. Mean temperature below average.

Station, Freehold, N. J. Latitude 40° 15′ N.; Longitude 74° 16′ W. Height of Barometer Cistern above Sea Level, 216 feet.

OBSERVER, CHAS. F. RICHARDSON.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.	Thunder and Lightning on days.
	Max.	Min.	Mean.	Max.	Min.	Mean.							
1878.													
July	29.94	29.40	29.72	95	59.5	75.60	77.5	W.	5.63	.....	12	6	8
August	29.91	29.41	29.66	86	53.5	71.30	83.2	W.	6.72	.....	16	7	6
September	30.19	29.45	29.87	85	43.5	65.65	82.6	W.	3.03	.....	13	10	5
October	30.05	29.23	29.76	76	32.5	55.41	74.9	N. W.	2.39	.....	9	5	2
November	30.25	28.78	29.71	59	25.4	43	78.6	W.	3.13	.....	14	7	1
December	30.21	29.57	29.72	59	12	31.11	75.8	W.	6.61	3.97	16	4	1
1879.													
January	30.22	29.23	29.76	49	—3	25.53	74	W.	2.63	13.5	12	7	....
February	30.47	29.18	29.78	54	8	36 77	72.8	W.	3.12	8.7	19	8	....
March	30.40	29.07	29.83	65	17	38.01	77.7	W.	3.55	.5	23	8	3
April	30.09	29.12	29.65	73	23	45.42	74.9	W.	4.47	.4	14	13	3
May	30 23	29.48	29.81	92	36	61.90	76	S.	2.43	.....	9	5	6
June	30.01	29.26	29.71	94	46	70.13	77.7	W.	4.72	.....	13	4	11
For the Year	.....	.....	29.74	.....	.....	50.74	77	.....	48.43	27.07	157	84	48

*Including melted snow.
1879, June—2 frosts. May—6 frosts. April—8 frosts.

Station, Freehold, N. J. Latitude 40° 15′ N.; Longitude 74° 16′ W. Height of Barometer Cistern above Sea Level, 216 feet.

OBSERVER, CHAS. F. RICHARDSON.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.	Thunder and Lightning on days.
	Max.	Min.	Mean.	Max.	Min.	Mean.							
1879.													
July	30.01	29.31	29.72	97	56	73.8	78.3	W.	5.45	.....	10	6	10
August	29.90	29.44	29.70	93	51	70.8	83.4	W.	9.58	.....	10	10	5
September	30.17	29.53	29.89	85	37	61.4	80.2	W.	1.86	.....	8	2	6
October	30.50	29.33	29.92	83	25	58.5	79.6	W.	.68	.....	9	3	2
November	30.31	29.26	29.93	72	16	41.5	74.2	W.	1.71	1.85	7	7	1
December	30.41	29.53	29.97	60	8	36.7	80.3	N. W.	6.77	4.75	12	14	....
1880.													
January	30.45	29.54	30	59	11	38.2	81.4	W.	2.06	4	11	8	1
February	30.37	29.24	29.95	67	9	34.8	76.1	W.	2.69	9.70	11	7	....
March	30.23	29.41	29.92	69	16	36.9	74.2	N. W.	5.71	15.40	16	11	....
April	30.11	29.50	29.84	82	23	49.7	67.5	N. W.	2.91	.....	12	8	7
May	30.05	29.57	29.82	95	32	68	69.2	W.	.82	.....	6	4	5
June	30	29.47	29.76	94	49	72	71.6	W.	1.58	.....	7	4	8
For the Year	.....	.....	29.88	.....	.....	53.5	76.3	.....	41.84	35.70	119	84	45

*Including melted snow.
1879, September—2 frosts. October—4 frosts. November—17 frosts. 1880, April—6 frosts. May—2 frosts.

Station, Freehold, N. J. Latitude 40° 15′ N.; Longitude 74° 16′ W. Height of Barometer Cistern above Sea Level, 216 feet.

OBSERVER, CHAS. F. RICHARDSON.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.	Thunder and Lightning on days.
	Max.	Min.	Mean.	Max.	Min.	Mean.							
1880.													
July	29.91	29.53	29.75	90	54	73.9	78.7	N. W.	8.57	.....	15	5	13
August	30.14	29.32	29.83	89	50	74.3	81	S.	4.17	.....	9	9	9
September	30.17	29.48	29.84	88	46	65.2	79.6	W.	2.87	.....	8	4	3
October	30.15	29.31	29.88	79	31	51.1	77	N. W.	2.61	.....	11	6	1
November	30.45	29.49	30	65	9	37	72.6	W.	3.44	4.3	10	7	1
December	30.19	29.42	29.79	49	—11	25.5	73.2	N. W.	6.58	51.2	12	10	....
1881.													
January	30.36	29.19	29.91	41	—7	22.5	75.3	W.	7.85	9.8	12	10	....
February	30.53	29.25	29.95	53	—6	27.3	80.1	N. W.	6.33	11.4	12	10	1
March	30.12	28.97	29.55	59	21	36.3	75.6	N. W.	7.14	3	11	13	1
April	30.09	29.27	29.67	76	21	44.9	70.6	W. N. W.	1.07	.....	5	8	1
May	30.21	29.43	29.82	91	35	60.1	80.7	S. E.	2.78	.....	13	9	7
June	29.93	29.44	29.79	90	47	64.5	81.3	W. N. W.	7.78	.....	16	9	9
For the Year	.....	.....	29.81	.....	.....	48.5	77.1	.....	61.49	79.7	132	100	46

*Including melted snow.
1880, October—11 frosts. November—19 frosts.

Station, Freehold, N. J. Latitude 40° 15′ N.; Longitude 74° 16′ W. Height of Barometer Cistern above Sea Level, 216 feet.

OBSERVER, CHAS. F. RICHARDSON.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.	Thunder and Lightning on days.
	Max.	Min.	Mean.	Max.	Min.	Mean.							
1881.													
July	30	29.42	29.71	90.2	56	73.5	75.7	W.	.70	.....	7	4	6
August	30.08	29.44	29.79	96	54	72.3	78.7	S. W.	3.13	.....	7	4	8
September	30.13	29.64	29.86	102	46	71.5	80.6	S. S. W.	2.65	.....	8	9	6
October	30.29	29.29	29.90	85	30	57.5	79.8	W.	3.45	.....	12	9	3
November	30.39	29.42	29.93	69	20	44.4	79	W.	3.55	.....	12	11	....
December	30.31	29.22	29.89	68	17	38.8	82.4	W.	3.87	25	16	13	....
1882.													
January	30.51	29.14	29.94	48	—3	29.2	75.2	W.	5.42	8.44	19	13	....
February	30.43	29.24	29.89	56	17	33.7	75.8	W. N. W.	5.17	14.5	13	8	1
March	30.33	29.24	29.87	61	16	30.5	70.9	N. W.	2.82	2.5	12	9	1
April	30.28	29.24	29.82	75	24.5	45.6	68.5	W.	2.40	.3	15	9	3
May	30.19	29.28	29.81	82	30	53.8	75.1	W.	4.51	.....	13	10	1
June	30.02	29.38	29.70	94	46.5	69.5	70	S. W.	3.44	.....	12	1	8
For the Year	.....	.....	29.84	.....	.....	51.7	75.9	.....	41.11	50.74	144	100	37

*Including melted snow.
1881, October—3 frosts. November—13 frosts. 1882, March—18 frosts. April—7 frosts. May—2 frosts.

Station, Vineland, N. J. Latitude 39° 39′ N.; Longitude 75° .01′ E. Height of Barometer Cistern above Sea Level, 111 feet.

OBSERVER, J. INGRAM, M. D.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.
	Max.	Min.	Mean.	Max.	Min.	Mean.					
1878.											
July	29.98	29.48	29.79	96	66	77.9	80	S. W., S. E.	6.42	.....	8
August	30.02	29.55	29.78	92	57	73.2	82	S. W., N. E.	8.46	.....	10
September	30.29	29.52	29.99	86	43	68	80	S. W., N. E.	.69	.....	5
October	30.14	29.02	29.89	78	33	56.2	76	S. W., N. W.	2.18	.....	7
November	30.32	28.82	29.81	61	23	42.9	79	N. W., S. W.	2.85	.....	7
December	30.31	28.66	29.83	60	9	31.7	67	N. W., S. W.	5.69	1.75	9
1879.											
January	30.36	29.29	29.90	63	−4	28.9	68	S. W., N. W.	3.75	5	6
February	30.60	29.31	29.89	58	7	29.6	71	N. W., S. W.	2.38	5.75	6
March	31.51	29.29	29.96	68	18	41	82	N. E., S. W.	3.36	.....	10
April	30.24	29.30	29.76	83	30	48.3	80	N. W., S. W.	3.47	.....	9
May	30.29	29.67	29.91	92	46	63.4	74	S. W., N. W.	.77	.....	4
June	30.09	29.36	29.83	94	44	75.3	78	S. W., N. W.	4.91	.....	9
For the Year	30.26	29.27	29.89	77	−3	52.9	76	.....	45.1	11.50	90

*Including melted snow.

Station, Vineland, N. J. Latitude 39° 29′ N.; Longitude 75° .01′ E. Height of Barometer Cistern above Sea Level, 111 feet.

OBSERVER, J. INGRAM, M. D.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1880.												
July	30.02	29.56	29.84	98	56	76.45	73	S. W., N. W.	8.64	.....	8	....
August	30.23	29.59	29.51	90	50	73.03	77	S. W., N. E.	6.64	.....	8	....
September	30.16	29.59	29.90	92	44	66.83	80	S. W., N. W.	2.94	.....	5	....
October	30.27	29.42	29.97	80	30	64.11	71	N. W., N. E.	2.75	.....	9	....
November	30.59	29.50	30.08	67	9	38.22	63	S. W., N. W.	4.44	4.50	9	....
December	30.33	29.53	29.91	50	−10	26.23	56	N. W., S. W.	7.53	39	10	....
1881.												
January	30.49	29.16	30	46	−10½	25.31	61	N. W., S. W.	6.81	9.50	10	....
February	30.60	29.31	29.92	58	−5	29.96	61	N. W., S. W.	5.61	14	9	....
March	30.07	28.88	29.53	63	22	28.86	76	N. W., S. W.	5.28	.....	9	....
April	30.07	29.31	29.75	88	26	27.38	69	S. W., N. W.	1.30	.....	5	....
May	30.25	29.49	29.75	94	44	64.36	72	S. W., N. E.	3.50	.....	10	....
June	29.98	29.52	29.74	94	54	69.74	79	S. W., N. W.	4.57	.....	11	....
For the Year	.....	.....	29.84	.....	.....	50.86	72	.....	59.99	67	103	....

*Including melted snow.

Station, Vineland, N. J. Latitude 39° 39′ N.; Longitude 75° .01′ E. Height of Barometer Cistern above Sea Level, 111 feet.

OBSERVER, J. INGRAM, M. D.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.
	Max.	Min.	Mean.	Max.	Min.	Mean.					
1879.											
July	30.10	29.40	29.82	97	46	75.3	73	S. W., S.	3.04	.....	7
August	30.06	29.53	29.79	94	49	73.2	77	S. W., N. E.	10.6	.....	10
September	30.29	29.62	29.96	91	38	65.5	75	N. W., S. W.	3.4	.....	7
October	30.59	29.38	29.99	92	28	63.8	76	S. W., N. W.	1.10	.....	7
November	30.41	29.38	29.98	80	18	48.1	74	N. W., S. W.	2.80	4.50	7
December	30.45	29.54	30.01	70	12	41.7	72	S. W., N. W.	6.27	15	12
1880.											
January	30.45	29.52	30.04	61	10	41.3	71	N. W., S. W.	2.82	5	12
February	30.39	29.01	29.97	69	12	29.1	60	S. W., N. W.	2.26	1.75	7
March	30.31	29.14	29.86	74	20	40.9	69	N. W., N. E.	6.35	.....	13
April	30.16	29.41	29.81	82	32	53.1	65	N. W., S. W.	2.61	.....	12
May	30.09	29.61	29.87	96	34	69.2	63	N. W., S. E.	2	.....	5
June	30.11	29.53	29.84	97	52	74.7	69	S. W., N. W.	3.05	.....	6
For the Year	.....	.....	29.91	.....	.....	56.07	73	.....	47	26.25	105

*Including melted snow.

Station, Vineland, N. J. Latitude 39° 29′ N.; Longitude 75° .01′ E. Height of Barometer Cistern above Sea Level, 111 feet.

OBSERVER, J. INGRAM, M. D.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1881.												
July	30.04	29.52	29.78	97	60	77.90	68	S. W., N. W.	2.96	.....	6	....
August	30.17	29.54	29.90	100	58	76.44	62	S. W., N.	.65	.....	4	....
September	30.16	29.71	29.94	194	58	76.76	63	S. W., N. W.	2.35	.....	4	....
October	30.37	29.47	30.03	92	50	61.72	61	S. W., N. W.	3.13	.....	8	....
November	30.54	29.59	30.07	78	24	48.56	68	N. W., S. W.	3.05	.....	9	....
December	30.46	29.36	30.05	68	18	41.98	62	S. W., N. W.	3.04	.....	10	....
1882.												
January	30.67	29.06	30.06	63	.....	34.63	65	N. W., S. W.	6.45	11	15	....
February	30.66	29.33	30.02	60	18	38.06	66	N. W., S. W.	5.41	12	8	....
March	30.51	29.45	29.97	62	21	41.46	61	N. W., S. W.	4.31	3	12	....
April	30.35	29.31	29.81	80	26	48.25	69	S. W.	2.19	.....	9	....
May	30.27	29.37	29.86	86	32	56.70	73	S. W., N. E.	5.49	.....	10	....
June	30.08	29.43	29.79	96	50	71.68	67	S. W., N. W.	1.36	.....	4	....
For the Year	.....	.....	29.94	.....	.....	56.17	.....	.....	40.59	26	99	....

*Including melted snow.

Station, Middletown, N. J. Latitude ° ′ N.; Longitude ° ′ E. Height of Barometer Cistern above Sea Level, feet.

OBSERVER, FRANK OSBORN.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1879.												
July				96	55	73.23						
August				92	53	71.09						
September				88	42	64.15						
October				92	27	61.56						
November				78	13	44.31						
December				73	6	37.56						
1880.												
January				69	12	40.64						
February				75	7	35.57						
March				71	13	37.91						
April				86	22	50.04						
May				99	31	67.06						
June				97	48	72.33						
For the Year												

*Including melted snow.

Station, Middletown, N. J. Latitude ° ′ N.; Longitude ° ′ E. Height of Barometer Cistern above Sea Level, feet.

