EIGHTH

BIENNIAL REPORT

OF THE

BOARD OF HEALTH

OF THE

STATE OF IOWA

FOR THE

FISCAL PERIOD ENDING JUNE 30, 1895

DES MOINES:
F. R. CONAWAY, STATE PRINTER,
1895.

Resolved, That the Board is in nowise responsible for the sentiments and opinions entertained in the following papers, prepared by special request of the Board, the respective author of each paper being responsible for its contents.—*Resolution adopted by the Board and ordered printed in the Biennial Report.*

STATE OF IOWA,
OFFICE OF THE SECRETARY OF THE STATE BOARD OF HEALTH,
DES MOINES, July 1, 1895.

To FRANK D. JACKSON, *Governor of Iowa:*

SIR—In accordance with the provisions of section 11, chapter 151, laws of Eighteenth General Assembly, the eighth biennial report of the State Board of Health, for the fiscal term ending June 30, 1895, is herewith presented.

J. F. KENNEDY, M. D.,
Secretary.

MEMBERS OF THE BOARD.

	TERM EXPIRES.
FREDERICK BECKER, M. D., Clermont (Homeopathic)	January 31, 1896
E. A. GUILBERT, M. D., Dubuque (Homeopathic)	January 31, 1897
E. H. CARTER, M. D., Des Moines (Eclectic)	January 31, 1898
J. M. EMMERT, M. D., Atlantic (Regular)	January 31, 1899
R. E. CONNIFF, M. D., Sioux City (Regular)	January 31, 1900
J. A. SCROGGS, M. D., Keokuk (Regular)	January 31, 1901
JOHN C. SHRADER, M. D., Iowa City (Regular)	January 31, 1902
WARREN DICKINSON, Civil Engineer, Des Moines	May 4, 1896

MILTON REMLEY, Attorney-General, *ex-officio*.

M. STALKER, Ames, State Veterinary Surgeon, *ex-officio*.

CONTENTS.

STATE AND LOCAL BOARDS OF HEALTH.

[Chapter 151, Laws of 1880.]

AN ACT to establish a State Board of Health in the State of Iowa, to provide for collecting vital statistics, and to assign certain duties to local boards of health and to punish neglect of duties.

SECTION 1. *Be it enacted by the General Assembly of the State of Iowa:* That the governor, with the approval of the executive council, shall appoint nine (9) persons, one of whom shall be the attorney-general of the State (by virtue of his office), one a civil engineer, and (7) physicians, who shall constitute a State Board of Health. The persons so appointed shall hold their offices for seven years; *provided*, that the term of office of the seven physicians first appointed shall be so arranged by lot that the term of one shall expire on the thirty-first (31st) day of January of each year; and that vacancies thus occasioned, as well as all other vacancies otherwise occurring, shall be filled by the governor with the approval of the executive council.

SEC. 2. The State Board of Health shall have the general supervision of the interests of the health and life of the citizens of the State. They shall have charge of all matters pertaining to quarantine; they shall supervise a State registration of marriages, births and deaths, as hereinafter provided; they shall have authority to make such rules and regulations and such sanitary investigations as they may from time to time deem necessary for the preservation or improvement of the public health; and it shall be the duty of all police officers, sheriffs, constables, and all other officers of the State, to enforce such rules and regulations, so far as the efficiency and success of the Board may depend upon their official co-operation.

SEC. 3. The clerk of the district and circuit courts of each of the several counties in the State shall be required to keep separate books for the registration of the names and post-office address of physicians and midwives, for births, for marriages and for deaths, which record shall show the names, date of birth, death or marriage; the names of parents and sex of child, when a birth; and when a death, shall give the age, sex and cause of death, with the date of the record and the name of the person furnishing the information. Said books shall be always open for inspection without fee; and the clerk of said courts shall be required to render a full and complete report of all births, marriages and deaths to the secretary of the Board of Health annually, on the first day of October of each year, and such other times as the Board may direct. [For which service the clerk shall receive, in addition to the compensation already allowed him by law,

the sum of ten cents for each birth, marriage or death, and the further sum of ten cents for each one hundred words of written matter contained in said report, the same to be paid out of the county fund.]—*Chapter 140, Section 1, Laws 1882.*

SEC. 4 It shall be the duty of the Board of Health to prepare such forms for the record of births, marriages and deaths as they may deem proper; the said forms to be furnished by the secretary of said Board to the clerks of the district and circuit courts of the several counties, whose duties it shall be to furnish them to such persons as are herein required to make reports.

SEC. 5. It shall be the duty of all physicians and midwives in this State to register their names and postoffice address with the clerk of the district and circuit courts of the county where they reside; and said physicians and midwives shall be required, under penalty of ten dollars ($10), to be recovered in any court of competent jurisdiction in the State, at suit of the clerk of the courts, to report to the clerk of the courts, within thirty (30) days from the date of their occurrence, all births and deaths which may come under their supervision, with a certificate of the cause of the death, and such other facts as the Board may require, in the blank forms furnished, as hereinafter provided.

SEC. 6. When any birth or death may take place, no physician or midwife being in attendance, the same shall be reported by the parent to the clerk of the district and circuit courts within thirty days from the date of its occurrence, and if a death, the supposed cause of death, or, if there be no parent, by the nearest of kin, not a minor; or, if none, by the resident householder where the birth or death shall have occurred, under penalty provided in the preceding section of this act. Clerks of the district and circuit courts shall annually, on the first day of October of each year, send to the secretary of the State Board of Health a statement of all births and deaths recorded in their offices for the year preceding said date, under a penalty of twenty-five dollars ($25) in case of failure.

SEC. 7. The coroners of the several counties shall report to the clerk of the courts all cases of death which may come under their supervision, with the cause or mode of death, etc., as per form furnished, under penalty as provided in section 5 of this act.

SEC. 8 All amounts recovered under the penalties of this act shall be appropriated to a special fund for carrying out the objects of this law.

SEC. 9. The first meeting of the Board shall be within twenty days after its appointment, and thereafter in May and November of each year, and at such other times as the Board shall deem expedient. The November meeting shall be in the city of Des Moines. A majority of the members of the Board shall constitute a quorum. They shall choose one of their number to be president, and shall adopt rules and by-laws for their government, subject to the provisions of this act.

SEC. 10. They shall elect a secretary, who shall perform the duties prescribed by the Board and by this act. He shall receive a salary, which shall be fixed by the Board, not exceeding one thousand two hundred dollars per annum. He shall, with the other members of the Board, receive actual traveling and other necessary expenses incurred in the performance of official duties; but no other member of the Board shall receive a salary. The

president of the Board shall [monthly*] certify the amount due the secretary, and on presentation of said certificate the Auditor of State shall draw his warrant on the State Treasurer *of* [for] the amount.

SEC. 11. It shall be the duty of the Board of Health to make a biennial report, through their secretary or otherwise, in writing, to the Governor of the State, on or before the fifteenth day of September† of each year preceding that in which the General Assembly meets; and such report shall include so much of the proceedings of the Board, such information concerning vital statistics, such knowledge respecting diseases, and such instruction on the subject of hygiene as may be thought useful by the Board, for dissemination among the people, with such suggestions as to the legislative action as they may deem necessary.

SEC. 12. The sum of five thousand ($5,000) dollars per annum, or so much thereof as may be necessary, is hereby appropriated to pay the salary of the secretary, meet the contingent expenses of the office of secretary and the expenses of the Board, and all cost of printing, which together shall not exceed the sum hereby appropriated. Said expenses shall be certified and paid in the same manner as the salary of the secretary. The Secretary of State shall provide rooms suitable for the meetings of the Board, and office room for the secretary of the Board.

SEC. 13. The mayor and aldermen of each incorporated city, the mayor and council of any incorporated town or village in the State, or the trustees of any township, shall have and exercise all the powers and perform all the duties of a board of health within the limits of the cities, towns and townships of which they are officers.

