1880-1886 STATE HEALTH DEPARTMENT

ANNUAL REPORTS

BOROUGH OF PRINCETON/PRINCETON TOWNSHIP

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FOURTH ANNUAL REPORT

OF THE

BOARD OF HEALTH

OF THE

STATE OF NEW JERSEY,

1880.

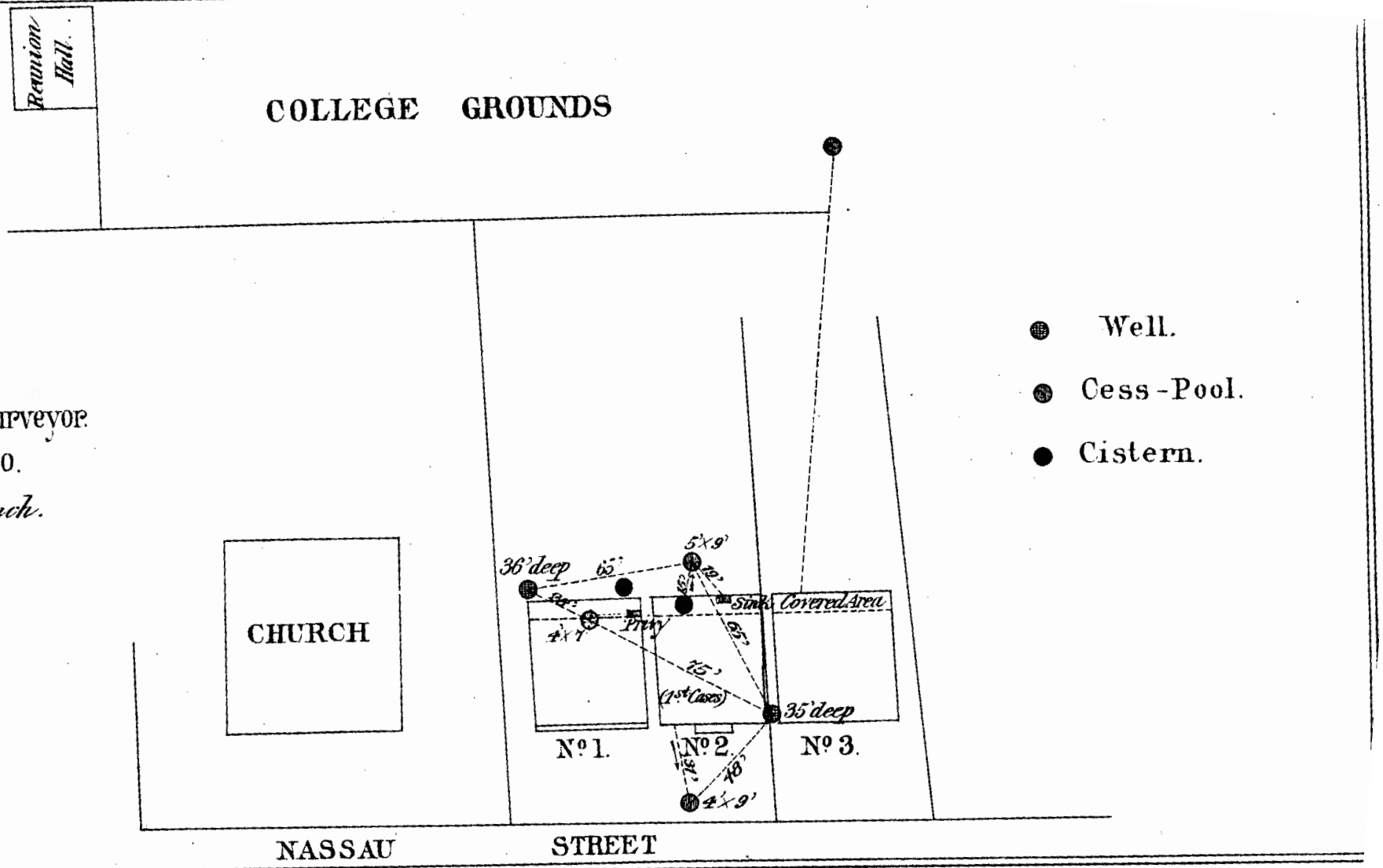
REPORT OF THE SECRETARY OF THE BOARD

To His Excellency, George B. McClellan,

GOVERNOR:—On behalf of the State Board of Health of New Jersey, I have the honor to present to your Excellency a brief survey of the work of the Board for the past year, and such accompanying statements, papers and reports as bear upon the vital conditions of the people. The increase of duties assigned to us by the last Legislature, the formation of very many new local Boards of Health, the occurrence of several endemic diseases and the inquisitive spirit manifested as to various matters of health administration, have required, as never before, our active attention. The law which requires local Boards of Health to be formed, has resulted in a large increase of interest in local health administration. Subjects of the utmost importance to our citizens are thus locally discussed and public opinion is educated by the information which is sought and secured from various sources. One of the designs of this Board has for the first time been fully realized, the past year. Its advice has been sought in many measures of local interest, so that the service the State is thus doing has come to be appreciated, both in the interests of health, and the prosperity that so much depends thereupon. The local reports we are receiving, enable us to estimate the general condition of the population, while the vital statistics are giving us records of precision as to the courses and causes of disease. In nearly all the localities that most need it, there are now those who have an intelligent conviction of many things needing to be done, and who are seeking to make that public opinion, which must ever preceed, or to a reasonable extent accompany, legal enactments. Foundations are being laid for a careful, systematic and faithful administration of those public affairs which have to do with the most vital concerns of our population.

While we have to regret the occurrence of some endemic diseases of a fatal character and a wide-spread extension of periodic fevers, yet the prevalence of serious or fatal disease was much less than for the period of our last report. The returns made up from July to July of each year show a less number of deaths by about twelve hundred than the previous year. While localities have suffered, there has been no wide-spread, fatal epidemic. The study of health questions is becoming organized into a system. From many of our cities and from some county and village localities, we have evidence of a comprehension of the necessities of a close watchfulness over the causes of disease, with a view to their prevention or abatement. It is no longer viewed as merely a professional matter, but as one which concerns the industrial welfare of the people. The advice of the Board is often asked in matters of local health administration, and we have thus been able to aid local authorities. We are now fairly in the position for a comprehensive oversight of the health interests of the State, and will be able to indicate how those evils are to be guarded against, which most imperil the life and health welfare of our citizens. Much information in this direction is diffused by the annual State report, as well as by personal correspondence and other agencies which we are able to promote. The library of the Board now presents a good outline of the various subjects of sanitary science and art, and we trust ere long to make it more extensively accessible to the people. Specimens of maps and other appliances also serve as models for the work necessary to be done by many of our cities and some of our closely settled rural districts. The wide duties imposed under the present law have brought us more in contact with localities and enabled us to indicate the most pressing wants. Requests are frequent for the presentation of these subjects to public attention, in connection with Teachers' Institutes and by Local Boards.