OBSERVER, FRANK OSBORN.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1880.												
July				92	56	74.98						
August				93	52	72.67						
September				98	48	68.31						
October				81	30	55.12						
November				68	9	38.95						
December				51	—11	27.37						
1881.												
January				50	—3	25.09						
February				54	—6	28.44						
March				63	18	37.21						
April				83	17	46.95						
May				96	38	61.17						
June				88	41	64.34						
For the Year												

*Including melted snow.

Station, Middletown, N. J. Latitude ° ′ N.; Longitude ° ′ E. Height of Barometer Cistern above Sea Level, feet.

OBSERVER, FRANK OSBORN.

	BAROMETER. Reduced to 32 degrees.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches.)*	Snow.	Days when precipitation equaled 0.01.	Cloudy days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1881.												
July				91	58	73.79						
August				99	56	74						
September				107	52	73.66						
October				89	32	58.22						
November				72	20	46.30						
December				70	—5	39.98						
1882.												
January				53	—5	28.56						
February				69	14	35.93						
March				70	15	41.34						
April				76	29	45.63						
May				79	29	53.14						
June				93	47	66.76						
For the Year												

*Including melted snow.

The full tables for Barnegat, Cape May and Sandy Hook, for five years, will be in the next report.

SYNOPSIS OF VITAL RETURNS.

The records of the statistical year ending July 1st, 1882, as given in the tables accompanying this report, show an aggregate of 59,287 returns, of which 8837 are marriages, 23,108 births, and 25,942 deaths. For the former year the returns were 8109 marriages, 23,484 births, and 20,812 deaths. The record is subject to some variations from supplementary returns too late for the annual record. Still births are included in the total, but not included in the returns of death. These for last year were 1476, and 1400 for 1881–2.

It will be seen that the chief variation is caused by an increase in the number of deaths. As next year will complete a quinquennial period, we shall reserve more extended tables and analyses of all returns for five years for the next report, and confine our chief present attention to an inquiry into the causes of this great increase in the returns of deaths, and our examination of the localities which are chiefly responsible for this aggregate. An increase of over 5000 deaths in a single year, may well attract our attention to an inquiry into the significance of the various influences which have aided to make this increase, and especially into such as admit of limitation.

Some consideration must undoubtedly be given to those climatic influences which do not admit of alteration, but as to which we need to learn the laws of adjustment and so practically protect ourselves from the disturbing or critical effects.

The summer of 1881, to which the first part of the record relates, had been preceded by a winter of remarkable length and of severe and steady cold. Such a winter is always depressing to such aged persons as are not in good health, and to that large class of children who suffer from inadequate provision in food, clothing or shelter. A comparison of the deaths from acute lung diseases and from consumption shows an increased record over both of the two preceeding years, which was quite evenly distributed through the various counties. This severe winter continued until late in the spring, was succeeded by the high temperature and severe drought of the summer

of 1881. The drought so continued until October as to make scarcity of water almost to the time of winter freezing. The effect of this prolonged heat and dryness is not slow to make its record in diarrheal or intestinal diseases and fevers and especially upon the younger population. If this were the whole of the story, we would need only to record the accident, and, as not having control of the weather, submit to it, with grief over an unalterable dispensation. But when we see how different are the effects of these climatic conditions on different townships and counties, on rural districts as compared with cities, and on different populations, and, as we know from other sources, on different parts of the same city, we find that disease and death derive their ratios to life not so much from these changes as they do from that local pollution which poisons an arrow otherwise not deadly, and from that artificial susceptibility which makes many a life a plant that withers in the sunshine which gives growth and vigor to the same species living on a proper soil. Thus if we look at this increase of over 5000 deaths, we at once perceive that 1357 of the increase was in Hudson county and 1258 in Essex county, making in these two counties about half of the total increase, their population being about one-third of that of the whole State.

Hudson county is so much a county of cities that the county death-rate represents a close population. In Jersey City especially the death-rate among children has been very high. Nine hundred and eight children died under one year of age, being an increase of 220 over the former year. Between one and five years there was an increase of 251. It is scarcely necessary to emphasize the insanitary condition of much of Hudson county, but when able to compare its cities and those townships which either contain the dependent or criminal population of the city or have special nuisances, with the two or three more rural townships, it is easy to see that the death rate is owing to artificial causes. The appended analysis by C. J. Rooney, Jr., the efficient Registrar of the county Board, is not only a valuable local outline, but a warning to those portions of the State that have not yet allowed sanitary problems to become too complicated for ready solution.

LETTER OF C. J. ROONEY, JR.

"DEAR SIR—In accordance with your request, I beg leave to present the following brief report of the vital statistics of Hudson county during the year July 1st, 1881, to June 30th, 1882.

"During the above-mentioned period Hudson county suffered the high death rate of 29.5 to 30 per 1000 persons living; the rate varying somewhat according to different estimates of the present population.

"The total deaths were 5862; and the greatest number prior to this report was 5233, in 1881, and before that, 4513, in 1876.

"Assuming the lower rate (29.5) to be correct, it is an unusually high one for this county; the highest, in fact, experienced since the records were begun in 1874.

"The average rate for the seven years ending December 31st, 1881, (records of Hudson county Board of Health,) was 23.9. Thus, it may be seen that the rate for the year ending June 30th, 1882, was 5.6 per 1000 above the average for seven years. The mortality of the year 1881 approached nearest to this, the rate being 27 per 1000; and, previous to that, the rate of the year 1876, 26.8, was highest.

"The death rates from 1874 to 1881 inclusive, have varied from 20.9 to 27. This will help to a comprehension of the meaning of the present rate.

"The larger part of the increase of the rate took place in the latter half of the year, January to July, 1882; that is to say, the rate of each month from January to July, 1882, as compared with the same months of previous years, showed a greater increase above the average than the months from July to December, 1881, did above the average for the same period of former years. Each month sustained a rate above the average for the same month for five preceding years of from 3.5 to 9.6 per 1000, the greatest increase being in January 1882, and the next greatest in December, 1881. July, 1881, and January, 1882, with rates of 36 and 33.8, making these respectively the most lethal months of the period.

"The greater part of the increase of mortality took place among persons over five years old. The rate for children under five years old was 13.7; that of persons over five years of age was 15.8.

"According to Hudson county Health Board records, the average for children under five for seven years ending December, 1881, was 11.7; hence, that of the period at present under consideration was 2 per 1000 above the average for this class of decedents.

"According to the same authority, the average rate of death of persons over five years old for seven years ending 1881, was 12.1; so that this year's rate for this class of deaths was 3.7 above the average.

"Upon examining into the causes of the increased mortality, the following named diseases are found to have been the chief factors:

Consumption, small-pox, pneumonia, croup, scarlet fever, diphtheria typhoid and typho-malarial fevers, measles, bronchitis and meningitis. Of these, small-pox, consumption, pneumonia and bronchitis were most notable.

"The rate of death from consumption was 3.3 per 1000, as compared with a seven-year average of 2.6. It was most prominent in October, 1881, January, March and May, 1882.

"Pneumonia, in January, March, April, May and June, 1882, showed the greatest increase when compared with the same disease in the same months of other years.

"Scarlet fever, from December, 1881, to June, 1882, and typhoid fevers, in October, November, December, 1881, March and April, 1882, were most fatal when contrasted with other years.

"If I may anticipate next year's report, I will say that since July, 1882, to time of present writing (December 1st, 1882,) there have not been any deaths from small-pox and no cases are known, none having been reported for some months. The system of general and school vaccination carried on by this Board, assisted by a corps of physicians who generously gave their services to the county without charge, seems to have checked and exterminated the disease.

"The number of births reported was 3207, of marriages, 1504, and of still births, 311. This is a poor showing for the promptness and fidelity of the physicians in complying with the requirements of law as to reporting births.

"The clergymen and justices have done better than ever before.

"I will again anticipate by saying that, at the direction of this Board, I have sent postal notices to all who were delinquent or not prompt in the matter of returning, and the resulting responses would seem to indicate that not only will return be made in future, by all upon whom the duty of reporting devolves, but that the returning will be characterized by promptness, and that the legal limit of thirty days' grace will not be overstepped.

"In looking over the record of mortality by cities and towns, it may be seen that the death rate in Jersey City, Hoboken, Bayonne, (cities,) Harrison, (town,) West Hoboken, Guttenberg, Kearny and Union, (townships,) fell more or less *below* the mean county rate. In the cases of town of Union, North Bergen and Weehawken townships the rate rose considerably above the mean county rate. In the cases of all these places, the rates are higher than for the other yearly rates in the table, with the exception that the rates for Hoboken and

Kearny were lower than for 1881. The high rate of North Bergen township resulted from the outbreak of typho-malarial fever in the winter and spring months of 1882 in the almshouse, and from the fact that so many of the county institutions, having usually a very high death rate, are located here. The small-pox hospital is situated in this township.

"The table here appended shows the area and population of the different 4340 districts and is valuable for reference.

Names of Cities, &c.	Population. Census 1880.	Area in Acres.	Sq. Miles.
Jersey City	120,728	8,000	12.50
Hoboken City	30,999	720	1.12
Bayonne City	9,372	2,500	3.90
Town of Harrison	5,510	760	1.20
Town of Union	5,849	275	.43
Town of Guttenberg	1,206	.....	.....
Township West Hoboken	5,441	520	.81
Township North Bergen	4,268	6,800	10.62
Township Kearny	2,165	6,400	10
Township Union*	1,310	835	1.30
Township Weehawken	1,102	400	.62

*This township divided (1878) into Guttenberg, (town,) and Union township."

The increase of 1258 deaths in Essex county depends chiefly on an increase of 1028 in the city of Newark. While the death rate under one is large, the rate between one and five is especially indicative of some local conditions which affect this portion of the growing population.

For the State at large, the increase of deaths under one year has been 1305; for from one to five years, 1590; from five to twenty years, 810; from twenty to sixty, 762, and over sixty, 476.

The loss of about 2300 children more under five years and the comparatively less number that reach an age beyond sixty years, are related facts. The causes that destroy the infant population tell on those who still live, and a county with a high child death rate always finds that in older life there is limit of age and limit of power.

It is not needful, in this synopsis, to follow out all the comparisons that can be made between different localities and different cities or between the ages and the diseases which destroy so many lives. But all through these tables, the vital statistician and the sanitarian will not fail to perceive indications or to get on the trail of inquiries which are informatory and most helpful in guiding to the necessity of more intelligent health administration. It is hoped, the next year, to give some comparative sketches of statistics over a period of time and relating to an amount of population which eliminates many limited or accidental or temporary influences. We only draw attention to these in order that physicians and sanitarians may be aiding in these inquiries. The tables in connection with this report show in detail the deaths by townships, by cities and by counties, and then of cities as compared with counties, and of cities, counties and the State in their relative significance. A further comparison of ages and of diseases gives still more specific character to these comparisons and the information to be derived therefrom. It is never wise to attach too much importance to a limited or varying death rate which represents less than 10,000 persons, and even this needs to be connected by comparisons by the hundred thousand and by that of the same population in succeeding years.

It is because of the little value of isolated observations over small fields, conducted without symmetry of method, and of the great value of the analyses of assemblages of facts which admit of practical study, that it is so important to gather all the facts in one place and to put them in such form and order as to admit of study and life-saving deduction. Besides the actual work done, it thus becomes possible, at any future time, that provision may be made therefor to derive information on many points of vital and social interest, on which investigation may be deemed desirable.

It is noticeable that, in the last statistical year, the two northern counties of Sussex and Warren had an increase of disease not in accord with their usual experience. Most of the townships show a higher death rate, but the increase has been chiefly owing to localities.

Newton more than doubled its death rate, owing both to typhoid and scarlet fevers and a general increase of disease, which betokens some defects in administration, certainly not in location. Hardyston has suffered much from an epidemic of scarlet fever and from increase in other respects, which tripled the death rate of the former year.

In Warren county, Phillipsburg shows an increase of 35 deaths,

which gives a much increased death rate. Washington township and borough, Hackettstown, Oxford, Harmony and Knowlton nearly doubled their death rates. Although the population of these localities is not compact, it has, in some of them, come our to knowledge that endemics are not properly dealt with by local Boards and that local nuisances exist. Our summary of local reports will give illustration of the different results attending a dilatory and a prompt dealing with such diseases as small-pox, diphtheria, scarlet fever, etc., as well as with general insanitary conditions that tend to foster disease.

For various other particulars and comparisons for various localities, we refer to the tables herewith furnished.

COMMENTS ON SPECIAL DISEASES.

Remittent Fever. This is a disease so rarely fatal and stands for so much in the way of malarial influence that, by numbers, it indicates a larger proportion of sickness and of suspension from labor than any other one disease. The record shows a decrease of about 50 deaths. An examination of localities indicates that, in the northern and middle portions of the State, there has been a very marked decrease, while in some of the southern counties, malaria has been more prevalent. Portions of Burlington, Camden, Cumberland and Ocean counties have suffered much. So long as undrained lands are made worse by obstruction of water-courses, by the building of cities without any preparatory drainage and by various other devices for combining heat, moisture and decaying vegetation, we shall not fail to secure materials which ever and anon will fill the inbreathed air and cause some form of periodic fever. Not only will such places suffer, but occasionally the winds or other favoring conditions will extend the miasm to localities which have good local conditions, and so the people at large come to have an interest in the abatement of such evils to the public health. Our laws, now, well provide for drainage wherever the public sentiment of the people demands it. The interests, both of agriculture and health, are largely promoted thereby. It is encouraging to find that citizens in affected localities are more and more recognizing the relations of saturated soils to malaria, and more care is taken as to ponds and stagnant water. But all this will not avail, until, in certain parts of the State, more extended drainage is conducted under the provisions of the State law.

Typhoid Fever. We have had occasion, in a separate article, to notice three outbreaks of fever, regarded as typhoid and especially connected with foul cesspools. Our reports from time to time give additional instances where one family suffers, or some one part of a city. These cases of local outbreak seldom fail to reveal on the premises a foul cesspool or a contamination of drinking-water, which seems to explain the occasion of the sickness.

The deaths from typhoid fever for the year were 884, as against a record of 499 in the previous year. Cumberland, Essex, Hudson and Passaic show the largest increase, but the gradual advance of the disease in the State must not escape public attention. It is not like malaria or diffused miasm, but a nosocomal or people and house-manufactured disease. Five hundred and twenty-seven of the cases occurred in cities, 310 being the record of the previous year. The most prominent advance was in Jersey city, Newark, Paterson, Camden and Hoboken. One cannot look over the statistical record of the last four years, making due allowance for certain local and institutional death rates, without being convinced that the uniform progress of this disease needs the most careful attention of local authorities. It counts its victims, not among the old—as its occurrence is very rare in those past fifty years of age—children over five and youths and men and women in young and middle life are its victims, while every case of death indicates numbers who have lived after long weeks of suspended labor and often with permanent impairment of vital power. While the question is fairly before the medical profession whether we have not mongrel forms of household and city fever, which differ somewhat from the abdominal typhus or typhoid and yet are fevers of putridity, it is not an open question whether these diseases are not, in their inception, due to the accumulated filth made incident to animal life, or to infiltration of the poison derived from persons who have contracted the disease. It is one of those diseases which are preventible, but can only be prevented by a knowledge of sanitary laws and by their enforcement.