SEC. 14. Every local board of health shall appoint a competent physician to the board, who shall be the health officer within the jurisdiction and shall hold his office during the pleasure of the board. The clerks of the townships and the clerks and recorders of cities and towns, shall be clerks of the local boards. The local boards shall also regulate all fees and charges of persons employed by them in the execution of the health laws and their own regulations.

SEC. 15. It shall be the duty of the health physician of every incorporated town, and also the clerk of the local board of health in each city or incorporated town or village in the State, at least once a year to report to the State Board of Health their proceedings and such other facts required on blanks and in accordance with instructions received from said State Board. They shall also make special reports whenever required to do so by the State Board of Health.

SEC. 16. Local boards of health shall make such regulations respecting nuisances, sources of filth, causes of sickness, rabid animals, and quarantine, not in conflict with regulations made by the State Board of Health, and on board any boats in harbors or ports within their jurisdiction, as may be necessary for the public health and safety. Upon written notice given by any practicing physician, that small-pox, diphtheria, scarlet fever, or any other contagious disease dangerous to the public health exists in any place, it shall be the duty of the mayor of any incorporated city or town, and the clerk of any district township, forthwith, without other authority,

* As amended by chapter 173, acts Twentieth General Assembly.

† As amended by chapter 82, Laws of 1888.

to establish quarantine in such cases, as may be required by regulations of the State Board of Health and said local boards, and to maintain and remove such quarantine in like manner. If any person shall violate any such regulation as herein provided, he shall be fined not less that twenty-five dollars for each and every day he knowingly disregards and violates the same, to be recovered by any court of competent jurisdiction. Notice shall be given of all regulations made by said local boards, by publishing the same in a newspaper published in their jurisdiction, or, where there is no newspaper, by posting in not less than five public places.*

SEC. 17. The board of health of any city or incorporated town or village shall order the owner of any property, place or building (at his own expense) to remove any nuisance, source of filth or cause of sickness found on private property, within twenty-four hours, or such other time as is deemed reasonable after notice is served as hereinafter provided; and if the owner or occupant neglects to do so, he shall forfeit a sum not exceeding twenty dollars for every day during which he knowingly or willingly permits such nuisance or cause of sickness to remain after the time prescribed for the removal thereof.

SEC. 18. If the owner or occupant fails to comply with such order, the board may cause the nuisance, source of filth or cause of sickness to be removed, and all expenses incurred thereby shall be paid by the owner, occupant or other person who caused or permitted the same, if he has had actual notice from the board of health of the existence thereof, to be recovered by civil action in the name of the State, before any court having jurisdiction.

SEC. 19. The board, when satisfied upon due examination that any cellar, room, tenement or building, in its town occupied as a dwelling place, has become, by reason of the number of occupants, or want of cleanliness, or other cause, unfit for such purpose, and a cause of nuisance or sickness to the occupants or the public, may issue a notice in writing to such occupant, or any of them, requiring the premises to be put in a proper condition as to cleanliness, or, if they see fit, requiring the occupants to remove or quit the premises, within such time as the board may deem reasonable. If the persons so notified, or any of them, neglect or refuse to comply with the terms of the notice, the board may cause the premises to be properly cleaned, at the expense of the owners, or may remove the occupants forcibly, and close up the premises, and the same shall not again be occupied, as a dwelling place, without permission in writing by the board.

SEC. 20. Whenever the Board of Health shall think it necessary for the preservation of the lives or health of the inhabitants to enter a place, building or vessel in their township, for the purpose of examining into and destroying, removing or preventing any nuisance, source of filth, or cause of sickness, and shall be refused such entry, any member of the Board may make complaint under oath, to any justice of the peace of his county, whether such justice be a member of the Board or not, stating the facts of the case, so far as he has knowledge thereof. Such justice shall thereupon issue a warrant, directed to the sheriff or any constable of the county commanding him to take sufficient aid, and being accompanied by two or more members of said Board of Health, between the hours of sunrise and sunset,

* As amended by Chapter 59, Laws 1892.

repair to the place where such nuisance, source of filth or cause of sickness complained of may be, and the same destroy, remove or prevent, under the direction of such members of the Board of Health.

SEC. 21. When any person coming from abroad, or residing within any city, town or township within this State shall be infected, or shall lately have been infected with small-pox or other sickness dangerous to the public health, the Board of Health of the city, town or township, where said person may be, shall make effectual provision, in the manner in which they shall judge best, for the safety of the inhabitants by removing such sick or infected person to a separate house, if it can be done without damage to his health, and by providing nurses and other assistance and supplies, which shall be charged to the person himself, his parents or other person who may be liable for his support, if able, otherwise at the expense of the county to which he belongs.*

SEC. 22. If any infected person can not be removed without damage to his health, the Board of Health shall make provision for him as directed by the preceding section, in the house in which he may be, and in such case they may cause the persons in the neighborhood to be removed, and may take such other measures as may be deemed necessary for the safety of the inhabitants.*

SEC. 23. Any justice of the peace, on application, under oath, showing cause therefor by a local board, or any member thereof, shall issue his warrant, under his hand, directed to the sheriff or any constable of the county, requiring him, under the direction of the Board of Health, to remove any person infected with contagious diseases, or to take possession of condemned houses and lodgings, and to provide nurses and attendants, and other necessaries for the care, safety and relief of the sick.

SEC. 24. Local boards of health shall meet for the transaction of business on the first Monday in April and the first Monday in October of each year and at any other time that the necessities of the health of their respective jurisdictions may demand, and the clerk of each board shall transmit his annual report to the secretary of the State Board of Health within two weeks after the October meeting. Said report shall embrace a history of any epidemic disease which may have prevailed within his district. The failure of the clerk of the board to prepare, or cause to be prepared, and forward such report as above specified, shall be considered a misdemeanor, for which he shall be subject to a fine of not more than twenty-five ($25) dollars.

SEC. 25. All laws in conflict with this act are hereby repealed.

* The statute, however, above cited [Secs. 21 and 22], makes it the imperative duty of the local board of health to provide for such person, regardless of his settlement, and if no county can be charged there is no provision in the statute in question for the payment of their expenses. It appears to us that where there is no settlement the sick or infected person must be deemed to belong to the county where the relief becomes necessary. * * * * * In our opinion, they are to be construed as if the provisions of both sections had been embraced in one section, and the provision as to charging had been placed at the close. If we are correct, then the sick person is properly chargeable with all the expenses which may properly be incurred under either section, including the expenses of removal, if that is adopted, and the expense of isolation, if that is adopted; and we think that the county is ultimately liable for the same, if the sick person, and those liable for his support, are unable to pay.—*Supreme Court, City of Clinton v. County of Clinton, 61 Iowa, 305.*

PREFATORY.

It is now over fifteen years since the law was passed creating the State Board of Health. The appropriation for the work of the Board was then, under economic management, sufficient to carry on its work, though never in a way satisfactory to its members. Since then the population of Iowa has nearly doubled; mechanical industries have multiplied; a necessity for a publication from the office of the secretary at regular periods was imperative, and led to the publication of the IOWA HEALTH BULLETIN, of which an edition of six thousand copies is issuedmonthly; increased demands have been made for the circulars and other literature of the Board by local boards and the people; for personal visits by the members and the secretary to infected localities; for the service of a chemist to conduct analyses, and of a bacteriologist to do microscopic and other biologic work. All this has added greatly to the efficiency and value of the work of the Board, and yet had to be so limited in extent and character as to come within the appropriation made so many years ago.

It is regretted that the Board has not done more for the public good, but it has done all that was possible with the limited means at its command.

With a more liberal appropriation, and thereby a more tangible expression of appreciation of the work and success of the Board, its usefulness along the lines suggested would be greatly enhanced.