It has been our plan, in connection with the report of the secretary, to fully consider some one of the more prominent prevailing diseases of the State. Last year periodic or other malarial diseases were considered.



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ENTERIC FEVER AT PRINCETON.

BY EZRA M. HUNT, M. D.

The State Board of Health of New Jersey commenced an examination into the sanitary condition of Princeton, on Tuesday, May 25, 1880. Vague reports had reached us that a fever of an intermittent or remittent variety was prevailing among the students of the College. One student had died a week after removal to his home, but it was claimed that the fever had no special type, and the fatigue of transfer had increased the severity of the symtoms. The disease was spoken of as malarial fever, a term not in use in any diagnostic sense in medical nosology. No case dates earlier than March 23d, probably none earlier than April, during the first week of which several cases commenced.

THE TYPE OF THE FEVER.

Careful inquiry as to the symptoms and cause of the disease, led other physicians, as well as myself, to entertain the belief that all the cases could not be identified as of the usual periodic type.

There seem to have been no new and well-declared cases in April, after the first week. It would appear from inquiry among students that many were complaining of headache and a depressed condition of vitality, and many were taking some tonic medicine. But few were interrupted from class attendance until about the 8th to the 20th of May, when there was a decided increase of sickness.

On the night of the 25th, a student died somewhat suddenly, after a sickness of ten days. His case had been called malarial fever, or towards its close typho-malarial. The State Medical Society of New Jersey was holding its annual session, at Prince-

ton, at this time. Some of its members, who had sought careful detail of this and the previous cases in April, were convinced that the fever was endemic in its character, and not of the usual remittent type. The case referred to had been seen that day by one or two of our most competent medical men. They had no doubt that the patient died of typhoid fever.

In addition we have reason to think that a majority of the students were not in a condition of health, such as generally exists in this college.

During the months of April, May, June and July, there occurred, in all, about forty cases of this, or a kindred type of fever, and eight deaths. The physicians of Princeton, some of whom regarded their first cases as remittents, and some of whom claim that there were cases that showed no typhoid element, nevertheless recognize that in the cases that proved fatal and some others, the fever was distinctly typhoid.

Of one of the first, if not the first case, I have the following detail from his own brother, an able medical practitioner.

PATERSON, June 5, 1880.

DEAR SIR:

Your letter to Dr. H. of Glen Gardner, was forwarded to me with a request to reply. My brother left Princeton April 8, 1880, reaching home in afternoon of same day, very much exhausted. He had complained of being sick some two weeks before leaving P., though able, through considerable effort, to prosecute his studies. While in P., his symptoms were loss of appetite, alternating diarrhœa and constipation, headache, slight fever and general prostration. Upon his arrival home, he at once took to bed, complaining of general lassitude, nervous irritability, fretful, and fearful concerning his recovery. My brother was telegraphed for on Saturday, the 10th, but did not get there until Sunday, the 11th. He found him as above described, except a sore throat. His first impression was that of typhoid fever, but on the following morning, he noticed what seemed to be the remains of a diptheretic membrane with general pharyngetis. The next day, Wednesday, I was telegraphed for. I left immediately, arriving there at 11, P. M. I found him with temperature 105°, pulse, 140. He had been delirious all day, and was partially so on my arrival. Under large doses of quinia and sponging, his temperature marked 103½°, at 8 o'clock, Thursday morning; in the evening of this day, it reached 104½°. On Friday morning it again fell to 102¾°, but in the afternoon and evening of this day it again went to 105°. Saturday it continued

nearly the same. Sunday there was no accurate temperature taken, as you will observe the reason where a full history is noted. He died early Monday morning, (1 A. M.) April 19th. The pulse, during the days before Sunday, ran from 120 to 140; but on Sunday it reached 160 and 180, and so feeble and rapid that an accurate count could not be made. There was delirium all this time of an active character. He was, until Sunday, able to recognize an acquaintance, and call out the name when requested, though he was unable at any time to understand a conversation or to make an intelligent reply, or in condition for any one to converse with him the last four or five days before death. The tongue was exceedingly dry, swollen and cracked; the fauces red, and the same general appearance as the tongue. There was, at times, a considerable secretion of yellow, tough mucus in his throat, which caused a good deal of choking. It was necessary, at times, to clear his fauces and mouth with the fingers and wet rags. Sordes covered the teeth. There were involuntary discharges. On Friday, the stools were largely of blood, and were quite copious. The abdomen was tympanitic and very markedly so Friday, Saturday and Sunday. Milk and other fluids were vomited the last two days. There began, on Thursday, a considerable jaclitation. The flexor muscles of the arm and fore-arm were in an almost constant state of clonic contraction; this extended to the muscles of the neck, face, jaw and eyelids. This agitation increased in extent and violence each day until his death. The hands were fixed firmly upon the fore-arm, the fingers left their imprint on the palms of the hands and the fore-arm upon the arm. He needed constant assistance and great force to control the constant movements. The muscles of the lower jaw were in such a constant tremor that it was almost impossible for him to swallow. The muscular spasm did not extend to the lower extremities until the morning of the 18th, the day preceding death, when the flexor muscles were more or less involved. There was none, or at least very slight, oposthrotonos. I think the head was thrown back slightly, though probably due to the spasm of the muscles of the neck. There were a few (three or four) rose-colored spots over the abdomen, which resembled typhoid fever spots; they disappeared under pressure; they were not seen only three or four days. The vomiting was probably partially due to the extreme tympanitic condition. His tongue was exceedingly dry and cracked, and at times he was unable to protrude it between the teeth. The teeth were completely covered with sordes. My diagnosis was typhoid complicated by irritation in basilic and upper spinal region. If there is anything more you would like to know, address me here and I will write at once.