Small-pox. Small-pox presents a record of 367 deaths, as against that of the year previous of 254 and of 15 for the year from July 1st, 1879, to July 1st, 1880. Our record for this year does not include the summer and fall epidemic at Paterson, which was mostly after July 1st. Although there has been this increase—an increase which proper and timely vaccination would wholly have prevented—yet we

are glad to know that the State oversight of the public health has in it been shown to be of very great advantage. Never, since the adoption of vaccination, has the county at large experienced such a wide-spread small-pox epidemic. New Jersey, as a centre of railroad communication and as exposed to all the risks of immigrant transfer, has had to contend with a great many local outbreaks. Our experience at Camden, the year before, led this Board to put itself in active communication with local Boards of Health, to insist upon early isolation and extended vaccination, and thus enable the local authorities to forestall any great extension of the disease. The law as to school vaccination, passed March 11th, 1880, was very effective as an aid, and school boards availed themselves of its provisions. Much space could be occupied in illustrating by local cases the promptness and efficiency of these Boards, with here and there an equally forcible instance of inadequate power or of a failure to follow the outline of prevention indicated. The summary from the local reports of this year, as given in this report, has some suggestive instances. Physicians as well as the laity have carefully availed themselves of the instructions which have been disseminated by our circulars and by correspondence. The importance of a proper vaccination and the troubles arising from a too disseminated production of lymph have been such as to lead the Board in this report to furnish valuable information from several acknowledged authorities. While the Board does not deem it advisable to ask for the authorization of a State vaccine farm, it does believe that it is not invidious for it to inspect or authenticate the sources from which the lymph is to be derived and to help to protect the people from those risks which have been incurred. Yet, it is to be remembered that so wide-spread a demand is not likely soon again to recur and that the lessons learned are such as almost to assure safe sources of supply. We believe now that every careful physician, who either obtains his supply directly from the producer or cultivates it in human remove, can be as certain as to its purity as he is as to the reliability of any medicine he is called upon to furnish.

Scarlet Fever. Scarlet fever had a marked increase during the winter of 1881–2 and the spring of 1882. The record for the year is 1306 deaths as in contrast with 499 of the previous year and 573 of the year before that. Of this, the greatest excess occurred in Essex, Hudson, Morris, Passaic, Sussex and Warren counties. Eight hundred and twenty-one of the whole number occurred in cities of

over 5000 inhabitants. Two hundred and sixty-eight of the excess of Essex was in Newark; 81 of that of Hudson, in Jersey City; 90 of that of Passaic, in Paterson, while that of Morris, Sussex and Warren counties was mostly in townships.

We are not as familiar with the circumstances which favor the origin of scarlet fever as with those of some other diseases. Yet, as it is more contagious and more fatal when it occurs in ill-kept houses or in close and low districts, we have much control over its spread and virulence. It is a disease easy to limit in its extension if all clothing on the person or in the room of the patient is thoroughly aired, if the skin is well oiled and bathed before mingling with others, and if proper isolation is practiced. We can point to local Boards of Health and to physicians who almost invariably prevent a spread of the disease from one house to another, and often prevent new cases in the same house. It is, we think, spread more by the public schools than in any other way. Children are returned too soon or without proper preparation, to the schools, or pupils attend from the same house during the sickness in it.

Whenever a case of small-pox, scarlet fever, measles or diphtheria occurs in a family, in some way, either the head of the family or the physician should be made responsible that every child from that family (and, often, it must apply to the house) should be prohibited from attendance at school or from mingling with others without a permit. How this shall be accomplished is a matter admitting of discussion more full than can be attempted here. But as to it, we think the following suggestions may be borne in mind:

1. As it is a matter of great public concern and seriously involving human life, it cannot be safely left to the opinions of individuals, but must be regulated by some form of law.

2. Such law, while careful to be as lenient as it ought to be and tolerant of the opinions of others, must rest on the grounds of necessity and social expediency. The law and the courts and the public have their rights of protection from a common carrier of contagion. The judgment of these as expressed in law is even more sacred than the right of private judgment, because it is fully as likely to be based on an unprejudiced view of what the public safety requires.

3. We believe such laws should be flexible to this extent, that the case being properly reported to the proper officer, the physician or head of family may, in some instances, be allowed to agree to take the responsibility of proper isolation and protection. The proper method,

both of regulative law and of securing a correct sentiment among physicians, Health Boards, School Boards and the people, will be discussed more fully at another time.

As scarlet fever is a disease so often fatal, and as it is not apt to be contracted by adults, except where there is some special concentration of the poison, the methods of limiting the disease, both by isolation of the patient and dilution of the poison should be sedulously enforced.

The contagion is not very diffusive. Experiments in hospitals and close observation in single cases seem to show that the disease is very rarely contracted beyond five feet from the patient, if none of the unaired garments or bed-clothing or secretions do not come any nearer than this to others. So if cleanliness of the person and of the room and of the attendant is secured, it is not a very communicable disease. As with it there is much separation of particles from the outside skin, whether of secretion or the epithelial layer itself, oiling and washing, as with a little warm borax-water, are quite efficient in preventing the conveyance of particles to others or to surrounding garments and furniture. In addition, it is the belief of many that potassium chloride, weak solutions of ferrum chloride, sulphur, etc., applied to the mouth and throat beforehand, are apt to prevent the absorption of the poison.

Measles. The record shows for the State 206 cases of death by measles, in place of 70 and 87 the two previous years, respectively. Of these, 156 cases were within city limits. This occurs, not because the disease is so much severer in cities, but chiefly from the greater density of population. This number of deaths stands for a great number of cases. The disease was epidemic in many parts of the State. It is unfortunate that it often leaves enfeeblement of lung tissue or some impairment of perfect respiration. Colds, bronchitis, pleurisy and consumption are too frequent sequelæ. Next to small-pox, it is the most communicable of the zymotic diseases; so much so, that in mild epidemics and in favorable seasons of the year, some parents deem it wise to take no special precautions to protect their children from exposure. It often occurs almost with regularity at periods between five to seven years, because these are the ages at which young children most generally make their first appearance at school or where there can be more general exposures. Yet, the disease is one in which preventive and mitigating measures are very important. Evenness of temperature, protection from cold winds and not too early return to school or other duties are very important.

Whooping Cough. Whooping cough is, at times, quite a fatal disease in England and sometimes shows much severity in damp and variable climates here. The colder months of 1882 and 1883 showed the unusual mortality of 253 against 119 of the year before. For the last three years it has had a higher range of mortality in this State than measles. This is in part because it is so seldom submitted to hygienic care or medical treatment in the earlier stages. Also, as it has both nervous and pulmonary irritations, it often causes diseases of the reflex nervous system or invades both systems of nerve life. Its spasmodic character and its tendency to congest the small vessels of the lungs, often need early attention. Warm clothing, protection from draughts and an equable temperature have much influence over it. There is reason to believe that the contagion is spread by the sputa and sometimes by the dried mucus which becomes mingled with floating particles in the atmosphere of rooms.

Croup and Diphtheria. In recent years, these have so prominently and fatally added to the diseases of childhood as to command our most inquisitive attention. While the disease is more manageable than formerly, it is not less virulent in some of its localized outbreaks.

The increase from 873 in 1879–80 to 1728 in 1880–81 and 1472 in 1881–82 well deserves a most careful study. One thousand and fifty-one of these cases were in cities. As the cities of over 5000 inhabitants represent just about one-half of the population of the State, (576,950,) this proportion does not confirm the somewhat prevalent idea that the disease exists as much in the country as in cities. Local outbreaks in the country seem to be equally virulent, and too often we have to record several of a family group as swept off by this virulent disease. But it is not so often transmitted from one to another as in cities, since we have come to know more as to the importance of isolation. While the particle of contagion is obscure, the connection of its fatal fertility with filth, bad air, household accumulation and stagnant dampness cannot be doubted. It may fall or grow amid other soil, but these are its forcing-places.

Two notable instances in this State connect it with cesspool filth. In both of these—the one in Montclair and the other in Chambersburg—it occurred soon after the free spreading of cesspool deposit over grass-plots, and in both instances, seized the nearest family group, when the disease did not prevail in the vicinity. Sudden changes of atmosphere have much to do with outbreaks of the disease at points where its substance and its soil have been provided.

Hygiene has largely to do with its prevention and not less with the milding of the cases and the limiting of its spread when it occurs. It is ever apparent that good physicians often save the members of the family who are taken four or five days after their visit to the one first stricken, because they are able to modify the type, to dilute the contagion and to restrain its virulence. This is done not less by the hygienic than by the medical treatment. We refer for its more extended consideration to the Fourth Report of this Board, (1880,) pages 7–13, and to various articles on modes of disinfection as contained in the State reports.

Diarrheal Diseases. The record of 2792 deaths, as an increase over the 2255 and 2166 of 1880–81 and 1879–80, is a very significant record of the summer drought of 1881, and is the analogue of the pulmonary diseases which marked the previous winter. All but 95 of these cases were in persons under twenty—as most cases of adult disorder of this kind are classified with the diseases of the digestive and intestinal track. Besides, many who die under one month are returned as from this cause, but are not added to this tabulation. Of these, 1814 died in cities. While excessive heat determines the fact of a high death rate from this cause with children, it is chiefly children of two classes that suffer—those that are dependent solely on cow's milk or other artificial food, and those who, by neglect or promiscuous feeding or by dwelling amid impure surroundings, are exposed to insanitary influences. Impure water, poor milk, ill-prepared food and foul air affect the intestinal canal much oftener than they give rise to specific forms of fever. The children of the laboring classes suffer much from too frequent piece-meal systems of feeding and from bad cookery. Foods otherwise digestible thus come to be irritants and cause serious derangement of the stomach and bowels. The tax of this kind of sickness is so great upon industrial life that social science and political economists have deemed it worthy of their notice. Both in New York City and Philadelphia much good has been done by a series of hygienic directions to mothers and by a system of summer sanitary inspection. Many of the children who are sacrificed by these summer diseases are not naturally very delicate, and die as the direct result of outside causes. Bereavements to the family thus too often become bereavements to the State.

Consumption and Acute Lung Diseases. The havoc which this

great destroyer of mankind makes in our own State was pointed out and its causes discussed in a special article in our last report. Three thousand, four hundred and seventy-five deaths occurred from this cause instead of 2989, as in the previous year. Of these, 2102 were in cities of over 5000 inhabitants. Our office records show that in the cities the excess of deaths among females was 20, and in the country, 83.

The large city rate is very informatory as to the influence of foul air and city dampness. While the disease is seldom checked when fully developed, the advance of pathology shows how frequently it is an induced disease.

In connection therewith, acute lung diseases also need to be noticed. Two thousand seven hundred and fifty-two deaths occurred from these, or an increase of 544 from the former year—very nearly the same increase as from consumption. Of these, 1741 were in cities, showing also nearly the same relative increase. While many causes are at work to produce the various forms of lung disease, either acute or chronic, the most careful observers and students of statistics have not failed to recognize the paramount influence of impure air and moist conditions of soil, in which the exchanges between earth and air are artificially embarassed. While in the city the first factor is the most prominent, yet, the undrained land of some country districts is fully offset by the high level of ground water and the mingling of stagnant water and stagnant decaying material in the uncropped soil of our cities—uncropped saved as it is diverted from the support of vegetable to the destruction of the higher animal life.

Brain and Nervous Diseases of Children. The record of increase is not so excessive with these, although 357 more for the State than the previous year. Of the 1999 deaths from this cause, 1364 occurred in cities of over 5000 inhabitants, whereas the relative share would have been about 1000.

So many influences tend to enfeeble the brain and nervous system, to overtax it or to subject it too early to tobacco or other toxics, that it is very difficult to single out each factor and affirm its relative significance. There can be no doubt that we need to study in the interests of population that nervous irritability which is so often early manifest and to guard against that class of degenerative changes which is, of all others, most disastrous in its effect on life.

There are some questions as to early discipline, both in the home

and in the school, that may well be started or that start themselves and need careful analysis and reply. It is not alone that there is over-cramming, but the sins of omission are greater than those of commission. Bodily training, habit-teaching and healthy discipline seem to have vanished as systems. They are talked about, they are patronized, but they find little place in the care of infant and of school life. The care of childhood as something to be aided and directed and drilled in harmonious physical development must have fuller recognition if we would have a diminution of those brain and nervous diseases of children which now sum up so large a number in the causes of fatality.

Other Diseases. After so many notices of increased mortality, it is pleasant, as we come to such adult diseases as those of the heart and circulation, to urinary diseases, to adult brain diseases, erysipelas, digestive and intestinal diseases, and cancers, to find no marked increase.

Acute rheumatism has been less frequent. Puerperal diseases show a favorable diminution. It thus appears that it is life before adult age that has chiefly suffered—a fact, the contrast of which points very plainly to most of the causes of the increased mortality as artificial.

NUMBER OF MARRIAGES, BIRTHS AND DEATHS, BY TOWNSHIPS.

Atlantic County.

	M.	B.	D.
Absecon	5	10	14
Atlantic City	45	90	174
Buena Vista	.....	17	10
Egg Harbor City	18	34	33
Egg Harbor Township	26	66	65
Galloway	6	39	41
Hamilton	9	39	29
Hammonton	21	45	27
Mullica	3	5	6
Weymouth	1	17	9
	134	362	408

Bergen County.

	M.	B.	D.
Englewood	25	28	64
Franklin	13	54	41
Harrington	16	28	25
Hohokus	20	58	28
Lodi	13	107	82
Midland	9	19	34
New Barbadoes	57	113	104
Palisade	12	36	26
Ridgefield	17	61	88
Ridgewood	13	34	31
Saddle River	3	18	21
Union	14	67	65
Washington	11	43	40
	223	666	649

Burlington County.

	M.	B.	D.
Bass River	3	31	23
Beverly	13	14	54
Bordentown	47	107	90
Burlington	59	83	166
Chester	29	71	36
Chesterfield	12	31	27
Cinnaminson	14	44	38
Delran	8	10	22
Evesham	12	39	31
Eastampton	1	10	9
Florence	8	30	18
Little Egg Harbor	13	39	34
Lumberton	.....	12	12
Mansfield	9	39	17
Medford	11	33	30
Mt. Laurel	2	20	19
New Hanover	28	46	38
Northampton	53	88	97
Pemberton	19	47	65
Randolph	3	9	9
Shamong	3	17	16
Southampton	17	37	29
Springfield	6	40	28
Washington	1	7	11
Westampton	1	18	6
Willingboro	2	15	20
Woodland	.....	2	3
	374	939	948

Camden County.