With so many topics considered in this report, it would be an invidious distinction to call special attention to any. The illustrations used in connection with several of the articles will add greatly to their interest and value, and the State, as well as the Board of Health, are debtors to the publishers, who so generously furnished and permitted their use.

The report covers, as will be seen, a wide range of subjects, and yet all are of vital importance and of growing interest, and it is believed furnishes a fair consensus of the best thought upon the subjects considered.

The secretary takes great pleasure in acknowledging the efficient assistance rendered by Mr. L. F. Andrews in the compilation and publication of this report.

J. F. KENNEDY,
Secretary.

September 15, 1895.

MEETINGS OF THE BOARD.

NOVEMBER MEETING, 1893.

Pursuant to adjournment the State Board convened at the capitol November 2, 1893. There were present Dr. Shrader, president, Drs. Guilbert, Carter, Becker, Reynolds, Emmert and Conniff and Loring, C. E.

The secretary's report for the quarter ending October 31, was presented and referred to a special committee of Guilbert, Loring and Conniff.

W. P. Hohenschuh, president of the Iowa Funeral Directors' Association, was present and invited the attention of the Board to the work of the Association, and the desirability of a law regulating the embalming and burial of the dead.

Dr. Guilbert moved that the Board approve the object presented by Mr. Hohenschuh, and that definite action be deferred until the meeting in Febuary, and that the subject be then presented as complete as possible.

The secretary presented the following circular which is furnished each physician to whom is granted a certificate to practice medicine by the State Board of Medical Examiners, as containing information which every physician should possess:

TO PHYSICIANS AND MIDWIVES.

OFFICE OF THE IOWA STATE BOARD OF HEALTH,
DES MOINES.

Chapter 151* (Laws of 1880) which has not been repealed nor changed by the Medical Practice Act of 1886, not only requires all physicians and

*Sec. 5. It shall be the duty of all physicians and midwives in this State to register their names and postoffice address with the Clerk of the District and Circuit Courts of the county where they reside; and said physicians and midwives shall be required, under penalty of ten dollars ($10), to be recovered in any court of competent jurisdiction in the state at suit of the Clerk of the Courts to report to the Clerk of the Courts within thirty (30) days from the date of their occurrence, all births and deaths which may come under their supervision, with a certificate of the cause of death, and such other facts as the Board may require, in the blank form furnished, as hereinafter provided.

Sec. 6. When any birth or death shall take place, no physician or midwife being in attendance, the same shall be reported by the parent to the Clerk of the District or Circuit Courts, within thirty days from the date of its occurrence, and if a death, the supposed cause of death, or, if there be no parent, by the nearest of kin not a minor; or if none, by the resident householder where the birth or death shall have occurred, under penalty provided in the preceding section of this act.

"A practicing physician should report births and deaths to the clerk of the county where the same occurs, without reference to where he is registered, or where he lives."—*Attorney-General, Jan. 4, 1897.*

midwives practicing in Iowa, whether holding the certificate of the State Board of Medical Examiners or not, to register with the clerk of the district court of the counties wherein they reside, but also requires a report of every birth and death, as well as the cause of such death, to the clerk of the county wherein such birth or death occurs, and fixes a penalty of ten dollars for a failure to so register and report.

The reports to this office show that there has been great negligence in this matter; that while some counties send in good and apparently complete returns, others almost wholly ignore the law. Such faulty and incomplete returns make any deductions based thereon of but little use and therefore do a great injustice to the State. There are those who have no faith in the value of statistics, and who see no reason why such service should be demanded without due compensation. A decision of our Supreme Court sustaining the legality of such requirements says very justly:

"A physician should honestly endeavor to obtain and report all information required by the regulations of the statute and the State Board of Health. This is his duty as a citizen, and is imposed as an obligation by the ethics of the useful and honorable profession of which he is a member."

Births, marriages and deaths constitute the chief events of human life. The record of these phenomena and of the causes leading to the last named, constitute vital statistics. A faithful registration of births and deaths—the beginning and ending of life—is surely of vital importance to every individual of the State, especially to all physicians and students of sanitary science. Such statistics facilitate the identification of individuals, and thereby aid in the settlement of estates; assist in the detection of criminals; afford data for the estimation of life expectancies; furnish to medical and sanitary science important and invaluable information regarding the state of public health; and throw light upon causal conditions upon which prevailing diseases occur, thus leading to intelligent methods for prevention. Indeed, the information obtained from such statistics, form the foundation of all researches in sanitary science. Such statistics, in order to obtain due credit, ought to be furnished wherever possible, by the medical attendant, and hence it is largely, if not only through the coöperation and assistance of the members of the medical profession that reliable reports can be obtained. New Hampshire, Connecticut, Rhode Island, Massachusetts, New York, Michigan, Illinois and Minnesota have reports on vital statistics that are of inestimable value, not only to sanitarians everywhere, but especially to the respective States themselves. Will not the medical profession of Iowa see to it that our State, with a less per cent of illiteracy than any other, is not behind in this particular? Is it too much for this Board to expect that every licensed physician and midwife in Iowa will in the future make full and reliable reports of births and deaths?

They must register in the county in which they reside, and without reference to their place of residence must report all births (including still-births), and deaths to the clerk of the courts of the county or counties in which these casualties occur, within thirty days after their occurrence.

In reporting deaths the names of diseases as given in the circular "Nomenclature of the Causes of Death" must in all cases be strictly conformed to, so far as possible, except that "164 croup" page 8, must be reported as "membranous" or "spasmodic croup"—the former being regarded for quarantine, transportation and interment purposes as identical with diphtheria.

Blanks for making birth and death returns can be had at the office of the clerk of the district court, who is required by law to furnish them upon application, to physicians and midwives in his county. No other form of blank must be used than that prescribed by the State Board of Health, and furnished by said clerk.

Health officers upon application to this office will be furnished pamphlets upon the prevention and restriction of contagious and infectious diseases, and other information desired pertaining to their duties and powers under the law.

It is pertinent here to say, no physician can be elected or serve as health officer of a local board of health who is not a lawful physician, and holds a certificate authorizing him to practice medicine in this State.

NOTE.—A physician may authorize, by letter or by proxy, the clerk of the courts to register his name for him. He should furnish the clerk with the data given in his certificate, issued by State Board of Medical Examiners entitling him to practice.

SMEAD DRY CLOSET SYSTEM.

Dr. Conniff presented the report of the committee to whom was referred the subject of investigation of the Smead Dry Closet System of Heating and Ventilation of School Houses, as follows:

Mr. President, Members State Board of Health:

Pursuant to instructions received at the last meeting of the board, your committee on schools, to whom the question of investigation of the "Smead System of Heating and Ventilating School Buildings" was referred, begs leave to submit the following report:

Your committee immediately entered into correspondence with prominent sanitarians, health commissioners and school officials of the principal cities of the United States and Canada, that we might obtain a consensus of opinion from those who had given the system a practical test.

The members of your committee also visited several places where the system is now, or has been, in the schools, and carefully ascertained its practical workings.

Twenty-six replies to our circular letter from seventeen cities were as follows: Six were in favor of the system, fifteen considered it unsatisfactory, and five expressed no positive opinion.

In some of the buildings visited we found the ventilation good; no odor at the time of our visit; excreta almost dry. In other buildings the ventilation was very bad, the excreta semi-solid in the vaults, and highly putrescent.

In every building, but one, visited we were told that offensive odors from the vaults were plainly discernible throughout the building at times, particularly so in warm weather when the wind was in some certain direction.

While we find much in the Smead system of ventilation to commend, we also find much in the dry-closet system to condemn, as it is now constructed, for the following reasons:

First. The drying of the excreta and ventilation of the closets depends wholly on the ventilation of the building—the "uninterrupted and continuous flow of air in one direction."