Respectfully yours,

G. W. T

Two cases which I saw in the earlier stages, about May 27th, were distinctly typhoid, and were so considered by the attending physician. On May 31st, being summoned by telegraph to see Dr. Wycoff, who had been taken ill, I saw for him his fever cases, six in number. Of these, four had the typhoid rash, and all had the symptoms generally accompanying typhoid fever. Prof. Austin Flint and Prof. E. G. Janeway saw other cases which satisfied them that the disease was enteric fever. I have heard directly from several cases which were treated by able physicians, at the homes of the students in other places, and which were distinctly recognized as typhoid. In the cases of death, most of them had serious hemorrhage from the bowels, and in one case death was sudden, as believed, from perforation of the intestine. Most of the cases had the rose-colored or lenticular eruption. The only case in which a post mortem was hoped for failed by delay of communication, but it scarcely seemed necessary to confirm so many agreeing diagnoses, except as such evidence is always valuable as corroborative. There were, in some cases, variations such as raised the question whether there is a fever which may be called sewer fever, in which the blood poisoning is modified from the abdominal typhus of the Continent or the typhoid of Great Britain; also whether in two or three of the cases there was a malarial element sufficient to justify the term typho-malarial.

Two years previously we had under observation, under similar circumstances, over one hundred cases of typhoid at the Reform School, at Jamesburg, which, like some of these in their inception, were regarded as remittent. A study of the details of that endemic, as given in the State Report of 1878, is an instructive introduction to the etiological study of this Princeton outbreak. Its last page of warning may get new emphasis from this trying repetition. The study of the two, side by side, while showing some of the milder types of the disease, some of those variations which are recognized, do not affect the identity or the identification of the fevers.

COURSE OF INVESTIGATION.

From verbal inquiries made, I became so concerned as to the probability of local existing causes, that I remained after the adjournment of the Medical Society, on the 26th of May, for the

purpose of knowing as to the water supply, and examining into the sewer and indoor appliances of the college building, so as to confer with the other members of the State Board of Health. It did not take long to discover some serious local defects, and such as made it evident that it would be our duty to make an examination in detail. A note addressed to our Board the next day, by the City Clerk of Princeton borough, asked an investigation in the interests of the town. The death of one student on the 25th instant, and of another on the night of the 26th, who was suffering from fever, together with the opinions expressed by many physicians, caused much alarm. On the 27th, I telegraphed to the City Clerk to hasten forthwith the organization of a Local Board of Health, which had been neglected. The 28th I returned to Princeton to carry on the work of investigation, and continued the examination of the water supply of the college buildings, and its entire system of sewage.

WATER SUPPLY OF THE COLLEGE.

The supply of water was derived from a spring on the ground in the rear of the college buildings. This spring was carefully covered and protected from all outside contamination. The fall previous it had threatened to fail in furnishing an adequate supply of water, and so had been enlarged into a kind of well. It was about eight feet deep, and collected the surface-soil drainage from the direction of the college property, through a soil fairly adapted for percolation, along the row of buildings nearest to it. Several hundred feet distant had formerly stood the privy resorts of the college. It was known to the secretary that several months before, in an examination of the underground of a dwelling house on this line, there had been found an amount of organic material out of all proportion to any natural condition of decaying substances in soil. The examination had been made on account of sickness in the family. While it was alleged that this was local and that the trend of the underground was such as to feed this large surface-well from another direction, it was plain that such a source of water supply can only be relied upon when it came from surface soil kept clear of organic filth of all kinds.

So long as such a spring or surface-well is in an open country district, and so long as the ground soil through which it perco-

lates is fitted to act as a filter, and is itself free from undue organic matter, the water is likely to remain pure as this seems to have done. It had of late been carefully watched and examined by the Professor of Analytical Chemistry. There is not reason to believe that up to this time it had suffered from the infusion of any sewer material into it, or that it had become fouled by organic matter in the soil. Yet as increase of population in a town like this always subjects natural surface springs to sources of befoulment, it is not safe to rely upon such an one for a large permanent water supply in such a locality.

RESERVOIR.

Another question as to water supply arises from the method of storage. This water was carried by an iron pipe to a reservoir, situate about fifteen feet from a large artificial pond, formed by the damming up of the storm and drainage water from the direction of the college buildings. At one time more recently, the water in the reservoir was found on chemical test to be of a lower standard of purity than that of the spring tested at the same time. The amount of water used in the college buildings also leads some to believe that the reservoir obtained a supply not only from the spring but also from the adjacent pond and grounds. It was not a cemented reservoir.

It is probable that the reservoir had, at times, some supply from such sources. Although this might give more of the products of vegetable decomposition, it is not so seriously different in source from the spring supply as to furnish adequate reasons for the prevalent sickness. The water from this reservoir was pumped, by an engine, into one of the colleges, and from tanks, distributed to the various buildings. These tanks were never intended to become dry, and have never been known to be but once or twice. The tanks were not, in every respect, the best, and yet nothing was found in these to account for the sickness. While then this water supply, as a permanency, cannot be depended upon, it is not believed that, up to this time, it had been the cause of any sickness of a typhoid character.

IMPERFECT DRAINAGE.

A question here arises whether any evil results, in the form of fever, did occur from the ponding of water and the interference with natural drainage, which is to be found in the rear of the college buildings. Since, it is claimed that, beside typhoid, there were some cases of remittent and intermittent fever.

The ground below it in the vicinity, is wet and somewhat marshy, and is in a condition favorable to interrupted or abnormal vegetable decay. Water is now believed to be a conveyancer of miasma, when it is derived from low ground and from a marshy vicinity. The evil cannot be detected by chemical examination. Both the well which furnishes water to the college, and the undrained ground which furnishes malaria to the air, could easily furnish elements which, combined with local complication of a nosocomal nature, must give rise to a fever of typo-malarial character. Princeton is naturally one of the healthiest of towns, and free from malarial influences, as the testimony of all the resident physicians shows. It can only be made unhealthy by neglect of, or interference with natural drainage, and by the accumulation of evils incident to congregated life. While we believe the drainage of all this district has been somewhat neglected, and much construction done without proper preparation therefore, it is not probable that this was the existing cause of the outbreak.

While thus presenting the facts as to the drainage and water supply of the college, our conclusion is that we were unable to find in it adequate reasons for the outbreak of disease at this time.

HEATING AND VENTILATION OF THE COLLEGES.