	M.	B.	D.
Camden	443	696	1023
Centre	3	41	25
Delaware	.....	23	25
Gloucester City	39	159	98
Gloucester	10	61	61
Haddon	19	73	51
Stockton	14	52	58
Waterford	10	29	24
Winslow	5	52	41
	543	1186	1406

Cape May County.

	M.	B.	D.
Cape May City	24	42	24
Dennis	13	43	31
Lower	6	53	29
Middle	11	46	22
Upper	11	43	28
	65	227	134

Cumberland County.

	M.	B.	D.
Bridgeton	118	219	208
Commercial	12	28	41
Deerfield	12	24	15
Downe	16	28	24
Fairfield	17	85	41
Greenwich	11	20	16
Hopewell	10	31	31
Landis	66	130	106
Maurice River	15	50	48
Millville	100	266	136
Stoe Creek	8	32	21
	385	913	687

Essex County.

	M.	B.	D.
Belleville	19	77	64
Bloomfield	37	125	33
Caldwell	20	57	45
Clinton	19	42	39
East Orange	25	193	113
Franklin	13	20	31
Livingston	10	16	19
Millburn	23	33	32
Montclair	26	126	101
Newark	1353	3646	3925
Orange	125	417	337
South Orange	22	83	69
West Orange	11	64	67
	1703	4899	4925

Gloucester County.

	M.	B.	D.
Clayton	25	39	33
Deptford	1	38	22
East Greenwich	6	31	20
Franklin	11	65	34
Glassboro	14	77	65
Greenwich	6	32	25
Harrison	15	43	53
Logan	9	29	20
Mantua	15	42	28
Monroe	8	50	26
Washington	13	31	31
West Deptford	.....	34	23
Woodbury	30	58	47
Woolwich	16	57	44
	169	626	471

Hudson County.

	M.	B.	D.
Bayonne	61	161	253
Guttenberg	8	24	33
Harrison	6	148	172
Hoboken	330	695	976
Jersey City	826	1288	3646
Kearney	4	24	36
North Bergen	7	48	317
Town of Union	65	150	216
Union	4	18	34
Weehawken	1	13	40
West Hoboken	30	140	138
	1342	2709	5861

Hunterdon County.

	M.	B.	D.
Alexandria	6	20	22
Bethlehem	15	46	55
Clinton township	4	26	37
Delaware	15	43	40
East Amwell	12	29	26
Franklin	14	21	9
Frenchtown	11	12	22
High Bridge	14	49	36
Holland	8	38	18
Kingwood	8	32	18
Lambertville	38	71	69
Lebanon	19	55	47
Raritan	19	66	54
Readington	16	58	52
Tewksbury	23	43	27
Town of Clinton	14	17	10
Union	3	12	14
West Amwell	3	12	14
	242	650	570

Mercer County.

	M.	B.	D.
Chambersburg	31	149	138
East Windsor	21	29	41
Ewing	8	21	85
Hamilton	11	46	78
Hopewell	32	59	77
Lawrence	10	41	55
Millham	2	27	3
Princeton	29	99	85
Trenton	344	588	615
Washington	2	19	17
West Windsor	9	15	18
	499	1093	1212

Middlesex County.

	M.	B.	D.
Cranbury	13	37	29
East Brunswick	30	73	69
Madison	2	18	20
Monroe	25	37	42
New Brunswick	178	405	390
North Brunswick	8	27	20
Perth Amboy	75	190	135
Piscataway	16	62	54
Raritan	16	65	55
Sayreville	14	26	22
South Amboy	30	71	89
South Brunswick	5	40	41
Woodbridge	11	78	85
	423	1129	1055

Monmouth County.

	M.	B.	D.
Atlantic	9	24	31
Eatontown	13	22	44
Freehold	49	71	80
Holmdel	1	25	16
Howell	23	72	64
Manalapan	16	46	27
Marlboro	11	29	27
Matawan	22	34	72
Middletown	31	73	83
Millstone	18	33	27
Neptune	53	125	176
Ocean	47	165	147
Raritan	41	85	81
Shrewsbury	44	127	128
Upper Freehold	28	48	60
Wall	39	140	86
	445	1119	1149

Morris County.

	M.	B.	D.
Boonton	25	67	53
Chatham	16	49	86
Chester	10	59	47
Hanover	15	56	125
Jefferson	9	19	26
Mendham	17	38	24
Montville	14	20	39
Morristown	29	104	121
Mount Olive	11	51	36
Passaic	8	35	30
Pequannock	7	39	54
Randolph	67	171	146
Rockaway	49	131	145
Roxbury	20	47	33
Washington	11	73	34
	308	959	999

Ocean County.

	M.	B.	D.
Berkeley	2	17	9
Brick	14	55	36
Dover	20	64	33
Eagleswood	7	13	15
Jackson	7	38	17
Lacey	5	20	16
Manchester	6	31	18
Ocean	2	10	11
Plumsted	6	40	28
Stafford	7	8	19
Union	8	25	18
	84	321	220

Passaic County.

	M.	B.	D.
Acquackanonk	3	30	21
Little Falls	15	30	39
Manchester	2	12	21
Passaic	71	214	149
Paterson	568	1517	1512
Pompton	29	35	47
Wayne	3	9	17
West Milford	24	48	45
	715	1895	1851

Salem County.

	M.	B.	D.
Elsinboro	.....	7	5
Lower Alloways Creek	9	20	13
Lower Penn's Neck	4	19	24
Mannington	1	40	60
Oldmans	3	26	17
Pilesgrove	33	64	69
Pittsgrove	11	44	41
Quinton	.....	36	20
Salem	51	110	98
Upper Alloways Creek	11	35	30
Upper Penn's Neck	17	43	43
Upper Pittsgrove	10	30	36
	150	474	456

Somerset County.

	M.	B.	D.
Bedminster	12	22	40
Bernards	14	55	47
Branchburg	4	32	24
Bridgewater	74	170	154
Franklin	21	47	73
Hillsborough	17	45	52
Montgomery	6	34	28
North Plainfield	11	67	60
Warren	5	17	26
	164	489	504

Sussex County.

	M.	B.	D.
Andover	11	15	29
Byram	15	17	24
Frankford	6	27	26
Greene	.....	16	4
Hardyston	12	9	70
Hampton	14	14	13
Lafayette	18	3	18
Montague	4	6	15
Newton	25	38	66
Sandyston	8	21	23
Sparta	15	30	44
Stillwater	14	23	39
Vernon	12	17	30
Walpack	3	8	4
Wantage	22	43	54
	179	287	459

Union County.

	M.	B.	D.
Clark	1	5	9
Cranford	.....	10	10
Elizabeth	269	813	612
Fanwood	5	15	17
Linden	4	23	38
New Providence	2	18	21
Plainfield	67	146	151
Rahway	51	96	183
Springfield	4	17	10
Summit	10	41	41
Union	8	33	27
Westfield	10	41	58
	431	1258	1177

Warren County.

	M.	B.	D.
Alamuchy	......	17	14
Belvidere	14	32	34
Blairstown	18	49	28
Franklin	18	31	30
Frelinghuysen	6	21	6
Greenwich	21	43	51
Hackettstown	23	61	58
Hardwick	......	6	7
Harmony	6	37	31
Hope	9	34	35
Independence	5	21	16
Knowlton	10	31	38
Lopatcong	4	42	30
Mansfield	8	12	50
Oxford	25	125	112
Pahaquarry	......	8	1
Phillipsburg	64	243	169
Pohatcong	2	9	12
Town of Washington	27	64	64
Washington	4	21	32
	259	907	818

Totals of Marriages, Births and Deaths for all the Counties.

	M.	B.	D.
Atlantic	134	362	408
Bergen	223	666	649
Burlington	374	939	948
Camden	543	1186	1406
Cape May	65	227	134
Cumberland	385	913	687
Essex	1703	4899	4925
Gloucester	169	626	471
Hudson	1342	2709	5861
Hunterdon	242	650	570
Mercer	499	1093	1212
Middlesex	423	1129	1055
Monmouth	445	1119	1140
Morris	308	959	999
Ocean	84	321	220
Passaic	715	1895	1851
Salem	150	474	456
Somerset	164	489	504
Sussex	179	287	459
Union	431	1258	1177
Warren	259	907	818
	8837	23,108	25,959

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending July 1st, 1882.

COUNTIES. Statistical Divisions.	DEATHS AT ALL AGES. Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefi'ed.	Population, census of 1880.*	Death rate per 1,000.
Atlantic	114	61	23	102	102	4	406	18,704	21.71
Bergen	119	122	67	180	153	8	649	36,786	17.64
Burlington	189	113	89	248	297	12	948	55,403	17.11
Camden	385	213	145	397	251	13	1,404	62,942	22.30
Cape May	29	15	15	82	39	4	134	9,765	13.72
Cumberland	128	118	82	169	185	8	690	37,687	18.31
Essex	1,107	1,154	578	1,336	717	19	4,911	189,929	25.85
Gloucester	125	44	41	129	129	3	471	25,886	18.19
Hudson	1,458	1,229	712	1,789	642	10	5,840	187,944	31.07
Hunterdon	103	41	40	136	244	6	570	38,570	14.77
Mercer	265	145	102	405	263	29	1,209	58,061	20.82
Middlesex	238	151	113	311	231	11	1,055	52,286	20.18
Monmouth	250	129	106	337	306	25	1,153	55,538	20.76
Morris	177	147	128	302	235	10	999	50,861	19.64
Ocean	55	16	18	79	48	3	219	14,455	15.15
Passaic	500	322	197	540	284	4	1,847	68,860	26.82
Salem	91	64	50	104	137	9	455	24,579	18.51
Somerset	99	52	64	129	155	5	504	27,162	18.55
Sussex	63	73	54	116	135	14	455	23,539	19.32
Union	265	228	130	318	236	5	1,177	55,571	21.18
Warren	174	146	132	178	174	10	814	36,589	22.24
Totals	5,984	4,578	2,886	7,337	4,963	212	25,910	1,131,117	22.90

COUNTIES.	PRINCIPAL CAUSES OF DEATH. Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.
Atlantic	....	13	2	10	2	14	12	66	25	33	32
Bergen	16	19	6	35	2	2	20	66	55	38	85
Burlington	17	40	3	11	7	11	29	99	66	84	101
Camden	33	65	3	40	2	11	48	194	81	105	189
Cape May	2	10	....	2	2	....	....	9	10	9	11
Cumberland	2	55	....	8	....	7	64	64	50	57	42
Essex	53	112	19	401	64	62	401	474	356	319	581
Gloucester	5	21	5	9	....	8	11	61	32	43	48
Hudson	86	235	277	266	70	42	443	680	381	338	639
Hunterdon	9	24	1	15	3	6	6	47	26	35	54
Mercer	18	37	19	10	11	11	43	128	115	102	119
Middlesex	15	33	11	43	1	8	45	110	57	80	104
Monmouth	9	24	5	40	3	11	33	130	68	72	113
Morris	21	26	....	86	1	7	50	76	52	63	120
Ocean	....	10	....	1	1	2	13	16	19	29	16
Passaic	30	61	3	134	3	14	53	269	123	138	203
Salem	5	22	....	7	1	18	27	30	39	42	39
Somerset	16	12	....	10	6	3	23	42	17	32	53
Sussex	9	17	....	44	2	....	26	32	21	26	38
Union	24	21	3	72	20	15	63	114	70	86	137
Warren	9	27	10	62	5	6	62	85	33	48	78
Totals	379	884	367	1306	206	253	1472	2792	1696	1779	2752

COUNTIES.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Atlantic	22	26	13	38	....	11	8	....	4	6
Bergen	54	37	15	29	1	15	12	1	10	27
Burlington	50	49	31	78	5	21	21	....	9	30
Camden	110	51	39	88	2	23	28	1	16	32
Cape May	12	5	3	11	....	1	4	....	1	4
Cumberland	56	33	22	47	3	26	4	1	6	19
Essex	457	189	180	242	12	118	76	7	44	94
Gloucester	32	25	10	28	1	13	8	1	6	13
Hudson	528	198	131	210	18	141	53	8	49	225
Hunterdon	23	56	26	65	4	14	20	2	8	21
Mercer	62	52	26	109	10	36	22	3	5	37
Middlesex	64	45	33	61	4	33	22	5	10	50
Monmouth	65	76	51	114	4	43	19	5	5	41
Morris	61	57	33	88	1	35	15	2	10	38
Ocean	19	13	1	13	1	10	3	3	3	2
Passaic	136	73	58	74	7	75	23	6	16	45
Salem	20	25	6	35	3	17	13	1	4	8
Somerset	34	41	19	51	6	34	10	1	9	19
Sussex	23	33	21	27	3	22	8	....	7	16
Union	113	55	25	57	4	31	24	1	12	48
Warren	58	42	14	56	5	21	9	4	10	18
Totals	1,999	1,181	765	1,521	94	740	402	52	244	793

Death-rate per 1,000 from these diseases, exclusive of accidents, 18.41. Note that consumption has two columns.

* On page 317, 5th Report, "1875" should be "1880," and the addition of diarrheal diseases, page 316, is 2,305.

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending July 1st, 1882.