This we believe under all circumstances impossible as adverse winds or even opening of a door may cause a reversal of the air current, there being no means of preventing back drafts. This we think under favorable conditions not probable but always possible.

Second. The so-called dry closet is, in many instances, not a dry closet in any sense of the word. On the contrary it very often is a foul mass of decomposing fæces that ought not to be tolerated in the basement of any school building.

Third. The excreta is never subjected to a sufficient degree of heat to destroy possible disease germs when desiccation of the material in the vault occurs.

And as the desiccated material is carried up through the ventilation shaft it may become a source of contagion to the surrounding community and even to the occupants of the building by contaminating the air as it is drawn into the fresh air ducts, should it be infected by the microbes of typhoid fever, diphtheria or other contagious diseases.

Your committee, therefore, regard the Smead dry closet system as it is now constructed, unsanitary, even dangerous, and not the best means of caring for excreta of school buildings when proper sewage or other approved methods are obtainable.

Respectfully submitted,

R. E. CONNIFF,
E. A. GUILBERT,
J. M EMMERT,
Committee on Schools.

The report was accepted and adopted.

The secretary presented opinions of the attorney-general upon the question of per diem of members of the board, and the powers of the board in the Birmingham school house matter which will be found in another part of this report.

SANITARY CONVENTIONS.

Dr. Emmert presented a report upon Sanitary Conventions, as follows:

ATLANTIC, IOWA, October 10, 1893.

To the Iowa State Board of Health:

Gentlemen:—I was one year ago appointed to investigate the matter of local sanitary conventions. I prepared a circular letter, which was sent to quite a number of boards of health, or rather the secretaries, and received quite a number of answers which you will find filed with this report. I was surprised to find that so few boards had any experience in the matter. The Michigan Board seems to have had the greatest success as appears by a number of valuable papers and pamphlets sent me, also a number of programs, which you will also find on file.

While attending the conference at Lansing, in 1892, I heard Prof. Fall read a valuable paper upon the sanitary work of the Michigan Board, and

in which he explained the method and good results. He regarded it as one of the most important factors in educating the people upon matters of sanitary work.

Dr. Benjamin Lee, Philadelphia, writes, that they have had considerable experience in Pennsylvania in this direction, and that it has done much good, also that they found they had better meetings and better attendance in the smaller towns. He further says there is no doubt that such conventions stir up an interest among the people and are a valuable means of distributing information on sanitary subjects.

The secretary of the Massachusetts Board writes, that they hold quarterly conventions of the local boards of health. The Ohio Board is the only one to my knowledge that tried the plan and made a failure of it, or that stopped it after trying it. The secretary says, they could not get up any interest in the matter, but that was some years ago, when the people took but little interest in sanitation. He says for the last three years they have been holding each year, a meeting of the State Board of Health and representatives of the various local boards, which has proved to be a success. They have also held meetings with the superintendents of public schools, and one with the funeral directors. The rest of the boards all report that they have had no experience in the matter of local conventions.

It seems to me that it is the most efficient way of educating the people upon the subject of sanitary work. The people are awaking to the fact that state boards of health are working in their interest, and are regarded no longer as mere political machines, or sinecures. The Board will be handicapped in its good work as long as it is not able to get the coöperation of the laity, and get them individually interested in the work.

The Public Health Association of Iowa is ready and willing to join the Board in this work, and they can do much to work up an interest in the meetings. I would advise the adoption of a resolution declaring it to be the sense of this Board:

That it is to the welfare and best interest of the people of the State of Iowa, that local sanitary conventions be held in different parts of the State, at least three times a year. And that the matter be published in the Bulletin with the request that the county papers copy, and that the different cities and towns be requested to invite the State Board to hold such conventions in their midst.

Respectfully submitted
J. M. EMMERT.

The report was accepted and the resolution unanimously adopted.

IOWA PUBLIC HEALTH ASSOCIATION.

Dr. Emmert presented a report of his attendance at the meeting of the Iowa Public Health Association, held at Davenport:

To the Members of the Iowa State Board of Health:

August 31st, 1893, I visited Davenport as delegate from this Board to the Iowa Public Health Association, and beg leave to very briefly make my report as such delegate. I am sorry to say that the attendance was very small, there not having been registered over forty members. Those who were present were very earnest in the work, and a number of very interesting papers were read and quite extensively discussed. Rev. Father J.

F. Kempker of Adair read a learned and interesting paper upon sanitation in construction of the residence. He made many good points in the paper, one of which was the recommendation to have the cellar dry, well lighted and heated, in fact as much so as any room in the house. We know that many diseases are caused by damp, ill lighted and unventilated cellars.

Dr. George L. Eyster of Rock Island read a practical paper upon the subject, "Collection and Disposal of Garbage." He said the city of Rock Island collected the garbage each day and placed it upon a flat boat, which was taken out into the current of the river and dumped. He said this was not a scientific or sanitary way of disposing of the offal, but was the best way they had, as they had no crematory. He recommended the idea of small furnaces upon wheels, that could be hauled from house to house, as being probably the cheapest and best for the smaller inland cities. The gentlemen who spoke on the subject all agreed that the only safe way to dispose of garbage was to burn it. I suggested the idea that in the near future all this material would be made a source of revenue, by disinfecting it and then using it as a fertilizer. This can be done without the least danger to health.

Dr. C. H. Preston read a paper on the subject of "Disinfection by Heat," that was ably discussed by a number of the members. He suggested that each city and town should have a place where clothing, bedding and all materials used about the sick room could be taken and disinfected without danger of destroying the goods. He thought this should be done at public expense.

A very elaborate and learned paper was read by J. H. Harrison upon "Cremation of the Human Dead." The paper was ably discussed by a number of the members, they all agreeing the only way to dispose of the dead in a sanitary and safe way was by cremation. I would recommend the publishing of this paper, as well as others, in the Bulletin.

Prof. E. Q. Smith of Beloit, Wis., read a very able and scientific paper upon "Water Analysis." This was one of the best papers read at the meeting. There was no discussion upon it, because no one there felt able to add anything to it or criticise it.

Many other papers were read, which were of interest, but those named will give a good idea of the ground covered by the meeting, and were among the more interesting. There was a committee appointed to confer with this Board, one to be appointed, looking toward a revival or creating greater interest in the meetings, and getting out a larger attendance. The Association is willing and anxious to assist in any way in holding sanitary conventions in different parts of the State. The general sentiment seemed to be that conventions of this kind could be made a success, and would do much to educate the people upon the subject of health.

In another report I discuss this matter more fully. Davenport entertained the Association in a royal manner. The meeting was a success, if the attendance was small.

Respectfully submitted,

J. M. EMMERT.

The report was accepted and adopted.

KEROSENE.

The committee on kerosene made the following report relative to branding the lighter products of petroleum, naphtha; benzine, gasoline, etc., which was adopted:

Your committee to whom was referred the matter of branding naphtha, benzine and other volatile products of petroleum by oil inspectors with their brand, "Rejected for illuminating purposes," have had the same under consideration and would report that—

WHEREAS, The statute prohibits the use of all products of petroleum for illuminating purposes that has not a flashing test of over 105°; and

WHEREAS, Naptha, benzine, gasoline and other volatile products of petroleum are so light as to render a test impossible under the statute; and

WHEREAS, These products are being sold about the country by unscrupulous persons for illuminating purposes under the guise of "safety oil," and safety lamps, to the great danger of the public, and in contravention of the intent and purpose of the statute, therefore, we recommend that all such products be branded by oil inspectors, and rejected for illuminating purposes, and the state inspector be so notified, and requested to enforce the regulation.

E. A. GUILBERT,
E. M. REYNOLDS,
L. F. ANDREWS,
Committee on Kerosene.

INTERNATIONAL CONGRESS OF PUBLIC HEALTH.