As the fever had occurred in the spring, it was not found necessary to make an exhaustive examination as to the modes of heating and ventilation in the college buildings. The heating of all the dormitory buildings is by open grates or stoves, with the exception of Reunion Hall, which is heated by steam coils. While some defects might be noted by experts as to facility for natural ventilation, yet none of those examining the buildings were disposed to attribute the sickness to structural defects as to these matters.

SEWERAGE AND WATER-CARRIAGE SYSTEM.

Our first examination, made on May 26th, was in three of the buildings, commencing in Witherspoon Hall. It was found that each entry was supplied with a small iron trough, similar to a kitchen sink. Over each of these was an iron pipe with a faucet communicating with the tanks and water-supply already described. All water used in the college was furnished from these. These troughs received all the liquid slops of the college, including all waste and chamber water. These had the S or Adee trap and ended in an upright soil-pipe. This passed from the various stories of the building into the continuous soil-pipes, until from the various directions they united at the Witherspoon Hall, carrying the liquid refuse, and also receiving the storm water from the leaders in time of rain.

Near where the soil-pipe and water closets pipes join, and on the inner side in Witherspoon Hall, there had been built a ventilating flue connected with the chimney, for the purpose of securing perfect ventilation between the large sewer main and the buildings. There had also been made a man-hole or ventilation opening into this main sewer, a few hundred feet in the rear of Witherspoon Hall. The workmen seemed to have mistaken the ventilating flue for a part of the chimney stack, and had gone round it with the sewer or soil pipes, avoiding connection. The man-hole outside had also been made tight and covered with ground and sod. So there was no inlet for air between the sewer main and its cesspool, and the water closets and entry sinks of the colleges, save what might be furnished by the storm leaders near the roofs; these, in times of storm, might siphon the ventless traps. The pressure of the sewer gas must often have been sufficient of itself either to siphon the traps or to force itself through. It is known that these traps were, at times, empty. This is made still more obvious, as we follow on, to notice the condition of the cesspool at the terminus of the sewerage system. This tank was built underground, beside the railroad track; it is an oval, fifty feet long, eleven feet deep, and eleven feet in its oval diameter; at each end it had a man-hole covered with a heavy iron lid closely fitted and covered over with earth. This cesspool was not cemented on the bottom, and was laid with loose stone part of the way upward; the sewer system from the

college entered it by a pipe about four feet from the top; there was an overflow pipe at the other end, two feet from the top, which thus made a water seal, and had generally served to carry off the super-abundant sewage by a pipe running for a few hundred feet underground and finally discharging itself along the railroad and upon the surface of a low tract of land. It apparently had been thought that the cesspool with its uncemented bottom would absorb much and that the rest would easily flow off, and that if, at any time, the floating matter in the cesspool become solid or cake-like, so as not readily to flow off, the flush of storm water from the roofs, at intervals, would answer for this purpose.

Prof. Brackett and myself first got access to it May 27th, one lid having been loosened the day before. This large cesspool was full nearly to its top with a black, tarry, offensive sewage. This covered the incoming sewer pipe from the college to the depth of two feet with a semi-solid mass, from which the foul escaping gases were bubbling. It was so tenacious as to stop up the entrance of the sewer pipe from the college, except as the back pressure become sufficient to cause an intermittent discharge. All sewage came from that direction without getting vent. The pent up gas in the pipes had but one ready escape and that was into the college buildings. Thus the soil pipe and water-closet system of the college was but an elongated cesspool with full arrangements for gas-discharge on each entry, both from the slop and water-closet apparatus, as the pipes of the latter joined the former near the buildings. Although the large cesspool had at its lower end an overflow pipe, intended each day to carry off any surplus, in the warm months of this spring, and the absence of rain, the mass between it and the sewer pipe had become too solid to be easily flushed off and too putrid to be retained.

With right traps in the buildings, with perhaps the addition of opening to the soil pipes on the roofs, and also vents to the traps as recommended of late, with the intended attachment to the chimney flue, and an open man-hole for free access and egress of fresh air, with watchfulness over the cess-pool to see that it was in working order, and with emptying when required by contingencies or by lapse of time, we can easily see how such a system might have been operated. But as it was it had been converted into a complete system for the storage of the

fouler part of sewage, so that its gases might be sent to the college buildings with the same precision with which lighting gas is kept in a reservoir and distributed through houses. Only in this case there must have been more constant escape. At the time of emptying this cess-pool, immediately after the adjournment of the college, there was also some sewage inflow from the direction of the colleges. All the buildings known as Witherspoon Hall, West College, Reunion Hall and East College, as well as the University Hotel, were connected with this system.

The School of Science and some other buildings were connected with just such a system and with like defects, which had its terminus in a smaller cesspool on Smith street, and was in no better condition. It is easy to see how, by such a state of affairs, the air of the college buildings could be laden with particles or so impregnated with aerial sewage and gases as to be deleterious to health. There can thus be no doubt that in the college buildings, in the University hotel and in one of the Professors' houses, there were found soil-pipe and water-closet connections highly favorable for the introduction and extension of foul air in the form of aerial sewage.

Only two questions confront us: As a matter of fact, did the disease commence in the college, or from a similar or still worse condition, in a students' boarding house? Wherever it commenced, was it of spontaneous or local origin, or was it introduced from some other focus, and then spread by these favoring and fertilizing provisions therefor?

FIRST CASES.

To throw light upon these questions, an examination of the earlier cases is of primary importance.

By the kindness of the college authorities, I early received a list of all known cases, with the places of rooming and of boarding specified, and have verified the dates of attack. These are given without repetition of the names, and with some slight alternating corrections, as furnished by personal inquiry and correspondence.