Cities having over 5,000 Population. Statistical Divisions.	DEATHS AT ALL AGES.							Population, census of 1880.	Death rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																			
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal Diseases.	Consumption. M.	Consumption. F.	Acute lung Diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Atlantic County.																													
Atlantic City	58	34	10	41	31	....	174	5,477	31.76	....	5	....	5	....	3	6	37	8	12	13	11	11	7	14	....	3	4	....	1	4
Burlington County.																													
Bordentown	10	16	5	34	24	1	90	5,334	16.88	2	1	1	1	....	1	7	6	7	7	6	8	9	4	11	1	.....	2	....	....	3
Burlington	24	16	23	48	51	4	166	7,237	22.94	5	3	....	1	....	....	11	15	17	19	13	3	11	7	13	....	3	4	....	1	4
Camden County.																													
Camden	284	166	113	291	156	13	1,023	41,659	24.55	27	50	2	37	2	7	38	142	57	64	105	80	35	32	54	1	14	25	1	12	26
Gloucester City	29	10	11	30	18	....	98	5,347	18.32	1	6	....	....	....	....	2	12	7	9	9	9	1	3	9	1	.....	1	....	....	2
Cumberland County.																													
Bridgeton	37	39	35	47	45	5	208	8,722	23.85	2	13	....	1	....	2	43	14	14	12	15	18	10	4	11	1	7	1	....	1	10
Millville	25	22	24	41	23	1	136	7,660	17.75	....	25	....	1	....	....	3	19	8	15	6	12	3	6	7	....	4	....	....	2	3
Essex County.																													
Newark	871	959	448	1,096	522	16	3,912	136,508	28.66	42	97	19	310	60	47	309	374	289	262	490	377	151	138	189	10	81	58	6	32	76
Orange	83	85	44	84	39	1	336	13,207	25.44	2	5	....	28	....	8	37	34	27	17	36	35	12	11	12	1	6	5	....	7	6
Hudson County.																													
Bayonne	73	62	25	74	18	....	252	9,372	26.89	5	9	....	11	1	1	13	31	8	12	50	26	4	7	9	....	3	1	....	2	16
Harrison	36	35	19	62	17	1	170	6,898	24.61	7	6	....	10	1	3	8	16	17	18	23	25	5	3	4	....	8	1	2	1	4
Hoboken	264	225	108	286	93	....	974	30,999	31.42	13	27	25	41	5	8	118	131	68	59	91	96	40	34	24	2	11	10	1	11	32
Jersey City	908	774	450	1,121	377	6	3,636	120,722	30.12	35	156	209	165	58	26	224	417	221	213	413	311	120	61	137	15	106	37	4	29	147
Union	59	55	40	43	19	....	216	5,849	36.93	2	3	4	14	1	....	47	28	9	10	10	31	8	6	6	....	5	2	....	3	3
Mercer County.																													
Chambersburg	48	21	19	27	18	3	136	5,437	25.01	2	6	....	4	....	4	8	21	7	8	22	9	5	1	5	....	5	1	....	....	2
Trenton	141	76	53	216	107	21	614	29,910	20.53	8	20	17	....	5	3	21	75	59	67	69	32	25	14	29	5	12	9	3	1	22
Middlesex County.																													
New Brunswick	93	57	49	113	75	4	391	17,166	22.78	6	12	9	20	....	4	14	46	20	37	36	30	14	15	17	3	11	12	1	1	12
Morris County.																													
Morristown	22	15	13	41	29	1	121	6,837	17.70	2	....	....	3	....	....	3	15	12	10	9	9	7	5	8	....	9	4	1	....	4
Passaic County.																													
Passaic	47	28	17	32	24	1	149	6,532	22.82	3	9	....	6	....	4	3	24	5	18	12	15	7	4	6	1	3	....	....	2	7
Paterson	417	260	150	463	221	....	1,511	51,031	29.61	24	49	3	101	3	10	37	232	106	112	178	108	57	51	52	6	63	19	5	12	31
Salem County.																													
Salem	19	11	10	25	32	2	99	5,056	19.58	3	5	....	1	....	....	2	6	8	12	7	7	4	2	9	....	.....	6	....	1	1
Union County.																													
Elizabeth	148	131	74	165	91	3	612	28,229	21.68	13	7	....	41	10	6	36	65	33	39	56	70	28	10	32	....	13	11	1	4	30
Plainfield	34	20	20	30	47	....	151	8,125	18.58	....	2	....	5	7	....	10	17	5	17	23	9	6	7	10	1	3	3	....	....	8
Rahway	33	37	22	46	45	....	183	6,455	28.35	1	5	3	15	3	2	10	13	9	11	36	15	14	4	8	2	7	3	....	1	3
Warren County.																													
Phillipsburg	54	34	21	34	26	....	169	7,181	23.53	2	6	....	....	....	3	26	24	15	6	13	18	11	1	10	....	2	1	....	2	1
Totals	3,817	3,186	1,803	4,490	2,148	83	15,527	576,950	26.71	207	527	292	821	156	142	1096	1814	1041	1061	1741	1,364	598	437	686	50	379	220	25	126	457

Death-rate per 1,000 from these diseases, exclusive of accidents, 22.55.

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year Ending July 1st, 1882.

ATLANTIC COUNTY. Population.....18,704 Statistical Divisions.	DEATH AT ALL AGES.							Population, census of 1880.	Death rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																			
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Absecon	4	3	1	3	2	1	14	507	.....	....	....	....	1	....	....	....	2	2	1	1	....	2	2	....	1	....	....	....	....	1
Atlantic City	58	34	10	41	31	....	174	5,477	31.76	....	5	....	5	....	3	6	37	8	12	13	11	11	7	14	....	3	4	....	1	4
Buena Vista	1	1	2	3	3	....	10	885	.....	....	1	....	....	1	....	....	....	1	....	....	....	1	....	1	....	....	....	....	....	....
Egg Harbor City	5	3	....	8	17	....	33	1,232	.....	....	....	....	....	....	....	2	1	3	2	4	....	2	....	7	....	1	....	....	1	....
Egg Harbor Township	20	7	3	17	15	1	63	3,563	.....	....	4	1	3	....	....	1	....	10	4	5	....	5	....	5	....	1	....	....	1	1
Galloway	9	3	2	12	14	....	41	2,337	.....	....	....	....	1	....	....	2	2	1	6	....	4	1	....	4	....	....	....	....	1	....
Hamilton	9	8	2	6	3	1	29	1,464	.....	....	....	....	....	1	....	5	1	8	....	....	2	....	....	1	....	....	....	....	....	....
Hammonton	5	1	1	13	7	....	27	1,776	.....	....	1	1	....	....	....	1	....	2	3	5	1	1	....	1	....	2	....	....	1	....
Mullica	1	....	1	2	2	....	6	717	.....	....	1	....	....	....	....	....	....	1	....	....	1	....	....	....	2	....	....	....	....	....
Weymouth	2	1	....	1	5	....	9	741	.....	....	1	....	....	....	....	....	....	2	....	1	....	....	....	1	....	....	....	....	....	....
Totals	114	61	23	102	102	4	406	18,704	21.71	....	13	2	10	2	14	12	66	26	33	32	22	26	13	38	....	11	8	....	4	6

Death-rate per 1,000, without cities of over 5,000, 17.55. Death-rate of Atlantic City includes a very large summer population.

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year Ending July 1st, 1882.

BERGEN COUNTY. Population.....36,786 Statistical Divisions.	DEATH AT ALL AGES.									PRINCIPAL CAUSES OF DEATH.																				
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.	Population, census of 1880.	Death rate per 1,000.	Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Englewood	14	15	4	21	5	5	64	4,076	.....	2	1	....	....	....	....	1	11	6	1	6	10	10	1	....	1	3	....	2	....
Franklin	6	11	2	10	12	....	41	2,206	.....	1	1	....	....	....	....	2	7	2	4	5	1	6	....	....	1	....	....	....	....	2
Harrington	2	4	4	8	7	....	25	2,570	.....	....	1	....	4	....	....	....	1	2	2	2	....	1	....	....	....	....	....	....	....	....
Hohokus	8	3	2	5	10	....	28	2,920	.....	....	....	....	....	....	....	....	5	4	2	5	1	2	1	....	....	1	....	....	....	....
Lodi	19	13	10	24	14	2	82	4,071	.....	....	3	2	1	....	1	2	4	11	3	15	10	2	3	....	....	1	....	1	....
Midland	5	3	....	15	10	1	34	1,591	.....	2	1	....	3	....	....	....	....	3	1	1	....	1	1	....	....	1	2	....	2	3
New Barbadoes	17	18	13	23	33	....	104	4,248	.....	2	1	....	5	....	1	9	5	6	4	15	11	4	1	....	....	3	4	....	2	1
Palisade	4	5	4	7	6	....	26	2,302	.....	....	....	....	2	....	....	....	5	1	3	3	2	1	....	....	....	....	1	....	2	7
Ridgefield	17	21	10	27	13	....	88	3,962	.....	2	3	2	9	2	....	3	12	3	5	11	2	4	....	....	....	2	4	....	....	....
Ridgewood	4	7	5	9	6	....	31	1,478	.....	....	....	....	2	....	....	....	2	3	3	4	....	2	....	....	....	....	3	1	....	....
Saddle River	3	3	2	6	7	....	21	1,355	.....	....	1	....	....	....	....	....	....	....	....	4	....	1	2	....	....	....	....	....	....	2
Union	14	17	8	14	12	....	65	3,164	.....	3	4	2	....	....	....	3	11	3	2	7	....	2	....	....	1	1	....	....	....	5
Washington	6	2	3	11	18	....	40	2,853	.....	2	1	....	....	....	....	....	3	6	6	5	2	2	2	1	....	....	....	1	....	1
Totals	119	122	67	180	153	8	649	36,786	17.64	16	19	6	35	2	2	20	66	55	38	85	54	37	15	29	1	15	12	1	10	27

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending July 1st, 1882.

BURLINGTON COUNTY. Population.....55,403 Statistical Divisions.	DEATHS AT ALL AGES.									PRINCIPAL CAUSES OF DEATH.																				
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.	Population, census of 1880.	Death rate per 1,000.	Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Bass River	4	3	3	5	7	1	23	1,006	.....	....	1	....	....	....	1	....	4	1	3	4	1	....	1	4	....	....	....	....	....	1
Beverly City	6	2	3	8	7	1	27	1,759	.....	....	....	....	1	....	....	....	4	3	5	1	....	1	1	1	....	1	....	....	....	1
Beverly Township	3	3	4	4	13	....	27	1,369	.....	....	1	....	....	....	....	1	2	3	2	4	2	1	....	1	....	....	....	....	....	1
Bordentown	10	16	5	34	24	1	90	5,334	16.88	2	1	1	1	....	1	7	6	7	7	6	3	9	4	11	1	....	....	....	....	1
Burlington	24	16	23	48	51	4	166	7,237	22.94	5	3	....	1	....	....	11	15	17	19	13	3	11	7	13	....	3	4	....	1	4
Chester	7	2	....	8	18	1	36	2,855	.....	1	....	....	....	....	....	....	4	1	1	4	2	....	3	6	....	2	2	....	1	....
Chesterfield	4	1	2	8	12	....	27	1,525	.....	1	....	....	1	....	....	....	....	3	....	4	1	....	1	3	....	....	1	....	....	1
Cinnaminson	9	4	4	9	12	....	38	2,184	.....	....	4	....	....	....	....	1	3	3	3	9	1	3	1	1	....	....	....	....	....	1
Delran	3	4	2	9	4	....	22	1,760	.....	3	4	2	1	....	....	....	2	....	2	....	....	1	2	....	....	....	....	....	....	....
Evesham	8	3	5	5	10	....	31	1,602	.....	....	2	....	1	....	....	....	5	3	2	5	5	3	1	1	....	1	1	....	1	1
Eastampton	4	....	....	1	1	....	6	566	.....	....	....	....	....	....	....	....	1	....	1	....	1	....	1	1	....	....	....	....	....	....
Florence	2	6	1	4	5	....	18	1,538	.....	1	....	....	....	....	....	1	2	....	1	2	1	....	1	2	1	....	....	....	....	1
Little Egg Harbor	8	4	1	5	16	....	34	1,891	.....	....	....	....	....	....	....	1	5	2	2	2	1	4	1	4	....	1	....	....	....	2
Lumberton	1	3	....	6	2	....	12	1,689	.....	....	1	....	....	....	....	1	1	2	....	1	1	1	....	....	....	1	....	....	....	1
Mansfield	9	....	1	5	2	....	17	1,648	.....	....	4	....	....	....	1	....	6	....	1	....	....	....	....	1	....	1	2	....	....	....
Medford	6	5	1	7	11	....	30	1,980	.....	....	....	....	....	....	....	....	....	1	....	1	....	....	....	....	....	....	....	....	....	....
Mount Laurel	7	2	1	5	4	....	19	1,739	.....	....	....	....	....	....	1	3	....	4	4	7	1	3	1	1	....	1	4	....	....	1
New Hanover	9	4	6	6	13	....	38	2,373	.....	....	3	....	....	....	....	....	....	2	5	4	2	1	1	1	....	....	....	....	....	....
Northampton	23	8	11	17	36	2	97	4,630	.....	2	2	....	....	....	2	1	11	5	8	8	5	4	2	5	1	2	1	....	1	....
Pemberton	14	4	5	20	21	1	65	2,885	.....	1	6	....	1	2	1	....	6	6	5	8	7	7	1	11	....	3	2	....	2	3
Randolph	2	2	1	3	1	....	9	428	.....	....	1	....	....	....	....	2	1	....	1	2	2	2	3	5	1	2	....	....	1	3
Shamong	7	1	1	4	3	....	16	1,097	.....	....	....	....	....	....	....	....	4	....	1	2	....	1	....	1	....	1	....	....	....	....	....
Southampton	2	3	1	13	10	....	29	2,269	.....	....	2	....	1	....	1	....	4	4	3	1	....	2	....	2	....	1	2	....	1	....
Springfield	5	8	2	5	8	....	28	1,886	.....	....	2	....	1	1	1	....	3	1	....	3	3	1	2	....	....	1	....	....	....	1
Washington	4	3	....	3	1	....	11	389	.....	....	1	....	....	....	....	....	2	....	2	4	....	....	....	3	1	1	....	....	....	2
Westampton	1	2	....	1	2	....	6	715	.....	....	....	....	....	....	....	....	3	....	....	1	....	....	....	....	....	....	....	....	....	1
Willingboro	6	4	3	3	3	1	20	743	.....	1	1	....	2	....	1	....	2	1	....	3	....	....	....	1	....	....	....	....	....	....
Woodland	1	....	....	2	....	....	3	325	.....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	1	....	1	....
Totals	169	113	89	248	297	12	948	55,403	17.11	17	40	3	11	7	11	29	99	66	84	101	50	49	31	78	5	21	21	....	9	30

Death-rate per 1,000 in counties without cities of over 5,000 population, 16.16.

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending July 1st, 1882.

CAMDEN COUNTY. Population.....62,942 Statistical Divisions.	DEATHS AT ALL AGES.									PRINCIPAL CAUSES OF DEATH.																			
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.	Population, census of 1880.	Death rate per 1,000.	Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Camden City	284	166	113	291	156	13	1023	41,659	24.55	27	50	2	37	2	7	38	142	57	64	105	80	35	32	54	1	14	25	1	12	26
Centre	6	5	1	4	9	....	25	1,532	.....	....	....	....	....	....	....	....	3	2	3	2	5	3	1	....	....	1	....	....	....	....
Delaware	6	2	....	10	7	....	25	1,481	.....	....	2	....	....	....	....	....	6	1	4	1	....	1	....	1	....	....	....	....	....	....
Gloucester Township	16	6	5	16	17	....	60	2,627	.....	1	2	....	2	....	1	....	8	7	4	5	5	2	....	4	....	1	....	....	....	1
Gloucester City	29	10	11	30	18	....	98	5,847	18.32	1	6	....	....	....	....	2	12	7	9	9	2	1	3	9	1	1	....	....	....	2
Haddon	11	7	1	13	19	....	51	2,551	.....	2	....	....	....	....	1	1	4	2	5	5	2	5	1	4	....	1	1	....	3	....
Stockton	19	8	8	14	8	....	57	3,532	.....	2	3	1	....	....	1	1	10	2	7	4	2	....	2	4	....	1	1	....	....	1
Waterford	7	4	4	4	5	....	24	2,149	.....	....	1	....	1	....	....	5	3	....	2	6	1	....	....	2	....	2	....	....	....	....
Winslow	7	5	2	15	12	....	41	2,158	.....	....	1	....	....	....	1	1	6	2	....	....	....	4	....	....	....	....	....	....	1	1
Totals	385	213	145	397	251	13	1404	62,942	22.30	33	65	3	40	2	11	48	194	81	105	139	110	51	39	88	2	23	28	1	16	32

Death rate per 1,000, without cities, 17.76.