The secretary presented a report of his attendance at the meeting of the International Congress of Public Health at Chicago, which was accepted.

To the State Board of Health:

The International Congress of Public Health as a branch of the World's Congress Auxiliary of the World's Columbian Exposition was held in the Memorial Art Institute, in Chicago, October 9-14. It was in conjunction with the American Public Health Association, and was after the formal opening as a congress presided over by the president of the A. P. H. A., Dr. S. H. Durgin, of Boston.

The congress was formally opened by Hon. Charles C. Bonney, president of the World's Congresses. He briefly set forth the importance of the work of sanitation and recognized it as one of the most important auxiliaries of the Columbian Exposition.

Addresses of welcome were delivered by Dr. Reynolds, health officer of Chicago, who represented the mayor, and by Mrs. Charles Henrotin, vice-president of the Woman's Branch of the World's Congress Auxiliary.

Responses were made by Dr. S. H. Durgin and by representatives from Canada and Mexico.

The attendance upon the sessions was not nearly so large, and the interest in the papers read was not nearly so great, nor the discussions thereon so animated and practical as usual. This may readily be accounted for. The opening day—the 9th, was "Chicago Day," and though it was the day

of days for Chicago people, and for the hundreds of thousands of visitors, it was such a poor day for a health congress that no attempt was made to hold a session. Then Tuesday and every remaining day of the week was filled with so many attractions and diversions that it was hard for the congress to get down to real excellent business.

There were a number of most excellent papers read, and those who attended all the sessions, and gave heed to their contents, carried away with them many excellent new practical thoughts respecting sanitary science.

Quite a number who were announced as having papers to read were absent, and some who were present asked to have their papers read only by title. There were quite a number of papers read in Spanish by their authors —only two or three of which were accompanied by translations. These were unintelligible to the English speaking members, as were the English papers to those from Mexico and Brazil. So much else was transpiring in Chicago that the press of the city devoted but little space to the meetings, and the work of the congress was but little known outside of the halls in which the sessions were held.

I believe this is a good place and time to question the efficiency, as an educational factor, of the American Public Health Association under its present organization. I believe after mature reflection and careful observation, that better results in disseminating the truths of sanitary science, hygiene and preventive medicine would be secured if it were less unwieldy. I believe, especially in matters relating to national legislation, the presence of aliens is embarrassing to the respective countries represented.

It would seem, if not impertinent, at least not in good taste for the United States members, being greatly in the majority, to dictate what the Dominion of Canada or the Republic of Mexico should do in the way of governmental legislation upon sanitary matters. So, also, resolutions introduced or supported by vote or voice by Mexicans or Canadians that are designed to influence legislation by the United States can only be entertained by courtesy, and if passed, can have but little weight. Again, papers read in a tongue foreign and unknown to any of the members, unless accompanied by translations, when read, do not receive the attentive hearing they deserve, and fail totally of any practical advantage. To furnish translations to be distributed to the members when assembled in session, or to be printed in the transactions, would be a great expense; and, indeed, the whole transactions should be in two editions, one Spanish and one English.

I believe there should be a Pan-American Association that should meet once in three or four years to discuss theories and deductions from experiments and furnish information as to the efficiency of certain lines of work and the practical operation of laws respecting public health in their respective countries.

Each American country should have a national and state or provincial organization of its own. Such a national association, the meetings of which if held in the language of the country, and within the boundaries of the government, for all lines of preventive medicine, and of public health work could do much better and more efficient service.*

I believe the social feature is the only one to commend the present arrangement, and that such Pan-American meetings should be held not oftener than once in three or four years.

BACTERIOLOGIST.

J. Christian Bay, assistant bacteriologist of the Missouri Botanical Garden, St. Louis, was elected bacteriologist of the Board and arrangements perfected for original investigations in the field of pathogenic bacteriology.

CHEMIST.

Prof. Elbert W. Rockwood of the State University was elected chemist of the Board.

FEBRUARY MEETING, 1894.

At the meeting held February 1, 1894, there was present Drs. Shrader, Conniff, Guilbert, Becker, Reynolds, Carter and Emmert, Attorney-General Stone and State Veterinary Surgeon Stalker.

On motion, Hon. Henry Sabin, superintendent of public instruction, was invited to attend the meeting.

The secretary presented his quarterly report, which was referred to the standing committees.

SMALL POX.

Small pox being prevalent at several points in the State, the subject was considered at length as to methods for its prevention and eradication, during which the question arose as to the powers of the Board in the premises. An exhaustive opinion was given by the attorney-general, which will be found elsewhere in this report. The Board thereupon made the following order, and directed it to be published, together with a circular of instructions:

THE STATE OF IOWA, HEALTH DEPARTMENT,
SECRETARY'S OFFICE, DES MOINES.

ORDER FOR VACCINATION.

At a meeting of the State Board of Health, February 2, 1894, for the purpose of preserving and improving the public health, and to prevent the spread of the disease known as small pox, the following rules and regulations were ordered:

FIRST.—All persons in this State over the age of one year, who have not been vaccinated, or who, in the opinion of the local board of health of the district or jurisdiction in which such persons reside or are found, who do not furnish satisfactory evidence of protection from small pox, are hereby ordered to be vaccinated.

SECOND.—Local boards of health and all officers who compose said boards, and all sheriffs, constables, city marshals and police officers within their respective jurisdictions, are hereby directed to enforce the foregoing order as soon as practicable; and so far as said order shall apply to the pupils of any public or private school or to the teacher thereof, the officers of the school district in which such school is held shall also require its enforcement.

J. C. SHRADER, M. D.,
President.

J. F. KENNEDY, M. D.,
Secretary.

THE STATE OF IOWA, HEALTH DEPARTMENT,
SECRETARY'S OFFICE, DES MOINES.

To whom it may concern:

In order to secure, with the greatest promptness, general vaccination or re-vaccination throughout the State—not only of school children, but of all persons not furnishing satisfactory evidence of successful vaccination, the regulations hereto attached were made.

Regarding the power of the State Board to make such regulations, Hon. John Y. Stone, attorney-general, in a decision rendered February 2, 1894, says:

"I am inclined to the view * * * that the State Board of Health could, under its general power 'to make such rules and regulations as they may deem necessary for the preservation of the public health,' make an order requiring all children in the public schools, and citizens of the State, to be vaccinated."

In accordance with this opinion, all local boards of health, school officers, mayors, sheriffs and other state officers are hereby directed to enforce the aforesaid regulation, and also the following general regulations of the State Board:

RULE 1. Every person entering any public school of Iowa must give satisfactory evidence of protection by vaccination.

RULE 2. The fact of vaccination and protection must be entered with each name on the school record, and on transfer and promotion lists.

J. C. SHRADER, M. D.,
President.

J. F. KENNEDY, M. D.,
Secretary.

The above, so far as it relates to the public schools of the State, is most heartily approved by this department. County superintendents, school officers and teachers are earnestly requested to assist in its enforcement.

HENRY SABIN,
Superintendent of Public Instruction.

The following form of certificate was adopted by the Board—the form being intended specially for children attending the public schools:

PUBLIC SCHOOLS.

CERTIFICATE OF VACCINATION.

Name of pupil.....Age.....yrs.....mos.
Residence.....
Date of primary vaccination.....18.. Virus { Bovine. / Humanized. } Result.....
Date of re-vaccination.....18.. Virus { Bovine. / Humanized. } Result.....
Had small pox or varioloid.....18.. Evidence.....

I hereby certify, that I have this day examined the above named pupil, and that the foregoing statements are correct, to the best of my knowledge and belief, and that said person is, in my professional judgment, *properly protected* against small pox.

.....M. D.
.....189.. Residence.....