	ROOM.	CLUB.	REMARKS.
THE SMITH WELL CASES.	A House No. 2	House No. 2	Remittent fever; Scarletina, (?)
	B 13 S. E	"	Left here April 8th. Died 19th.
	C 10 W. M. Witherspoon	"	Left here sick early in April. Had Typhoid fever at home.
	D Dohm's	"	Left here April 5th or 6th. Typhoid fever at home. Dr. Fay, Altoona.
	E 10 N. R. H	"	Sick in Princeton with Typhoid fever early in April.
	6 N. M. R. H. Colored housemaid.	"	Left April 1st. Sick at Auburn with nervous fever. No Typhoid fever. April 29th, removed. Sick two months.
WITHERSPOON HALL.	F 10 E. W. H	Univ. H	Chill May 16th. Died May 26th
	G 12 E. W. H	"	Went home sick May 24th. Typhoid fever at home, Madison, N. J.
	H 5 E. W. H	"	Went home sick May 25th. Sick at Manhattan Beach Hotel.
	I 4 W. M. W. H	"	Sick here May 12—26th. No Typhoid development.
	J "	"	Sick May 23d. Still sick here, (Aug. 20).
	K 2 E. M. W. H	"	Sick and went home about May 24th. Came back about June 1st for part of two days. Returned home and died June 6th.
REUNION HALL.	L 5 S. M. R. H	Jesse Williams	Sick here from May 9th to 27th. No decided typhoid symptoms.
	M 15 N. M. R. H	Univ. Hotel	Went home sick May 24th. Had Typhoid fever. Wilkesbarre.
	N 7 S. R. H	"	Taken sick about May 15th. Went home May 22d. Died June 10th. (?)
EAST COLLEGE.	O 13 N. E	Lavake's	Took cold, April 1st, lying on ground. Went home May 20th. (Doubtful case).
	P 18 N. E	Univ. Hotel	Went home sick May 17th. Had Typhoid fever.
WEST COLLEGE.	Q 3 N. W	Mrs. Harvey's	Taken sick about May 20th. Very marked case. Died July.
	R 6 N. W	Univ. Hotel	Same as above. Died July.
	S 1 S. W	Clow's	Left about May 15th. Returned May 20th. Went away again May 25th. Sick in Newark. Died June 5th.
ROOMING AND BOARDING IN TOWN.	T M. House, No. 22	Parkhill's	One of the first sick, about March 14th. Went home about April 12th. Returned to Princeton about April 17th, and was again sick for a few days, but recovered here. Attended by Dr. Wikoff, who says his was not this fever.
	U M. House, No. 19	Univ. Hotel	Went home sick May 26th. Called Remittent fever up to May 31st. Died June 6th.
	V Mrs. L.'s	"	Went home sick about May 26th. Typhoid fever in New York.
	W Mr. L.'s, Canal street, previously at Lavake's	"	Had chills and fever about March 1st. Went home, returned, and was taken sick about May 10th. Typhoid symptoms.
	X Univ. H	Univ. H	Complaining during second session while in 12 W. W. H.; moved to hotel about April (?) 21st. Died May 26th.

It is at once noticeable that the first seven cases of sickness occurred among those who cannot be associated as in any one part of the college buildings, or in any one place in town as to rooms, but who were alike in the one particular that they all ate in the same house. Of these, two lived only in the house, and one other had a room in town elsewhere. The others were in three different college buildings. One student was slightly sick in April who was not of this group—although named in another part of the list, it is evident from the account of his brief indisposition that he had no typhoid symptoms. Of these seven, six are reported to me as having had typhoid fever, unless one called nervous fever is an exception. Four of these were taken to their own homes and recognized as typhoid fever by their physicians there. The seventh one is claimed to have had remittent fever, and to have broken out with scarlet fever after he had been in his room over two weeks. His case was reported as beginning March 23d. The first student who died, and whose case has been already related, was taken sick March 26th, or as the brother's letter would date it, about two weeks before April 8th. Four other cases were taken so simultaneously, April 5th, as to lead the physician to suspect that there was some local cause and to make inquiries as to the well water, etc. Previous to these cases there were none of earlier date, which, before or afterwards, were identified as typhoid. These facts are so significant as to invite to close inquiry.

HOUSE NO. 2.

This boarding house was situated on the main street known as Nassau street, being the second house west from the First Presbyterian Church. One student boarded with the family and roomed in the house. The family consisted of four adults, including *servants, one of whom* had typhoid fever about April 25th. Two clubs boarded in the house, one consisting of thirteen college students and the other of thirteen seminary students and a college tutor. Why none of the seminary students sickened can be accounted for, the same as why only seven out of the whole number in the house sickened, or on the hypothesis that college students sickened because of the additional and constant exposures in the college buildings, or on the hypothesis that the cause of the sickness was only in the

colleges. Against this latter is the fact that so many sickened here and here only at first; that one was a servant in the family, and that one other not including the remittent fever case, roomed as well as boarded outside of the college. As two other houses were in close proximity and had either water or cesspool relations, we show on the accompanying map their position, the middle house being the place of sickness.

[SEE MAP.]

This house, No. 2, derived its drinking water and its upstairs wash water from a well located between houses No. 2 and 3, the houses being separated just enough to allow space for the well. The well is about thirty-five feet deep, and very old. The first sickness led to an examination of this well. The water, although it had not been complained of, was found so bad on chemical analysis, that Professor Cornwell thought that it could not be defiled by sewage alone. We tasted it in June, after it had ceased to be used, and could detect no foul taste, although it was chemically impure. In the front yard of house No. 2 was a covered cesspool, forty-eight feet from the well. This received the water-closet excreta of the house, and the bathtub water. The size is about nine feet deep by four wide. When examined, about one foot of semi-solid fetid matter was in the bottom. As the structure directly beneath is rock, the cesspool matter all along this section is only absorbed and disseminated laterally.

The next nearest cesspool is in the rear of lot No. 2, nine feet deep and five wide, and sixty-five feet from the well. At the time of examination in June, it had seven feet of water and filth.

In the yard of house No. 1 was another cesspool found in a still fouler condition, into which both the kitchen slops and water-closet refuse was received; this was seventy-five feet from the well of No. 2, with a foul privy in between. It was only twenty-eight feet from the well of No. 1, which was foul, and which is of the same depth and same water-bearing strata as the well of No. 2.

The only chemical difficulty in discovering whether sewage matter was percolating from these three cesspools into the well of No. 2, arises from the fact that there was a dead cat in the

seventy-five feet respectively, were also fouling it. The Chemical Professor thought there was more of the chlorides and albuminates than the cat would account for. The well is large and deep, (thirty-five feet,) and like most of the wells of Princeton, of this depth, cannot be pumped dry by usual method.

This water was used for drinking purposes and to different amounts by different students. Some of it was each day pumped into the up-stairs cistern for general water supply, communicating chiefly with the room in which one of the students was sick several weeks.