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending July 1st, 1882.

CAPE MAY COUNTY. Population.....9,765 Statistical Divisions.	DEATHS AT ALL AGES.									PRINCIPAL CAUSES OF DEATH.																			
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.	Population, census of 1880.	Death rate per 1,000.	Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Cape May City	8	5	1	6	3	1	24	1,699	.....	....	....	....	1	....	....	....	3	1	....	1	5	2	....	1	....	....	....	....	....	....
Dennis	6	3	2	12	8	....	31	1,812	.....	....	1	....	....	1	....	....	....	3	....	....	7	....	2	....	....	....	2	....	1	1
Lower	6	3	2	7	6	7	1	32	1,977	.....	....	....	....	1	....	....	3	3	2	2	1	1	....	1	....	....	....	....	....	1
Middle	6	3	3	4	9	....	25	2,575	.....	2	....	....	1	....	....	....	3	1	2	2	1	....	....	4	....	....	....	....	....	1
Upper	6	2	2	4	12	2	28	1,702	.....	....	....	....	....	....	....	....	2	2	....	2	3	1	1	3	....	1	2	....	....	1
Cape May Point*	....	....	....	....	....	....	....	.....	.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Totals	29	15	15	32	39	4	134	9,765	13.72	2	10	....	2	2	....	....	9	10	9	11	12	5	3	11	....	1	4	....	1	4

* Population and return are included in the lower township.

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year Ending July 1st, 1882.

CUMBERLAND COUNTY. Population.....37,687 Statistical Divisions.	DEATHS AT ALL AGES.									PRINCIPAL CAUSES OF DEATH.																			
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.	Population, census of 1880.	Death rate per 1,000.	Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Bridgeton	37	39	35	47	45	5	208	8,722	23.85	2	13	....	1	....	2	43	14	14	12	15	18	10	4	11	1	7	1	....	1	10
Commercial	10	7	2	11	11	....	41	2,265	.....	....	4	....	....	....	1	....	5	3	2	4	3	3	1	6	....	....	....	....	....	2
Deerfield	3	2	2	5	3	....	15	1,643	.....	....	....	....	1	....	....	1	....	....	2	....	2	1	....	1	1	....	1	....	....	1
Downe	6	8	....	2	8	....	24	1,687	.....	....	....	....	1	....	....	....	3	3	1	1	2	1	1	1	....	1	....	....	....	1
Fairfield	14	2	3	10	11	1	41	3,215	.....	....	3	....	....	....	2	....	....	4	3	2	2	2	1	1	....	1	....	1	....	....
Greenwich	2	4	4	3	5	....	18	1,245	.....	....	....	....	....	....	1	3	5	4	2	2	2	1	1	1	....	4	....	....	....	....
Hopewell	3	3	1	7	17	....	31	1,764	.....	....	....	....	1	....	....	....	4	2	3	....	1	1	....	3	....	1	....	....	....	....
Landis	16	21	8	23	38	1	107	6,005	.....	....	....	....	....	....	....	....	4	4	3	....	....	4	4	5	....	1	....	....	....	1
Maurice River	9	7	2	16	14	....	48	2,374	.....	....	5	....	3	....	....	10	5	2	1	4	1	3	3	6	....	4	1	....	2	....
Millville	25	22	24	41	23	1	136	7,660	17.75	....	3	....	....	....	1	....	5	4	2	3	6	4	1	3	1	2	1	....	1	....
Stoe Creek	3	3	1	4	10	....	21	1,107	.....	....	25	....	1	....	....	1	19	8	15	6	12	3	1	3	....	4	....	....	2	3
										....	....	....	....	....	....	1	1	2	2	1	1	....	....	....	....	....	....	....	....	1
Totals	128	118	82	169	185	8	690	37,687	18.31	2	55	....	8	....	7	64	64	50	57	42	56	33	23	47	3	26	4	1	6	19

Death rate per 1,000, without cities, 20.94.

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending July 1st, 1882.

ESSEX COUNTY. Population.....189,929 Statistical Divisions.	DEATHS AT ALL AGES.									PRINCIPAL CAUSES OF DEATH.																			
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.	Population, census of 1880.	Death rate per 1,000.	Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases of children.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Belleville	19	10	7	15	14	....	65	3,004	.....	2	1	....	4	....	2	1	7	5	3	5	8	2	1	4	....	2	3	1	....	2
Bloomfield	17	16	12	19	18	....	82	5,748	.....	3	....	....	11	....	....	5	8	7	5	7	4	4	2	5	....	2	....	....	....	1
Caldwell	11	9	3	8	14	....	45	3,167	.....	....	....	....	5	1	....	3	6	4	1	3	1	2	1	....	....	1	1	....	....	....
Clinton	13	5	8	8	5	....	39	2,742	.....	....	....	....	2	....	....	5	11	2	2	3	1	2	1	4	....	1	....	....	....	....
East Orange	23	21	15	28	26	1	114	5,349	13.65	2	5	....	16	....	....	5	11	7	6	8	8	3	6	4	....	1	1	....	....	3
Franklin	6	....	2	11	12	....	30	1,617	.....	....	....	....	1	....	4	5	2	2	5	8	3	6	4	1	....	2	1	....	....	....
Livingston	3	2	2	2	9	....	19	1,401	.....	....	....	....	....	....	....	4	....	2	1	1	2	1	1	1	....	1	....	....	....	1
Millburn	4	5	2	10	7	....	32	1,743	.....	....	....	....	....	....	....	4	....	1	1	1	2	1	....	2	....	2	....	....	....	....
Montclair	23	17	13	27	21	....	101	5,147	.....	2	3	....	4	....	....	8	2	4	3	1	2	1	2	1	....	1	....	....	1	....
Newark	871	959	448	1096	522	16	3912	136,508	28.66	42	97	19	310	60	47	309	374	289	262	490	377	151	138	189	10	81	58	6	82	76
Orange	83	85	44	84	39	1	336	13,207	25.44	2	5	....	28	....	8	37	34	27	17	36	35	12	11	12	1	6	5	....	7	6
South Orange	16	9	12	17	13	1	68	3,911	.....	....	1	....	9	3	1	8	8	3	3	4	1	6	6	3	....	6	2	....	....	1
West Orange	19	16	5	11	17	....	68	3,388	.....	....	....	....	11	....	....	2	7	3	3	5	9	1	3	4	....	3	....	....	1	1
Totals	1107	1154	578	1336	717	19	4911	189,929	25.85	53	112	19	401	64	62	401	474	356	319	581	457	189	180	242	19	118	76	7	44	94

Death-rate per 1,000, without cities, 17.23.

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year Ending July 1st, 1882.

GLOUCESTER COUNTY. Population 25,886 — Statistical Divisions.	DEATHS AT ALL AGES.									PRINCIPAL CAUSES OF DEATH.																			
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.	Population, census of 1880.	Death rate per 1,000.	Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Clayton	10	2	3	9	9	....	33	1,981	.....	....	1	2	....	....	....	1	....	3	3	3	4	1	....	....	....	2	1	....	....	1
Deptford	11	1	1	4	5	....	22	1,520	.....	1	2	1	....	....	1	....	....	1	....	3	1	1	1	2	....	....	....	....	....	1
East Greenwich	7	2	....	6	4	1	20	.....	.....	....	1	....	....	....	....	1	2	1	4	1	....	....	1	1	....	....	3	....	1	....
Franklin	7	5	1	13	8	....	34	2,480	.....	....	1	....	1	....	....	1	2	2	4	4	3	3	1	1	....	....	....	....	....	2
Glassboro	12	10	11	19	13	....	65	2,088	.....	2	2	2	1	....	....	4	4	5	8	7	3	....	1	4	....	1	1	....	....	2
Greenwich	4	2	3	12	4	....	25	2,598	.....	....	4	....	....	....	1	....	2	4	1	1	2	....	1	2	....	3	2	....	....	....
Harrison	15	5	4	12	17	....	53	2,841	.....	....	....	....	2	....	....	2	2	9	2	10	2	....	1	....	....	1	1	....	1	....
Logan	7	....	1	1	11	....	20	1,765	.....	....	1	....	....	....	....	....	1	4	....	2	2	1	....	....	....	1	....	....	1	....
Mantua	9	1	3	7	8	....	28	1,718	.....	....	5	....	....	....	....	1	....	5	....	2	2	1	3	1	1	....	....	1	....	1
Monroe	7	....	1	7	11	....	26	1,858	.....	....	1	....	....	....	....	....	1	4	4	2	2	4	1	5	....	1	....	1	....	1
Washington	8	3	2	11	7	....	31	1,866	.....	1	2	....	....	....	....	1	....	2	1	2	2	2	1	4	....	....	....	....	....	1
West Deptford	5	5	2	7	4	....	23	1,399	.....	....	1	....	....	....	....	1	....	2	1	1	2	2	1	4	....	....	....	....	1	1
Woodbury	13	4	2	13	14	1	47	2,298	.....	....	....	....	1	....	1	1	3	2	2	6	2	5	1	4	....	....	....	....	1	3
Woolwich	10	4	7	8	14	1	44	1,974	.....	1	....	....	4	....	3	....	6	2	2	5	2	5	1	1	....	2	....	....	1	1
Totals	125	44	41	129	129	3	471	25,886	18.19	5	21	5	9	....	8	11	61	32	43	48	32	25	10	28	1	13	8	1	6	13

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending July 1st, 1882.

HUDSON COUNTY. Population 187,944 — Statistical Divisions.	DEATHS AT ALL AGES.									PRINCIPAL CAUSES OF DEATH.																			
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.	Population, census of 1880.	Death-rate per 1,000.	Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Bayonne	73	62	25	74	18	....	252	9,372	26.89	5	9	....	11	1	1	13	31	8	12	50	26	4	7	9	....	8	1	....	2	16
Guttenberg	10	11	1	6	5	....	33	1,206	.....	....	....	....	....	....	....	4	6	2	1	3	3	4	....	....	....	....	....	....	....	1
Harrison	36	35	19	62	17	1	170	6,898	24.61	....	6	....	10	1	....	8	16	17	13	23	25	5	3	4	....	3	1	2	1	4
Hoboken	264	223	108	286	93	....	974	30,999	31.42	13	27	25	41	5	8	118	131	68	59	91	96	40	34	24	2	11	10	1	11	32
Jersey City	908	774	450	1121	377	6	3636	120,722	30.13	35	156	209	165	58	26	224	417	231	213	413	311	120	61	137	15	106	37	4	29	147
Kearny	7	3	6	18	1	....	35	777	.....	....	....	1	....	....	....	3	2	1	1	5	3	2	....	2	....	1	....	....	....	6
North Bergen	43	19	34	131	85	1	313	4,868	78.33	16	29	35	5	1	....	47	24	40	30	19	12	8	15	21	....	2	....	....	1	6
Town of Union	59	55	40	43	19	....	216	5,849	36.93	2	3	4	14	1	1	47	28	9	10	10	31	8	6	6	....	5	2	....	1	8
Union Township	7	10	4	9	3	1	34	1,310	.....	2	....	1	3	1	....	6	1	2	3	3	1	2	2	....	....	1	....	....	1	3
Weehawken	12	9	6	7	5	1	40	1,102	.....	1	1	....	....	....	....	....	2	2	3	4	3	1	2	....	....	....	....	....	1	....
West Hoboken	39	28	19	32	19	....	137	5,441	25.17	3	4	2	11	2	3	10	15	9	4	16	17	4	3	6	1	4	2	1	....	5
Totals	1458	1229	712	1789	642	10	5840	187,944	31.07	86	235	277	266	70	43	443	680	381	338	639	528	198	131	210	18	141	53	8	49	225

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year Ending July 1st, 1882.

HUNTERDON COUNTY. Population.....38,570 Statistical Divisions.	DEATHS AT ALL AGES.							Population, census of 1880.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																			
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Alexandria	1	1	....	6	14	....	22	1,324	.....	....	1	....	....	....	1	....	3	2	....	4	....	2	2	5	....	2	2	....	....	5
Bethlehem	7	5	5	13	23	2	55	2,830	.....	....	5	....	....	....	1	....	1	3	4	2	1	2	6	....	2	....	....	1	....
Clinton Township	7	3	....	9	19	....	37	2,133	.....	....	1	....	....	....	....	1	....	1	2	1	2	3	4	10	....	1	1	....	....	1
Delaware	3	1	3	11	22	....	40	3,092	.....	....	1	....	....	1	....	....	4	1	1	2	1	4	5	4	....	1	2	....	....	....
East Amwell	6	2	....	4	14	....	26	1,696	.....	....	....	....	....	....	1	....	....	....	1	....	....	2	1	2	....	....	1	....	....	....
Franklin	2	....	....	4	3	....	9	1,338	.....	....	1	....	....	....	....	....	....	....	2	....	....	2	....	1	....	....	1	....	....	....
Frenchtown	1	3	4	4	10	....	22	1,039	.....	1	....	....	4	....	....	....	2	....	....	....	....	2	....	2	1	....	....	....	....	....
High Bridge	10	3	4	10	9	....	36	2,209	.....	....	1	....	....	....	....	1	5	1	2	3	1	2	1	1	....	3	1	....	....	....
Holland	2	1	....	9	6	....	18	1,896	.....	....	3	1	....	....	....	....	....	1	1	....	....	2	....	1	....	1	1	....	....	2
Kingwood	2	1	....	3	11	1	18	1,694	.....	....	....	....	....	....	....	....	2	2	2	2	....	1	....	7	....	....	....	....	....	3
Lambertville	17	4	7	16	23	2	69	4,183	.....	1	....	....	....	....	....	....	....	1	....	....	....	....	....	4	....	....	....	1	2	1
Lebanon	12	3	3	13	16	....	47	2,699	.....	2	3	....	2	....	....	....	5	7	5	1	....	4	....	4	....	....	....	....	....	1
Raritan	12	3	4	10	24	1	54	4,188	.....	....	2	....	1	1	....	....	7	3	....	1	....	3	....	6	....	....	....	....	....	2
Readington	8	6	3	12	24	....	53	3,103	.....	....	2	....	2	....	....	1	4	5	2	2	....	3	....	4	....	2	....	....	....	1
Tewksbury	4	3	2	3	15	....	27	2,108	.....	....	....	....	....	....	....	1	1	1	....	2	....	2	....	6	2	1	2	....	....	....
Town of Clinton	2	1	2	3	3	....	10	842	.....	....	....	....	1	....	....	....	1	1	....	....	....	1	....	3	....	1	....	....	....	....
Union	3	2	2	2	5	....	14	1,168	.....	1	1	....	1	....	....	1	....	....	1	....	....	....	....	....	....	....	....	1	....	....
West Amwell	3	1	2	5	3	....	14	1,099	.....	....	1	....	....	....	....	....	3	....	2	....	1	....	....	....	....	....	....	....	1	....
Totals	103	41	40	136	244	6	570	38,570	14.77	9	24	1	15	3	6	6	47	26	35	54	23	56	26	65	4	14	20	2	8	21

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year Ending July 1st, 1882.