Principals must preserve this certificate.

Reverse Side.

TO PHYSICIANS FILLING OUT THIS CERTIFICATE.

1. Fill every blank calling for any fact obtainable.
2. Erase all unnecessary words.
3. State whether the *result*, as to the scar, etc., is *typical, fair* or *bad.*
4. Pupils must be re-vaccinated at least every seven years—unless they have had small pox or varioloid.
5. If vaccination *will not "take"* the physician may certify that there exists vaccinal insusceptibility, *provided,* he has repeated the vaccination (with tested virus) without result often enough to justify him in assuming the responsibility of asserting the proper protection of the child.
6. *This certificate is valid only when signed by a legally qualified physician.*

Immediately following the issuance of the foregoing order numerous inquiries from local boards all over the State were made as to how the order is to be enforced, who is to pay the expense, and whether or not all school children must be vaccinated or excluded from the schools. To reply generally to these inquiries the following circular letter was issued.

THE STATE OF IOWA, HEALTH DEPARTMENT,
SECRETARY'S OFFICE, DES MOINES.

Numerous inquiries are being made as to what proceedings are necessary, and what power there is to enforce the recent order of the State Board requiring general vaccination. It is proper to say that the order was made by the State Board as an important precautionary measure for the protection of the public health, as it was clearly its right and duty to do. Its enforcement rests with local boards of health, and with all officers who compose said boards, as well as all sheriffs, constables, city marshals, and police officers within their respective jurisdictions, and with school officers so far as said order shall apply to the pupils of any public or private school, or to the teachers thereof, in which such school is held.

It is not the province of the State Board to construe the statutes, or prescribe the manner of enforcing regulations by local boards. The State Board will not furnish virus. All matters relating to obtaining virus, and the compensation for vaccination must be determined by local boards.

As to public schools, the order of the State Board is peremptory, and is an order for the quarantine of all schools against all children and teachers who do not give evidence of successful vaccination. If the parents of children refuse to have them vaccinated, the children must be excluded from school until they conform to the regulations made. A record should be made of the name and residence of all children so excluded.

Families may have the vaccination done at their homes by whomsoever they please. For the indigent poor, means should be provided for vaccination at public expense, which will be nothing in comparison to an outbreak of small pox in an unprotected community.

It is of great importance that local boards, and all persons, should secure only pure and healthy virus. This done, the chances of unfavorable results are reduced to the lowest possibility.

Opposition to this order is unwise, absolutely false in fact, and nothing less than favoring the spread of small pox, and bringing death and misfortune where it might be prevented.

Already has arisen opposition and protest to destroy public confidence in vaccination. In Sheffield, England, where small pox was epidemic owing to the opposition of anti-vaccination theories, of ninety-five thousand vaccinated children only *one hundred and eighty-nine* contracted small pox, and of these *two died*, whereas out of only five thousand unvaccinated children *one hundred and seventy-two* contracted the disease and *seventy died*. Of two hundred and ninety postal carriers, messengers and telegraph messengers, who cannot be employed unless protected by vaccination, and whose service brought them repeatedly in contact with the disease, not a single one contracted small pox.

We trust that in enlightened and intelligent Iowa, the most progressive State in the Union, we shall have no more senseless obstruction to the health and safety of the people, which is without a single basis of fact, and will result only in creating distrust among those who are more easily controlled by their fears than convinced by truth or facts, however skillfully or unequivocally presented.

School boards cannot interfere with regulations made by the State or local boards. They must conform to and execute them.

In reply to numerous inquiries from those living in rural districts, remote from physicians and towns, who desire protection from small pox by vaccination, it has been deemed advisable to set forth a plain, simple method by which any person may vaccinate themselves, or parents their children at the mere nominal cost of vaccine points, which are ten cents each, for packages of ten points.

1. Secure pure and healthy virus, which is not more than ten days old, as beyond that age it loses its vitality and becomes unreliable.

2. Roll up the sleeve of the left arm to the shoulder. With the edge of a knife, not too sharp, lightly scrape off the skin on a space about the size of one-half of a small pea, in two places about an inch apart on the outside of the arm about six inches below the top of the shoulder. Avoid cutting so as to cause blood to appear. Take up some tepid water on the blade of a table knife, and dip the ivory point in the water. Give the point a gentle shake to remove the excess of water; wait a moment for the virus to soften; wipe off the blood, if any there be on the arm, and press the flat side of the point to the scarified spot, rubbing the virus well in, and also picking it in with the point. Scrape up all the resulting blood and lymph, plaster it over the spot; wait about fifteen minutes for it to dry; then roll down the sleeve and let it alone. Use no court plaster or device to cover the spot. The sleeve should be loose to allow free circulation. Use one point for every person. Never attempt to vaccinate different persons with the same point. Use no scab, nor lymph taken from another person. Wash the knife clean and wipe it dry after each vaccination.

If there are not indications of inflammation by the eighth day, it may be regarded as unsuccessful, and if it be a primary vaccination it should be repeated; if a re-vaccination, it may be considered as evidence of successful protection against small pox.

J. F. KENNEDY, M. D.,
Secretary.

Dr. Guilbert offered the following resolution, which was unanimously adopted by a rising vote:

To the Governor: The State Board of Health, in quarterly session assembled, after due consideration of the merits of the situation, unanimously reaches the conclusion that the best interests of the cause of public health would be subserved by the reappointment to membership of the Hon. E. M. Reynolds, whose term of office has just expired.

President Shrader was selected to lay the resolution before Governor Jackson.

The Board proceeded to the consideration of a bill providing amendments to chapter 151, laws of 1880—the laws governing the health department of the State. The bill was completed and Hon. A. B. Conaway of the senate, who was present by invitation, was unanimously selected to introduce it in the senate and to use his best endeavors to secure its passage. Representative Lauder was unanimously chosen to take charge of it in the house.

Dr. Conniff introduced the following resolution, which was adopted:

Resolved, That for the purpose of preventing the spread of small pox, the managers of the several railroads in Chicago be requested to provide means, so far as possible, of preventing the transportation of persons on trains from Chicago to western points whom there is good reason to believe have been exposed to that disease.

A communication was read from Keota, stating that "parties here are shipping in and selling at auction immense quantities of second-hand world's fair furniture, beds, bedding, etc.," and

asks: "Would our local board be justified in compelling the disinfection of these goods before disposing of them?"

The secretary was instructed to advise this and all other local boards to be vigilant on this point, and in all cases where there is reason to suspect infection, to require the disinfection of all such supplies.

A committee on behalf of the Funeral Directors' Association of Iowa was received, and they were permitted to lay before the Board a bill prepared by them, providing for the appointment of a Board of Embalming for the State of Iowa, and for the education and licensing of embalmers.

The bill was considered seriatim by the Board, amended, approved as amended, and recommended for enactment.

It was unanimously ordered that a bill be drafted and introduced in both houses, providing that the superintendent of public instruction be a member of the State Board of Health, *ex-officio*.

It was also recommended that the attorney-general be requested to prepare a suitable bill providing for an emergency fund to be placed in the hands of the Executive Council, to be expended as directed in cases of great emergency.

The State Plumbers' Association also laid before the Board a bill providing for the regulation of plumbing in the State of Iowa. The Board expressed itself in hearty sympathy with the ends sought by the bill.

The Board also recommended the passage of a bill amending the law relating to barbed-wire fences about school houses, so as to expunge the word "public," and make the law equally applicable to all school houses—whether private, parochial or public.

MAY MEETING, 1894.

At the meeting held May 3, 1894, there was present Drs. Shrader, Guilbert, Conniff, Emmert, Carter and Becker, and Prof. M. Stalker, State Veterinary Surgeon. Dr. J. A. Scroggs of Keokuk, presented his appointment as successor to Dr. Reynolds, whose term had expired.