Besides these conditions, as to water, the house was provided with unusual facilities for the introduction of foul air. The cesspool of house No 1. was in the area, within twenty-eight feet of house No. 2, with the privy a few feet nearer. The rear cesspool of house No. 2 was fourteen feet from the house, and had from it an untrapped pipe in the area basement for receiving slops thrown into the sink. There was a rain water cistern under the piazza, which had its overflow pipe into the cesspool, and which thus let foul air into the area. Then in the brick floor of the basement there was an outlet for slops. In heavy rains the cesspool overflowed its filth water into the area so as to cover it. The dead mawkish odor, peculiar to confined sewage, had been frequently observed. As the property, when purchased, had these conveniences, the localities of cesspools, pipes, etc., and their connections were not known. The soil, beneath and about the building, was saturated with organic matter. The condition of the water supply, added to that of the cesspools, presented a more flagrant and dangerous complication than any found in the college dormitories. Both Professor Janeway and myself, who had occasion to act with E. S. Philbrick, of Boston, as a committee for advising what changes should be made, came, therefore, to the conclusion as herewith expressed.

"The disease was typhoid fever, caused in the first instance by the use of water from a well, which was proven by chemical analysis to be impure, in which a dead cat was found, and having such relations to cesspools, as shown by subsequent investigations, as to render its contamination by them extremely probable. We have been forced to this conclusion by the fact that the first cases of typhoid fever amongst the students during April, occurred in those boarding at the house using this well water, and

because these students who became ill lived in different buildings. Moreover, it has since been ascertained, that a servant who worked at this house, became ill at this same time, was removed to another house, and is considered by her physician to have had typhoid fever.

The evacuations from the students who had become affected in this manner were thrown without disinfection into the sinks and water-closets in the dormitories, and gained access to the sewer system of the college, and to the cesspools which formed a part of it. A subsequent outbreak of the fever occurring in May, was caused by the infection of the sewage of the college, contained in the aforementioned cesspools and pipes. On this occasion the disease was not limited as before, but followed the sewer distribution. The poison gained access through the sinks, water-closets, and the pipes connected with them.

The spring water used at the college has been analyzed a number of times, but without affording any evidence that it was contaminated; and we are informed that it has been used at several houses having a total population of about seventy persons, but having no connection with the sewer system, and that there has been no sickness in these houses. The view might be entertained that the foul-air conditions of the house co-operated with the water conditions and shared prominently with it in incipient causation, but at any rate it seems well-nigh certain that the local structural conditions in and about the house were the exciting cause whether through fouled water or fouled air."

WAS THE FEVER SPONTANEOUS IN ITS ORIGIN AS AN ENDEMIC HERE?

The question now arises whether the enteric or typhoid was implanted in such a favoring soil from some other person or locality or whether it originated amid these favoring conditions. It is well known that on such a question there are still two opposite opinions. One class of medical observers maintains that like small-pox "the disease breeds so true that no fresh case is known to arise except by contagion or infection from some previously existing case." As the view has gained ground that the specific element in the communication of diseases associated under the name "zymotic" is not volatile but "particulate" in that it is in substance not gaseous but solid, and so a particle, it must

be conceded as Russell has recently expressed it, "that the progress of discovery on the laws of the particulate theory of the contagia makes constant inroads upon the domain of the spontaneous or transcendental in the origination of communicable disease." So there is maintained "in the mind of the ætiologist a wholesome attitude of thorough skepticism as to the spontaneity in any instance of diseases known to be in some instances lineally propagated from pre-existent cases through ascertained media."

Dr. William Budd may be quoted as representing those who always look for a pre-existing case from which the infective particle was derived, either in person or through air or water, contaminated by the fecal discharges of the patient, while Sir William Jenner and Dr. Murchason represent those who, while recognizing this source, also believe that it may be generated independently of any previous case, and especially from excretions and from sewer fermentation and decompositions.

Dr. George Wilson, in his recent book on "Healthy Homes," says, "some writers maintain that genuine typhoid fever can only be propagated from a previously existing case or cases; but there is a constantly increasing amount of evidence which goes to prove that it is often induced by sewer air, foul effluvia from cesspools or polluted water, independently of any previous cases." (pp. 293.)

It therefore becomes the duty of any investigator—even if finding conditions highly favorable to the epidemic extension of any disease—to inquire whether its origin, after all, was not from some place, whither it had been brought either by a person sick of the diseases or by some medium that might have been infected from him or from his sickness. It has been said that enteric or typhoid fever is the most versatile of all the communicable diseases in its choice of a medium. (Russell.)

Since the conveyance of typhoid fever through milk that has either been watered with fouled water, or has absorbed infectious material from typhoid surroundings, has been proven, our first inquiry was in this direction. No clue could be found to any possible derivation from the source. Care was taken to trace the first cases to their home relations, to their absences from college or to some other circumstances that might furnish evidence of transportation. While in the case of so composite a gathering and of so many conflicting statements which have to be elim-

nated, it is well nigh impossible to make such an inquiry exhaustive. After tracing carefully every possible or suspected source, we were not able to identify this as an imported disease. Several suspected sources failed under extended investigation. The next natural inquiry was, whether cases of typhoid fever had previously occurred in other parts of Princeton, the infection of which might have, in some hidden manner, reached the locality of house No. 2, so as partly to assume an epidemic form.

It was found that it is true of Princeton, as it is of most such sized towns with no Boards of Health, that causes for local diseases exist. Also that occasional cases of typhoid fever occur as brought from without. By careful inquiry of the resident physicians, and examination of the vital records, it was found that there had been no case of typhoid fever in Princeton previous to this outbreak, within two years. Six years ago, and again five years ago, cases occurred in town which were known to have been brought from other places. Three years since there were five cases in one family. In these cases it was believed at the time, after chemical analysis, that a filthy cesspool had found its way into the well, so as to foul the drinking water.

Two years ago last March, there were two cases in a professor's family, who lived in a hired house in the town. The well had gone dry, and it was necessary to blast in order to deepen it. After the water was secured it began to taste badly, and an odor was perceptible from the well. The sickness soon occurred. It was believed in the blasting a crack had been made which communicated with a cesspool. The well was abandoned and afterward filled up because of its odor. We could not obtain any clue which would, after so long an interval, associate any of these cases with those now occurring.