MERCER COUNTY. Population.....58,061 Statistical Divisions.	DEATHS AT ALL AGES.							Population, census of 1880.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																			
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Chambersburg	48	21	19	27	18	3	136	5,437	25.01	2	6	....	4	....	4	8	21	7	8	22	9	5	1	5	....	1	....	....	....
East Windsor	3	4	1	17	14	2	41	2,271	.....	1	2	1	....	....	....	....	1	2	2	5	2	4	2	2	....	1	1	....	....	1
Ewing	4	1	....	51	29	....	85	2,413	.....	....	3	....	....	....	....	....	1	2	4	4	1	4	....	5	....	....	....	....	....	....
Hamilton	11	7	5	29	24	2	78	3,370	.....	3	1	....	....	....	....	....	3	9	13	4	2	4	1	4	....	2	2	....	....	....
Hopewell	15	12	10	17	22	1	77	4,462	.....	....	1	....	2	2	1	6	2	7	17	3	4	7	2	12	....	2	1	....	....	....
Lawrence	13	10	4	21	7	....	55	3,174	.....	3	1	....	1	....	1	....	3	7	9	7	4	4	2	2	....	1	1	....	....	....
Millham	1	....	....	....	2	....	3	.....	.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1	....	1	....
Princeton	24	12	9	17	23	....	85	4,348	.....	1	3	1	1	....	1	2	6	7	7	8	9	1	3	5	....	4	1	....	1	4
Trenton	141	76	53	216	107	21	614	29,910	20.53	8	20	17	....	5	3	21	75	59	67	69	32	25	14	29	5	12	9	3	1	22
Washington	1	1	....	7	8	....	17	1,281	.....	....	1	....	....	....	1	....	....	2	....	....	....	....	....	4	....	....	....	1	....	....	1
West Windsor	4	1	1	3	9	....	18	1,396	.....	....	....	....	2	....	....	....	....	....	1	....	3	....	....	5	1	....	....	....	1	....	3
Totals	265	145	102	405	263	29	1209	58,061	20.82	18	37	19	10	11	11	43	128	115	102	119	62	52	26	109	10	36	22	3	5	37

Death-rate per 1,000, without cities, 20.21.

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending July 1st, 1882.

MIDDLESEX COUNTY. Population.....52,286 Statistical Divisions.	DEATHS AT ALL AGES.									PRINCIPAL CAUSES OF DEATH.																			
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.	Population, census of 1880.	Death-rate per 1,000.	Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Cranbury	7	3	2	10	7	....	29	1,599	.....	....	1	....	....	....	....	....	2	2	4	5	1	....	....	1	....	1	1	....	1	1
East Brunswick	17	8	8	18	13	3	67	3,272	.....	....	1	1	....	....	....	1	2	1	2	3	1	....	....	1	....	1	....	....	....	....
Madison	5	2	2	5	7	....	21	1,662	.....	1	1	....	....	....	....	....	2	1	3	1	....	2	....	....	....	1	....	....	....	....
Monroe	5	1	5	15	15	....	41	3,017	.....	....	2	....	....	....	....	....	4	1	1	5	....	....	....	....	....	1	....	....	....	....
New Brunswick	93	57	49	113	75	4	391	17,166	22.78	6	12	9	20	....	....	4	14	46	37	36	30	14	15	17	3	11	12	1	1	12
North Brunswick	4	1	....	4	10	....	14	1,251	.....	....	1	....	....	....	....	....	....	1	....	5	....	1	....	....	....	....	....	....	....	....
Perth Amboy	37	29	13	39	14	2	134	4,808	.....	4	....	1	5	....	3	3	29	4	13	9	16	6	....	6	....	4	1	2	....	7
Piscataway	5	3	6	14	21	....	54	3,242	.....	1	....	....	....	....	....	....	8	....	6	6	1	3	4	5	....	2	....	....	....	....
Raritan	9	5	10	17	18	1	60	3,789	.....	....	....	....	....	....	....	....	4	....	....	4	....	....	....	1	....	1	....	....	1	....
Sayreville	7	3	1	9	3	....	26	1,930	.....	2	1	....	1	1	....	....	3	....	5	7	....	1	....	1	....	4	....	....	1	1
South Amboy	18	16	7	37	13	....	91	3,648	.....	....	....	....	6	....	....	....	4	....	....	3	....	2	1	5	....	4	....	....	2	2
South Brunswick	5	3	1	8	19	1	37	2,803	.....	....	1	....	1	....	....	6	....	....	....	2	....	2	2	3	....	....	....	1	2	3
Woodbridge	26	12	9	22	16	....	85	4,099	.....	1	3	....	3	....	....	11	6	8	7	9	5	2	2	3	....	....	....	....	....	....
Totals	238	151	113	311	231	11	1055	52,286	20.18	15	33	11	43	1	8	45	110	57	80	104	64	45	33	61	4	33	22	5	10	50

Death-rate per 1,000, without cities, 18.91.

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending July 1st, 1882.

MONMOUTH COUNTY. Population.....55,538 Statistical Divisions.	DEATHS AT ALL AGES.									PRINCIPAL CAUSES OF DEATH.																			
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.	Population, census of 1880.	Death rate per 1,000.	Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Atlantic	4	6	4	9	8	....	31	1,743	.....	1	1	2	....	5	....	....	1	1	4	1	2	1	....	3	....	1	....	....	....	....
Eatontown	15	7	1	10	12	....	45	2,642	.....	1	2	....	1	2	....	....	1	3	1	2	4	2	1	4	....	1	1	....	....	....
Freehold	12	5	11	26	23	1	78	4,302	.....	1	....	1	2	....	3	1	3	5	1	2	11	4	2	13	....	4	....	....	1	....
Holmdel	3	....	1	8	4	....	16	1,575	.....	....	....	....	....	1	....	....	1	2	1	1	2	1	1	2	....	....	....	....	....	2
Howell	15	5	4	20	17	3	64	3,374	.....	....	4	....	1	....	....	....	9	2	2	1	5	5	3	12	....	4	....	....	....	....
Manalapan	4	1	1	6	13	5	30	2,175	.....	....	....	....	....	....	....	1	....	1	....	1	2	3	4	5	....	1	....	....	1	....
Marlboro	2	4	4	9	8	....	27	2,193	.....	....	2	....	1	....	....	....	2	....	7	2	1	3	3	2	....	2	....	....	....	....
Matawan	11	14	9	22	17	....	73	2,669	.....	1	2	....	2	....	....	2	7	8	7	3	5	5	2	5	....	2	....	....	....	....
Middletown	15	11	7	20	30	....	83	5,059	.....	1	....	1	4	1	....	2	2	8	3	4	7	5	10	8	....	2	....	1	....	3
Millstone	8	1	1	8	9	....	27	2,080	.....	....	1	....	....	....	....	2	2	1	2	1	1	1	1	1	....	....	....	1	....	....
Neptune	54	22	18	49	31	4	178	4,187	.....	3	1	....	12	2	....	2	35	9	6	18	15	11	4	10	....	5	1	1	....	1
Ocean	39	21	13	40	23	5	146	6,027	.....	1	2	....	6	....	2	5	23	6	3	21	7	9	6	13	1	5	1	1	1	10
Raritan	16	9	6	25	25	3	84	3,891	.....	....	2	1	2	....	....	4	9	2	5	8	8	2	3	5	2	2	3	1	....	4
Shrewsbury	23	13	15	38	34	2	125	6,826	.....	....	3	....	3	....	....	2	12	3	8	8	10	7	3	6	16	....	3	2	1	4
Upper Freehold	8	....	3	20	23	....	59	3,336	.....	....	1	....	....	....	1	....	2	5	13	2	....	3	1	8	....	2	2	1	....	4
Wall	21	16	8	27	19	2	87	3,829	.....	....	3	....	....	....	....	6	10	4	5	9	3	5	4	10	....	5	2	....	2	1
Totals	250	129	106	337	306	25	1153	55,538	20.76	9	24	5	40	3	11	33	130	68	72	113	65	76	51	114	4	43	19	5	5	41

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending July 1st, 1882.

MORRIS COUNTY. Population.....50,861 Statistical Divisions.	DEATHS AT ALL AGES.							Population, census of 1880.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																		
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Boonton	9	4	8	15	17	....	53	2,682	.....	1	2	....	3	....	....	5	1	2	5	4	1	4	2	8	....	2	....	....	....	1
Chatham	15	10	8	27	25	1	86	4,276	.....	3	4	....	7	....	2	6	4	2	6	8	4	6	4	3	....	3	....	....	4	2
Chester	14	3	4	14	12	....	47	2,337	.....	1	1	....	....	....	....	1	7	2	2	5	1	5	1	1	....	1	1	....	1	4
Hanover	7	6	7	57	46	2	125	4,138	.....	4	1	....	1	....	....	7	3	7	7	18	2	8	4	39	....	3	....	....	1	....
Jefferson	2	5	3	10	6	....	26	1,792	.....	....	....	....	....	....	....	2	1	1	3	2	2	5	....	2	1	1	....	....	....	4
Mendham	2	1	1	10	10	....	24	1,526	.....	1	....	....	....	....	....	....	2	3	3	2	1	....	1	3	....	3	1	....	....	....
Montville	7	4	3	11	14	....	39	1,270	.....	....	5	....	....	....	....	3	3	1	4	4	2	1	2	5	....	....	1	1	....	....
Morristown	22	15	13	41	29	1	121	6,837	17.70	2	....	....	3	....	....	3	15	12	10	9	2	7	5	8	....	9	4	1	....	4
Mount Olive	9	6	2	11	7	1	36	1,982	.....	1	....	....	2	1	....	1	5	2	4	3	4	3	....	2	....	....	2	....	....	3
Passaic	7	1	2	8	11	1	30	1,896	.....	....	....	....	1	....	....	1	4	1	2	4	1	1	....	1	....	3	....	....	....	....
Pequannock	4	15	16	12	6	1	54	2,229	.....	2	....	....	15	....	....	8	1	1	8	4	1	4	4	3	....	....	....	1	....	....
Randolph	33	32	28	31	19	3	146	7,700	.....	3	2	....	21	....	3	9	12	3	6	17	14	7	2	5	....	2	3	....	3	7
Rockaway	27	33	28	33	24	....	145	7,366	.....	2	6	....	26	....	1	2	2	3	6	34	12	4	6	4	....	4	2	....	....	10
Roxbury	10	7	3	10	3	....	33	2,139	.....	....	3	....	6	....	1	2	3	1	2	2	1	2	1	1	....	1	1	....	....	....
Washington	9	5	2	12	6	....	34	2,681	.....	1	2	....	1	....	....	....	4	2	....	2	....	....	1	4	....	3	....	....	....	3
Totals	177	147	128	302	235	10	999	50,861	19.64	21	26	....	86	1	7	50	76	52	63	120	61	57	33	88	1	35	15	2	10	38

Death-rate per 1,000, without cities, 19.94.

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Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year Ending July 1st, 1882.

OCEAN COUNTY. Population.....14,455 Statistical Divisions.	DEATHS AT ALL AGES.							Population, census of 1880.	Death rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																		
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Berkley	3	1	....	2	3	....	9	683	.....	....	....	....	....	....	....	....	....	1	1	1	1	1	....	1	1	....	....	....	....	....
Brick	6	7	2	14	7	1	37	2,990	.....	....	2	....	....	1	1	....	....	....	1	4	5	1	....	....	....	....	1	1	1	....
Dover	8	1	3	11	8	1	32	2,439	.....	....	....	....	....	....	....	4	1	4	5	4	1	1	....	1	....	1	....	....	....	1
Eaglewood	2	1	2	5	4	....	14	592	.....	....	....	....	....	....	....	....	....	1	2	....	....	1	1	....	....	....	....	....	....	....
Jackson	2	1	1	9	4	....	17	1,803	.....	....	1	....	....	....	....	....	2	2	2	....	1	....	....	1	....	....	....	....	....	1
Lacey	4	1	4	6	1	....	16	814	.....	....	1	....	....	....	....	4	....	1	2	1	1	1	....	....	....	1	....	....	....	....
Manchester	5	2	5	4	2	....	18	1,057	.....	....	1	....	1	....	....	3	2	....	1	1	....	....	....	1	....	1	....	1	....	....
Ocean	3	2	....	4	2	....	11	484	.....	....	....	....	....	....	....	....	....	....	....	1	....	1	....	....	....	....	....	1	....	....
Plumsted	13	....	....	9	6	....	28	1,561	.....	....	1	....	....	....	1	2	5	4	2	2	....	....	....	....	....	....	1	....	....	....
Stafford	2	....	1	8	7	1	19	1,088	.....	....	1	....	....	....	....	....	....	2	....	1	....	1	....	....	....	....	....	....	....	....
Union	7	....	....	7	4	....	18	1,034	.....	....	1	....	....	....	....	....	3	2	....	1	....	....	....	....	....	4	....	....	....	....
Totals	55	16	18	79	48	3	219	14,455	15.15	....	10	....	1	1	2	13	16	19	29	16	19	13	1	13	1	10	3	3	3	2

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Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year Ending July 1st, 1882.