SMALL POX.

The secretary reported that so far as the records indicated small pox during the year had appeared within the State at Burlington, one case, *recovered;* Marion, one case, *recovered;* Chelsea, one case, *recovered;* Ft. Madison, one case, *died;* Salt Creek twp., Tama county, five cases, *three deaths;* Marengo, one case, *recovered;* Carson, eight cases, *recovered;* Clinton, six cases, *one death;* Pacific Junction, three cases, *one death;* Council Bluffs, seven cases, *two deaths;* New Hampton, eight cases, *four deaths;* Keokuk, one case, *recovered;* and Tama City, one case, *recovered* —making a total of 46 cases, with 11 deaths. So far as ascertained no deaths occurred in persons who had been previously vaccinated, and no cases of small pox developed in persons who had been thus protected, except in two or three alleged instances, and then only in the varioloidal form.

As indicating the measures adopted by the Chicago railway companies in coöperation with the various state boards of health in their efforts to prevent the spread of this disease in response to requests made by various state boards of health, the following circular was laid before the Board:

CHICAGO, MILWAUKEE & ST. PAUL R'Y CO.

GENERAL MANAGER'S OFFICE.

CHICAGO, April 25, 1894.

To Station Agents and Conductors:

To prevent the spread of infectious diseases it is hereby made the duty of conductors to report by wire to their superintendents and the secretary of the State Board of Health any person on their train suspected of having small pox or cholera.

Station agents and depot masters are also required to report such cases as above, and in addition thereto, to report to the local board of health the arrival of ALL IMMIGRANTS at their stations so that such local boards may have an opportunity of making such inspection of persons and baggage as may seem desirable.

BACTERIOLOGY.

Mr. J. C. Bay presented a report of his investigations of the etiology of small pox which is given in another place, title "Small Pox."

CONSUMPTION.

Dr. Becker introduced the following resolution, which was unanimously adopted:

WHEREAS, Consumption is a constant menace to the people and has been recognized to be an infectious disease, therefore, be it

Resolved, That a committee of two be appointed to formulate rules and regulations for the management of those sick with consumption, and to submit the same to the Board for consideration at its next quarterly meeting in August, and that this investigation include the dangers, if any, of infection by domestic animals affected with tuberculosis.

Dr. Becker and Prof. Stalker were appointed as said committee.

Dr. Frederick Becker was elected president for the ensuing year and Dr. J. F. Kennedy was re-elected secretary and L. F. Andrews, assistant to the secretary

STANDING COMMITTEES.

President Becker appointed the following standing committees for 1894–1895:

Auditing—Loring, Shrader, Scroggs.
Animals—Stalker, Guilbert and Carter.
Contagious diseases—Emmert, Guilbert and Secretary.
Corpses—Scroggs, Conniff and Secretary.
Food and Water—Carter, Emmert and Loring.
Kerosene—Secretary, Shrader and Andrews.
Legislation—The Board.
Library—Conniff, Guilbert and Secretary.
Plumbing—Loring, Conniff and Carter.
Publication of Papers—Guilbert, Shrader and Emmert.
Rules and Regulations—Attorney-General, Stalker and Secretary.
Schools—Shrader, Guilbert and Carter.
Ventilation—Conniff, Stalker and Loring.

AUGUST MEETING, 1894.

At the meeting held August 2, 1894, there was present Drs. Becker, Shrader, Carter, Conniff, Emmert and Scroggs and Prof. Stalker, State Veterinary Surgeon.

TRICHINÆ.

Dr. C. W. Styles, representing the National Bureau of Animal Industry, was present and was invited to report the result of his investigation of trichinæ among hogs in this State. At the conclusion of his report, Dr. Carter moved that the Secretary of Agriculture be requested to have the investigation of trichinæ continued throughout the State. The motion was adopted.

SMALL POX.

The secretary reported that since the last meeting, small pox had appeared at several points, but owing to the prompt and vigorous action of local boards, there had been no spread of the disease—in fact, in nearly all instances it was confined to the original case, or to the family of its first invasion.

Numerically, and in the order of appearance, the cases were as follows:

	Variola.	Varioloid.	Vaccination after exposure.	Not vaccinated.	Recovered.	Died.	Previous vaccination.
Fort Madison	...	1	...	...	1	...	1
Clinton	3	4	4	3	5	2	...
Dubuque	1	...	...	1	...	1	...
Vinton	1	...	...	1	...	1	...
Jefferson township, Poweshiek county	1	2	2	1	3	...	...
Mt. Pleasant	...	1	...	..	1	..	1
Bethlehem township, Pacific Junction and Pacific City, Mills county	25	11	28	8	27	9	...
Total	31	19	34	14	37	13	2

The case at Mt. Pleasant was that of a prisoner—confined in a cell with two others, who were promptly vaccinated. The same night they broke jail, went to Burlington, where they were captured and returned to jail. No symptoms of the disease appeared in the two who were vaccinated.

If any argument were necessary to demonstrate the protective value of vaccination it is clearly presented in the facts shown by the above report. Here we have in all fifty cases, of which thirty-one were variola, and nineteen varioloid. Thirty-four were vaccinated after exposure and two previously. There were thirty-seven recoveries. Fourteen were unvaccinated—of whom thirteen died. At Pacific Junction sixteen cases of variola were so modified by vaccination as to result in recovery. Two of varioloid were vaccinated before any known exposure. Real source of exposure unknown. Dr. Hunter, who had varioloid, was vaccinated at the age of five and again at fourteen. He recovered.

OIL INSPECTORS.

At the last meeting of the Board a question arose as to the proper construction of the statute regarding the appointment of deputy oil inspectors—as to whether or not it was the province of the State Board of Health to confirm or reject appointments of deputies made by the state inspector, or simply to determine as to the number appointed. The question was referred to the attorney-general. His opinion thereon is given in another part of this report, title, "Decisions."

LEPROSY.

The effort being made to provide systematic disposal and control of lepers in the United States was presented to the

Board in a paper read before the Congress of American Physicians and Surgeons, at Washington, D. C., May 30, 1894, by Walter Wyman, M. D., supervising surgeon-general, United States Marine Hospital Service, as follows: *

In October, 1889, the American Public Health Association, at its meeting in Brooklyn, passed a resolution calling upon the Marine Hospital Service and the State Board of Health of Florida, and all quarantine commissioners of ports having intercourse with Cuban ports, to exercise the same vigilance with regard to leprosy that is already observed in the case of yellow fever during what is known as the quarantine period. In accordance with this request, a circular was issued by the surgeon-general of the Marine Hospital Service, approved by the secretary of the treasury and the president, December 23, 1889, forbidding entry of any vessel to any port of the United States without a certificate from the proper officer that no case of leprosy was found on board said vessel, or, in case one had been found, that it had been removed from the vessel and detained at the quarantine station; with a further provision permitting the departure of the detained leper on outgoing vessels bound to the foreign country from which the leper last sailed.

The new quarantine regulations of the treasury, promulgated April 26, 1894, provide as follows:

"Vessels arriving at quarantine with leprosy on board shall not be granted pratique until the leper with his or her baggage has been removed from the vessel to the quarantine station.

"No case of leprosy will be landed.

"If the leper is an alien passenger, and the vessel is from a foreign port, action will be taken as provided by the immigration laws and regulations of the United States.

"If the leper is an alien, and a member of the crew, and the vessel is from a foreign port, said leper shall be detained at the quarantine at the vessel's expense until taken aboard by the same vessel when outward bound."

Furthermore, the immigration law of the United States, providing for the medical inspection of immigrants, forbids the landing of immigrants afflicted with a loathsome or contagious disease, thus furnishing an additional protection against the importation of cases of leprosy. These laws and regulations have, in a measure at least, been effective. I am informed by the sanitary inspector stationed at Havana, that several persons afflicted with leprosy desiring to immigrate to Florida have been deterred from so doing by reason of these restrictions.