As it has been alleged that low forms of fevers have before prevailed at Princeton, we examined closely the records so far as available. We found ex-President MacClean, from a ready memory, able to give details which were corroborated by Dr. Stephen Alexander and others. The record, both of the college and the town, has, with rare exceptions, been one of remarkable health. It is said that twenty years at a time have elapsed without a single death of any student from any sickness at Princeton. Remittent fevers, except about the time of the digging of the canal, long years since, have been almost unknown. This year,

in the surrounding country, there has been more than usual of remittent and intermittent fever. It has generally been so rare that all the physicians have regarded any occasional case as an importation. Yet it is evident that structural changes, excavations and interferences with natural water-courses need here, as elsewhere, to be guarded against or compensated for. Three cases of typhoid fever occurred in the house of Dr. Farmer. He died, as did also one student of the college.

In 1835–6 occurred what has been spoken of so frequently since this outbreak as the *Princeton fever*. It was confined to one house and this happens to be house No. 1 of our map, and what may be regarded as a part of the same plot in which the first case occurred this year, since it is only separated by a few feet used in common. In the house, now occupied by Dr. S. Alexander, there were then five deaths from typhoid fever, and one or two more who recovered after prolonged illness. One student died and two physicians in succession. The sickness was attributed to the well, which was found to be receiving the household slops. The well was long known as the *sickness well*, and was abandoned for about two years, but is now used, although found in bad condition at the time of our examination. No sickness has occurred in that house since, which could be attributed to any local causes, although the family of adults is believed to have suffered in general health from impure air and water. The fact of locality, so far as the present epidemic is concerned, we can only regard as a coincidence, and as having no causal relation. The fact of a graveyard having once existed in the rear of house No. 2 was also brought to our attention. It was found that some seventy years ago there were, several hundred feet from the house, five or six gravestones, probably the remains of some family ground before the college was located at Princeton. "There have been," said President MacClean, "no burials there in the memory of man."

It would seem, from all the facts that we gathered, that typhoid fever commenced here only because of certain more recent and local structural conditions, and was extended into an epidemic by prevalent conditions in the college, as also in a few houses in town.

That the fever did not get a more rapid and disseminated hold at the time, is to be accounted for by the fortunate occurrence of

the Spring vacation, and the fact that none of the earlier cases remained in the college buildings. About two weeks after the return of the students, April 22, new cases began to appear, which might easily occur from excreta, or the continued operation of the same causes, or from the predisposition which had been established.

So soon as the cases were recognized as typhoid fever, dependent upon local causes, all officers of the college were prompt in ordering an adjournment. We believe thus only was it saved a far more wide-spread and fatal epidemic. At the very day of adjournment we found the excreta of typhoid fever patients being emptied in a common water closet, and believe that the seed had been sown for a prolific harvest of death. However sad the record, with all the facts in evidence before us, we rejoice that the scourge was not more intense in its virulence and more wide-spread in its desolation.

CLIMATIC OR WEATHER CONDITIONS.

The question occurs whether there were at this time, either in thermal or atmospheric conditions, any reason why the material of cesspools or sewers should thus become operative, or why soil or air or water should be unusually impregnated, or persons have an unusual predisposition to such influences here. It is fully recognized that conditions of temperature, moisture, and prevailing winds may determine the outbreak of an endemic or epidemic disease. These would be inoperative without the necessary materials to operate upon were present in the soil, in the atmosphere, in the food or drink, or in the person. On the other hand the material might be present in any one or all of these, but be restrained in operation because of the absence of the heat, moisture or other conditions necessary to development.

A record of the meteorology of the year from July 1st, 1879, to July 1st, 1880, and especially of the latter six months, shows some exciting causes well worthy of attention.

We refer our readers to our tables for this period as worthy of study on another page. The winter was an unusually open one, with much less frost and ice, and with a smaller amount of rain than usual. The average temperature of February, March, April and May was much higher than ordinary.

The deficiency of rain was such as almost to occasion a March drought. The accompanying graphic map presents the lines of temperature, humidity and rain-fall from January 31st to May 31st, 1880.

The failure of flushing the sewers of the college, which depended so much on sluice-water, has already been noticed, and no doubt contributed much to the filling up of pipes and the influx of sewer air.

It affected still more the wells which are the vertical drains for an area of which they form the center. If the ground about them is filth sodden, or abounds in organic matter, or if having combined with cesspools it is never so sure to pollute the water supply. The favorite and only and time-honored method of sewage disposal in Princeton Borough is by uncemented cesspools in the rear yard and often in the front yard, and sometimes in both, nicely covered over and sodded. They are expected mostly to take care of and empty themselves. That means that the ground soil shall so absorb the liquid and muck of the semi-liquid and fecal matter as to make the need of emptying the exception. This may do for a time where population is sparse and regulations enforced, or longer where the water supply is not derived from wells. But it is a most hazardous experiment when it is followed up in a compact town, and only awaits favoring warmth and weather to stir these multitudinous cauldrons into activity, and with a soil unusually and unseasonably dry and warm, the first natural diversion is the well. As this cannot afford full relief, the air undertakes to be a corrective and so becomes the common carrier of whatever effluvia may arise. Some parts of Princeton are kept with scrupulous care, and the objectionable conditions are flagrant only in one or two small sections, or in here and there two or three adjacent houses as they were in the two houses shown on our map. A dead animal in the well—three cesspools within seventy-five feet, tainted air from these and from the overflow in the house, and the previously favoring weather conditions seem to have precipitated the crisis. The condition of the college sewers and of some town localities favored the progress of the infection.

The college having been dismissed and this deportation as the first thing resorted to, it is proper to note some of the means advised to overcome the disease, and to insure against recurrence.

1st. The cesspools were emptied, cleaned and disinfected.

2nd. All the sinks and the water-closets, and the pipes which connected them with the cesspools have been removed from the buildings; and the pipes outside of the buildings have also been taken up.

3d. The rooms have been cleaned, and those in which sickness occurred have been disinfected.

4th. The use of cesspools has been given up and a temporary arrangement provided which will avoid liability to disease. A permanent system of sewage and slop disposal is in course of construction, which is in accord with the development of sanitary science. Mr. C. E. Philbrick, Civil Engineer, of Boston, Mass., has charge of the construction of the new system. The water-closets are located in a separate building and have no connection with the dormitories.

5th. Two large cisterns have been built to hold filtered rain-water, collected from pure sources, to be used as drinking water.

6th. The house where the disease originated has been thoroughly overhauled.

7th. It was recommended that students be prohibited from boarding at houses in a defective sanitary condition.