PASSAIC COUNTY. Population....68,860 Statistical Divisions.	DEATH AT ALL AGES.									PRINCIPAL CAUSES OF DEATH.																			
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.	Population, census of 1880.	Death rate per 1,000.	Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Aquackanonck	3	4	3	3	7	1	21	1,781	.....	....	....	....	3	....	....	1	1	1	....	4	1	....	....	2	....	1	3	....	....	1
Little Falls	5	8	6	10	7	....	37	1,404	.....	....	1	....	5	....	....	1	3	3	2	4	2	2	....	5	....	1	....	....	2	1
Manchester	5	1	2	9	4	....	21	1,513	.....	....	1	....	....	....	....	....	1	1	....	....	1	....	....	....	....	....	....	....	....	....
Passaic City	47	28	17	33	24	1	149	6,534	22 82	3	9	....	6	....	4	3	24	5	18	12	15	7	4	....	1	....	....	....	2	7
Paterson	417	260	150	463	221	....	1511	51,431	29.61	24	49	3	101	3	10	37	232	106	112	178	108	57	51	52	6	63	19	5	12	31
Pompton	13	10	7	9	6	1	46	2,251	.....	2	....	....	7	....	....	4	5	1	....	2	2	3	2	....	....	2	1	....	....	....
Wayne	3	2	2	3	4	....	17	1,757	.....	....	....	....	2	....	....	1	2	3	1	....	2	....	....	....	....	....	....	....	....	1
West Milford	6	9	10	8	11	1	45	2,591	.....	1	1	....	10	....	....	6	1	2	1	2	1	3	1	5	....	2	....	1	....	2
Totals	500	322	197	540	284	4	1847	68,860	26.82	30	61	3	134	3	14	53	269	123	138	203	136	73	58	74	7	75	23	6	16	45

Death-rate per 1,000, without cities, 16.55.

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending July 1st, 1882.

SALEM COUNTY. Population....24,579 Statistical Divisions.	DEATHS AT ALL AGES.									PRINCIPAL CAUSES OF DEATH.																			
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.	Population, census of 1880.	Death rate per 1,000.	Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Elsinboro	2	....	....	2	1	....	5	570	.....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	1	....	1	....	....	....	....
Lower Alloways Creek	4	....	1	4	5	....	14	1,373	.....	....	1	....	....	....	....	1	1	1	....	....	....	....	....	....	4	1	....	....	....	....
Lower Penn's Neck	7	1	4	3	9	....	24	1,334	.....	....	....	....	....	....	....	1	3	3	4	....	....	4	....	....	....	....	....	....	....	....
Mannington	12	11	3	16	17	....	59	2,230	.....	2	2	....	....	....	....	1	2	5	9	7	1	5	1	....	1	1	....	....	....	1
Oldmans	4	4	3	2	4	1	17	.....	.....	....	1	....	2	....	4	....	....	1	1	....	1	4	....	....	....	1	....	....	....	....
Pilesgrove	10	9	3	18	21	1	67	3,497	.....	....	5	....	1	....	4	4	....	2	1	6	4	4	....	1	....	1	....	1	....	1
Pittsgrove	8	12	3	8	8	....	44	1,778	.....	....	2	....	1	....	1	10	5	3	1	4	1	4	1	2	....	5	....	....	....	1
Quinton	3	4	3	4	5	1	20	1,390	.....	....	....	....	....	....	....	1	2	1	2	....	....	1	....	4	....	1	2	1	....	1
Salem	19	11	10	25	32	2	99	5,056	19.58	3	5	....	1	1	....	2	2	1	2	7	1	2	2	....	1	1	....	....	1	....
Upper Alloways Creek	2	2	3	7	14	....	28	1,917	.....	....	....	....	1	....	....	3	6	1	4	7	....	4	....	2	....	3	6	1	1	....
Upper Penn's Neck	11	5	7	7	8	4	42	3,361	.....	....	1	....	2	....	....	3	5	3	4	5	3	1	....	2	1	3	1	....	1	1
Upper Pittsgrove	9	5	1	8	13	....	36	2,073	.....	....	5	....	....	....	3	3	3	4	....	5	....	1	....	2	1	3	1	....	1	3
Totals	91	64	50	104	137	9	455	24,579	18.51	5	22	....	7	1	13	27	30	39	42	39	20	25	6	35	3	17	13	1	4	8

Death-rate per 1,000, without cities, 18.24.

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending July 1st, 1882.

SOMERSET COUNTY. Population.....27,162 Statistical Divisions.	DEATHS AT ALL AGES.									PRINCIPAL CAUSES OF DEATH.																				
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.	Population, census of 1880.	Death rate per 1,000.	Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Bedminster	9	5	5	10	11	....	40	1,812	.....	3	....	....	3	....	....	....	6	....	2	1	....	4	2	....	....	....	3	3	....	....	1
Bernards	11	6	3	14	13	....	47	2,622	.....	2	1	....	1	....	....	2	8	1	1	7	2	1	2	....	1	4	....	....	....	....
Branchburg	4	2	1	7	10	....	24	1,316	.....	1	....	....	....	....	....	....	1	....	1	1	2	1	2	....	....	2	....	....	3	....
Bridgewater	34	18	23	34	43	2	154	7,997	.....	7	4	....	4	3	....	9	12	4	7	13	11	12	4	16	1	9	1	....	....	3
Franklin	14	5	8	17	27	2	73	3,818	.....	2	2	....	....	1	1	3	5	2	3	10	4	8	4	4	....	10	....	....	5	3
Hillsborough	9	2	5	18	17	1	52	3,248	.....	1	....	....	....	1	....	5	1	1	4	9	4	10	1	1	1	3	....	1	....	1
Montgomery	4	6	1	4	13	....	28	1,928	.....	....	....	....	....	....	1	....	1	1	3	8	2	6	1	5	....	2	....	....	....	1
North Plainfield	12	4	12	15	17	....	60	3,217	.....	....	1	....	2	1	1	2	4	3	3	8	....	3	1	3	1	2	....	....	....	5
Warren	2	4	6	10	4	....	26	1,204	.....	....	4	....	....	....	....	1	2	4	3	1	2	3	1	....	....	1	....	....	....	1
Totals	99	52	64	129	155	5	504	27,162	18.55	16	12	....	10	6	3	23	42	17	32	53	34	41	19	51	6	34	10	1	9	19

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year Ending July 1st, 1882.

SUSSEX COUNTY. Population.....23,539 Statistical Divisions.	DEATHS AT ALL AGES.									PRINCIPAL CAUSES OF DEATH.																				
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.	Population, census of 1880.	Death rate per 1,000.	Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Andover	3	4	4	8	10	....	29	1,150	.....	....	1	....	1	....	....	....	5	1	1	2	....	....	....	....	....	....	....	....	....	....
Byram	6	5	1	12	11	....	34	1,406	.....	2	....	....	....	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....
Green	4	3	3	3	8	1	25	1,682	.....	....	2	....	....	1	....	....	4	1	2	1	....	3	1	....	....	1	....	....	....	....
Hardyston	....	....	....	3	1	....	4	727	.....	....	....	....	1	....	....	....	1	1	....	....	....	1	....	....	....	....	....	....	....	....
Hampton	13	12	11	14	18	2	70	2,645	.....	....	....	....	4	....	....	....	1	....	....	1	....	....	....	1	....	1	....	....	....	....
Lafayette	1	7	1	2	1	1	13	895	.....	2	1	....	12	....	....	4	2	1	1	12	5	1	2	....	....	....	1	....	....	....
Montague	2	....	....	5	8	....	15	781	.....	....	....	....	2	....	....	2	....	....	....	....	....	7	3	1	....	4	....	....	....	1
Newton	4	....	....	5	6	....	15	1,032	.....	....	....	....	....	....	....	....	1	1	....	2	....	1	....	1	1	....	1	....	....	4
Sandyston	10	16	10	12	5	4	64	2,513	.....	....	....	....	10	....	....	4	1	2	1	2	....	2	1	1	....	1	....	....	1	....
Sparta	....	2	4	3	11	2	22	1,195	.....	....	3	....	....	....	....	....	7	2	1	4	2	7	1	....	....	....	....	....	....	2
Stillwater	10	6	5	11	8	3	43	2,274	.....	....	1	....	3	....	....	1	1	2	2	2	2	4	1	3	....	1	....	....	....	1
Vernon	3	6	8	12	14	1	39	1,502	.....	2	1	....	1	....	....	2	5	1	2	4	2	4	1	2	....	1	....	....	....	....
Wallpack	2	4	4	7	13	....	30	1,811	.....	1	2	....	6	....	....	2	5	1	3	5	2	4	1	1	....	2	....	1	1	1
Wantage	....	....	2	2	....	....	4	575	.....	....	....	....	1	....	....	3	....	....	3	5	2	1	1	2	1	5	1	....	....	....	....
	6	8	6	13	21	....	54	3,361	.....	1	5	....	3	1	....	1	4	4	2	6	1	3	5	4	....	1	2	1	....	1
Totals	63	73	54	116	135	14	455	23,539	19.32	9	17	....	44	2	....	26	32	21	26	38	23	33	21	27	3	22	8	....	7	16

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year Ending July 1st, 1882.

UNION COUNTY. Population ..... 55,571 Statistical Divisions.	DEATHS AT ALL AGES.									PRINCIPAL CAUSES OF DEATH.																				
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.	Population, census of 1880.	Death rate per 1,000.	Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Clark	3	....	....	3	3	....	9	353	.....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	3	....
Cranford	3	2	1	3	1	....	10	1,184	.....	....	1	....	....	....	....	....	....	1	2	....	....	....	....	....	....	....	....	....	1
Elizabeth	148	131	74	165	91	3	612	28,229	21.68	13	7	....	41	10	6	36	65	38	39	56	79	28	10	32	....	13	11	1	4	30
Fanwood	4	2	3	2	6	....	17	1,167	.....	3	....	....	1	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....
Linden	6	7	1	13	11	....	38	1,889	.....	1	1	....	1	....	....	....	....	2	3	3	6	2	2	2	....	2	1	....	1	....
New Providence	7	....	....	10	3	1	21	781	.....	....	1	....	....	....	....	1	....	5	1	1	3	....	....	....	....	1	....	....	....	1
Plainfield	34	20	20	30	47	....	151	8,125	18.58	....	2	....	5	7	....	10	17	5	17	23	9	6	7	10	1	3	....	....	....	1
Railway	33	37	22	46	45	....	183	6,455	28.35	1	1	3	15	3	2	10	13	2	11	36	15	14	4	8	2	7	3	....	1	....
Springfield	1	2	1	3	3	....	10	844	.....	2	....	....	....	....	....	....	....	1	....	2	1	....	....	1	....	....	....	....	....	....
Summit	10	7	2	16	6	....	41	1,910	.....	2	3	....	....	....	....	4	6	3	5	2	2	....	1	2	....	....	....	....	2	1
Union	8	3	1	8	9	....	27	2,418	.....	1	....	....	1	....	....	....	1	2	4	4	1	2	....	1	1	2	....	....	....	....
Westfield	10	12	5	19	11	1	58	2,216	.....	1	1	....	8	....	5	....	4	5	5	5	3	3	1	1	....	2	1	....	1	....
Totals	265	223	130	318	236	5	1177	55,571	21.18	24	21	3	72	20	15	63	114	70	86	137	113	55	25	57	4	31	24	1	12	48

Death-rate per 1,000, without cities, 18.01.

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending July 1st, 1882.

WARREN COUNTY. Population ..... 36,589 Statistical Divisions.	DEATHS AT ALL AGES.									PRINCIPAL CAUSES OF DEATH.																				
	Under one.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Undefined.	Total, including undefined.	Population, census of 1880.	Death rate per 1,000.	Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Diarrheal diseases.	Consumption. M.	Consumption. F.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Erysipelas.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Allamuchy	3	3	2	1	5	....	14	648	.....	1	....	....	....	2	....	....	....	....	1	1	2	1	....	....	....	1	....	....	....	....
Belvidere	3	6	8	7	10	....	34	1,773	.....	1	....	....	7	1	....	1	1	....	4	5	3	2	2	3	....	....	1	1	1	....
Blairstown	5	4	2	6	11	....	28	1,458	.....	....	....	....	....	....	....	....	3	1	2	5	3	2	1	1	1	2	1	1	....	....
Franklin	6	3	5	5	11	....	30	1,529	.....	....	....	....	2	....	....	1	5	1	2	1	....	2	2	3	....	....	1	....	....	....
Freilinghuysen	....	....	....	1	3	2	6	1,042	.....	1	....	....	....	....	....	....	....	1	....	1	....	....	....	....	....	....	....	....	....	1
Greenwich	13	6	6	13	12	1	51	2,554	.....	....	2	....	3	....	....	6	7	1	3	2	....	....	....	3	....	....	2	1	1	2
Hackettstown	10	15	7	16	10	....	58	2,502	.....	2	1	....	10	....	....	2	4	1	7	3	7	3	....	1	1	2	1	....	1	2
Hardwick	....	2	1	2	2	....	7	583	.....	....	....	....	....	....	....	....	....	1	....	....	1	....	1	....	....	....	....	....	....	....
Harmony	7	2	8	6	7	1	31	1,350	.....	1	....	....	....	....	....	3	2	1	3	1	1	1	....	2	....	....	....	....	1	2
Hope	7	10	7	5	5	1	35	1,569	.....	....	1	....	5	....	....	2	6	2	3	2	1	2	1	1	....	1	1	....	....	....
Independence	2	2	4	8	....	....	16	1,018	.....	....	2	....	....	....	....	....	....	1	3	1	1	....	....	1	....	3	....	....	....	....
Knowlton	5	2	10	7	13	....	37	1,476	.....	....	4	....	1	....	....	3	2	2	1	5	3	1	1	4	....	....	1	....	....	1
Lapatcong	8	5	3	4	9	....	29	1,591	.....	....	1	....	....	....	....	6	4	....	....	1	1	....	....	4	....	1	....	....	....	....
Mansfield	7	8	8	8	16	2	49	1,709	.....	....	....	....	6	1	1	3	2	1	3	7	3	1	....	5	....	5	....	....	....	....
Oxford	26	28	19	22	16	1	112	4,594	.....	....	2	7	19	....	....	4	16	1	4	17	8	2	2	6	1	2	....	....	3	4
Pahaquarry	....	....	....	....	....	....	....	418	.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Phillipsburg	84	34	21	34	26	....	169	7,181	23.53	2	6	....	....	....	3	26	24	15	6	13	18	11	1	10	....	2	1	....	2	1
Pohatcong	1	3	2	6	1	....	13	.....	.....	1	1	....	....	....	....	....	....	....	1	4	1	2	....	....	....	....	....	....	....	....
Washington Borough	12	11	14	19	6	2	64	2,142	.....	....	6	....	8	1	1	....	6	2	6	4	3	3	1	6	1	....	....	....	4	....
Washingtown Township	5	2	5	8	11	....	31	1,452	.....	....	1	3	1	....	1	....	3	1	1	4	....	2	1	3	1	....	....	1	1	....
Totals	174	146	132	178	174	10	814	36,589	22.24	9	27	10	62	5	6	62	85	33	48	78	58	42	14	56	5	21	9	4	10	18

Death-rate per 1,000, without cities, 21.94.

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NOTE.—The article alluded to, page 28 of Report, is postponed until the next Report.

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