This latter was rendered necessary from the fact that very insanitary conditions were found on the premises of several boarding houses. The location of many wells and cesspools was such as to make it obviously unjustifiable to expose students to the possibility of such soil and water contamination. This was made the more obligatory from the fact that scattered cases of typhoid fever had occurred in the town during the vacation, and even when college assembled, although it had been put in so thorough a sanitary condition, the fact of existing cases in town made it necessary to protect the students from such possibilities. It was unfortunate that the Health Board of the borough did little during the summer, but we believe that it is more alive to exigencies which exist and which must be remedied upon a plan.

FUTURE WATER SUPPLY AND SEWER SYSTEM.

Either the uncemented cesspool system, or the wells must be abandoned in Princeton. It is hazardous to secure drinking water from the same soil in which these exist in near proximity;

with the soil and understructure of Princeton it is aboslutely unsafe.

The water-bearing strata of the borough is nearly the same in its most closely inhabited sections; it is reached through deep wells and rock, so hard as often to require blasting; the water as thus secured would be good if no surface matter could reach it, but the rock extends within a few feet of the ground surface; it is a hard shale arrayed in layers. This compact rock causes organic matter to remain near the surface, or if liquid or semi-liquid, as it must become through accumulation and by storm water, it forms into streams or little trickling rivulets along the surface of the rock. It is found that this rock is blocked off, or has frequent seams or joints, so that at points not suspected and sometimes quite distant from some series of cesspools, the foul substance can find exit and so reach wells, and mingle at the water bearing strata. These joints are much more frequent than in trap rocks. Here and there a well is thus known to be impure where there are no cesspools immediately adjacent. Such a condition as this demands either a constant watching and testing of almost each well used, or the prohibition of uncemented cesspools, or the use of cisterns, or the procurement of a water supply away from any possible household or populous complications. The risks are greater to the town than to the college, since the buildings of the latter need not be closely located, and its facilities for collecting and storing water from the buildings are greater.

In reference to all that relates to this outbreak of enteric fever at Princeton, it must only be said, that in its chief feature it is only a repetition of what has elsewhere occurred over and over again from similar causes and complications. There are many towns that just after this fashion are storing up material for just such sickly and deadly use in the future. By a want of co-action or co-ordination of conditions of water, soil and weather and susceptible live material, the evil day has thus far been postponed. Some have postponed the evil by securing a separate water supply. Although still polluting the ground, its results are, for a while, delayed by nature's conservatism, or by flight to the sea shore, or other methods of avoiding the continuous inhalation of polluted air, or when such air is inhaled, if it is common foulness and has not yet attained to specific contagion, it only causes

that general malaise and weariness and half force which devitalize and demoralize population, and so is now sapping vital power by insidious inroads, instead of decimating by virulent epidemics. There was no other way to convert New Orleans and Memphis to correct hygiene except to have yellow fever. It may be that our New Jersey cities, will continue to foster insanitary conditions until they too have some significant losses, or until there is a general reduction of the standard of good health, so pronounced, as to exhibit itself in the statistics of mortality. Still with the noble advance made in our own State in the last three years, and with an increase of intelligent popular sentiment and official power, we cannot but hope that many of our cities and townships will, more or less rapidly, put themselves upon a better health basis, and secure for themselves and for their homes, that blessing which, more than any other human gift, tends to life, liberty and the pursuit of happiness.

PRINCETON BOROUGH, - WM. A. DURYEE, *Princeton.*

Our Board was chosen in early summer. It was scattered during our vacation period. A portion of the members, after a few weeks, declined to serve, and it is only within a few days (October 25,) that all the above members consented to serve. Still some good has been accomplished. Locations that need care are known; wells have been examined; some nuisances abated, and otherwise the Board now hopes to begin to do good work. The borough is districted, and committees appointed. It may be expected that we would include the college in this report, but so much has already been written—much true and much false—and the circumstances of the college sickness are so fully known to the officers of the State Board, that nothing further is said at present.

1881

PRINCETON (Borough), *Report from* Prof. J. S. SCHENCK, *Princeton.*

A water company has recently been formed, and it is believed before many months our supply through street mains will be abundant and of the best quality.

A much more general attention to and interest in sanitary matters than formerly.

Statistics fully attended to. Monthly returns forwarded regularly to Secretary of State.

Within the year the Board of Health ordered a general vaccination, at the expense of the borough, of such as were unable to pay for themselves. About 250 were vaccinated under this order.

No case of smallpox has occurred within the year.

1883

PRINCETON. - - - - *Report from* J. S. SCHENCK.

The most important event of the year is the introduction of public water of fine quality and abundance. Will soon come into general use.

1885

PRINCETON. - - *Report from* PROF. J. S. SCHANCK, M.D.

No public sewers yet, but privies and cesspools. The college distribution is on surface of about twelve acres, and is fairly satisfactory. We need public sewers. Some of our cellars are damp. Some malaria; less than two years ago. But few basements are used as kitchens. No systematic house inspection.

Frequent publications in town paper by Board of Health. Just now engaged in formulating a code of regulations.

Much care and anxiety during the year regarding the prevalence of diphtheria. Considerably over one hundred cases have occurred in and about Princeton since early spring, and a large number have proved fatal. It is almost entirely confined to children—largely the indigent and with unfavorable surroundings. Many cases may be traced to direct communication with the disease. Many have appeared to begin spontaneously. Latterly it is much intermixed with scarlet fever. The diseases seem very closely allied. We have been thorough in fumigations and care. Only tolerably successful in preventing public funerals.

PRINCETON. - - - *Report from* JAS. R. DRAKE, *Sec'y.*

As to sewers, we have no general system. The College of New Jersey has a private system of surface distribution for their sewage. Cellars are dry, with some exceptions, in parts of the town where the ground is almost level. There are no swamps very near, yet malaria is quite frequent.

Sewers are used only by the college for their buildings. Their pipes empty into distributing troughs on a lot on the borough line, the liquid matter is absorbed by the ground and sun and the thick matter is mixed with ashes and used as compost. Throughout the town cesspools, both cemented and open-bottomed, are used, and are cleaned, generally, by being pumped into air-tight barrels and carted away and disposed of to farmers for fertilizer. We have no perfectly odorless excavating apparatus at present, but expect to have in the near future.

Members of the Board are furnished with copies, and abstracts of them and circulars are often published and circulated throughout the town. Considerable difficulty is experienced in getting the people at large to believe in the virtue and the necessity of enforcing ordinances.

All legal and persuasive means are resorted to in resisting possible epidemics and the spread of contagious diseases.