National control of leprosy *within* the United States has been frequently advocated, particularly by state and municipal boards of health, when finding such cases upon their hands and desirous of being relieved of their care. The arguments for such control, of course, are based upon the presumption of the contagiousness of the disease (even though moderately contagious) and also upon the claim that where no segregation of cases, or no supervision of cases not colonized is enforced, the disease gradually

* Delivered before the Congress of American Physicians and Surgeons, Washington D. C., May 30, 1894, under the direction of the American Dermatological Association.

increases in prevalence, and that where segregation or colonization has been enforced the disease has been made to disappear.

One reason alleged for a national establishment is the fact that in some States the disease is of so rare occurrence that the erection of a special hospital or place of confinement for lepers is scarcely justified, and it is desirable, therefore, that there should be established an asylum to which any of the States might send these unusual but highly objectionable patients. It is further urged that by reason of the difficulty of properly caring for lepers, and because of the uneasiness and excitement that would prevail in cities or localities should the presence of a leper be announced, the health authorities themselves are tempted to conceal the cases from the knowledge of the public. Thus, if there is anything in the doctrine of contagiousness whatever, the local authorities themselves may directly aid in the extension of the disease. If a national asylum were provided there would be no motive for concealment.

Granted that the danger of contagion is small; granted that in the language of another, a case of leprosy within a family should be regarded with less concern in its relation to the health of the remaining members than a case of tuberculosis; granted that the disease spreads chiefly among the lower classes, nevertheless, in the movement which is now only near the starting point, but which promises to be a controlling movement, and which will mark the close of the present century and the beginning of the next, so far as medical science is concerned, as distinctly as any other evidence of progress in the healing art (I refer to the settled resolution to exterminate every contagious disease), it would appear to be incumbent on the profession to leave nothing undone to exterminate this, together with other communicable diseases.

Now, with regard to national control, there are two conditions involved. *First:* Does the *right* of national control exist? *Second:* If it does, how may that right be best exercised?

Concerning the first consideration, I find a difference of opinion among eminent men with whom I have conversed, based upon their different views regarding the Constitution of the United States.

A strict constructionist will inform you that the United States government can only legislate in accordance with powers expressly delegated by the Constitution, and that the general-welfare clause of the Constitution applies as a qualifying clause to the specified prerogatives—that the latter are only granted when necessary for the general welfare.

The States, however, may make any laws which are not forbidden by the Constitution of the United States. This view would discourage the attempt to establish a national leper hospital by the general government, but it is claimed that the end might be met by one State establishing a hospital and being willing to receive into it the lepers consigned from other States, their expenses being paid by the latter, as has been done in a number of instances with regard to jails and penitentiaries.

Those who take a different view of the Constitution assert that it is quite within the province of congress to appropriate a sufficient sum to establish a national leper hospital, though the necessity for it must be plainly shown. They call attention to laws already passed to which objections similar to those mentioned above were urged.

An outline of a bill for this purpose might be stated as follows:

An Act appropriating a sufficient sum to establish a national leper hospital, and authorizing the national officer in charge thereof to receive, or to proceed and take possession of, a leprosy patient upon the consent of the proper authority of the State. There should be a corresponding act passed by the legislature of the State, conferring power upon some official—preferably the governor, with the advice of the State Board of Health—to *respond* to such a requisition. It should be made the duty of the government officer in charge of the institution, upon hearing of the presence of a leprosy patient, to request such authorities of the State as have been designated for that purpose by the legislature, to turn over said patient to said officer, for the purpose of being transferred to said hospital; and the congressional act should also provide that the officer in charge of the institution should make such regulations for the treatment and confinement of the patient as the nature of the case demands.

It will be observed that an act of this nature would still practically leave the determination of the disposition of the patients within a State to the State itself, and leave to the discretion of the governor and the State Board of Health whether, in a given instance, the leper should be segregated. The necessity of this discretion is evident from the fact that special circumstances might so surround a given patient as to make it cruel or unnecessary to remove him. At the same time it would provide for the proper removal and proper care of those who are not surrounded by such circumstances. To the objection that some States might fail to thus legislate or avail themselves of the privilege of a national institution, it may be urged that in this event the law of February 15, 1893, which permits the making of regulations to prevent the spread of contagious diseases from one State to another, could be brought into exercise to prevent lepers leaving such a State. It is believed that this State would in time have a physical demonstration of the necessity of taking advantage of the national institution, or of making equal provision itself.

This is a brief outline, which it might be necessary to modify.

To determine whether such a bill would pass, it would be necessary to introduce it, but, as preliminary to its passage, its necessity would have to be demonstrated to congress. For this purpose, and that congress may be assured that the medical profession and sanitary officers had not acted upon insufficient premise, it is suggested that a leprosy commission should be appointed, of three or five members, to make report upon the prevalence of leprosy in the United States, and the necessity and proper method of its control.

A preliminary bill might be introduced, empowering the president to appoint such a commission; and, as the success of the bill would be enhanced if it called for no additional appropriation, there might be included a provision setting aside a portion of what is known as the "Epidemic Fund" to meet the expenses of this commission.

Whether a national leper hospital would be the result of this action or not, a commission of this character would cause a sense of relief to the people of the United States, whatever its conclusions, either affirmative or negative, to such establishment.

As for myself, I believe that leprosy should be under national control.

Dr. Shrader gave a verbal report of his visit to San Francisco, and of the opportunity afforded to examine a number of leprosy cases in different stages. He earnestly indorsed the movement to secure control of lepers in this country.

On motion the recommendations of Dr. Wyman were unanimously approved.

CIVIL ENGINEER.

The resignation of J. L. Loring as civil engineer of the Board was presented, accepted, and placed on file.

GASOLINE.

In view of the numerous accidents resulting from carelessness, and mistakes of dealers in substituting gasoline for kerosene, and for the protection, so far as possible, against the loss of life consequent upon such mistakes, the following order was presented by Dr. Shrader, and adopted:

In order to prevent, so far as possible, the injury to persons, the loss of human life, and the destruction of property resulting from negligent and careless handling of products of petroleum, by which gasoline is substituted for kerosene to be used for illuminating purposes, the State Board of Health has made the following regulation, as a measure of protection to human life; to-wit:

"Every package, cask, barrel, or vessel containing gasoline shall be properly and distinctly labeled, and no gasoline shall be sold, given away, or delivered to any person within this State until the vessel containing the same has been plainly marked with the word 'gasoline.'

"This rule shall also apply to gasoline sold or delivered from so-called delivery wagons."

TUBERCULOSIS.

Prof. Stalker spoke at considerable length upon the prevalence of tuberculosis among cattle, and the great importance of tuberculin as a diagnostic test of its presence.

Dr. Becker, in behalf of the committee on tuberculosis appointed at the last meeting, made the following report:

To the Iowa State Board of Health:

GENTLEMEN:—Your committee, to whom was assigned the investigation of tuberculosis, most respectfully report that the time allotted to this investigation has been too limited for any very extensive investigation, and their reports as offered to-day must consequently be imperfect and incomplete.

Two varieties of tuberculosis.—After careful investigation your committee have arrived at the following conclusions:

That there are two distinct forms of tuberculosis, the non-bacillary, and the bacillary; the former being the rapidly terminating, commonly known

as quick consumption, or as given by some authors, cheesy degeneration of the lungs and other visceral tissues, in which all manifestations of the disease closely resemble bacillary tuberculosis, except that the regular rise of afternoon temperature is absent, and the bacillus itself is not found.

The bacillary variety.—This, with its afternoon rise of temperature and the presence of the bacillus, is the one in which we are especially interested, it being the contagious and infectious variety of tuberculosis.

To it are especially subject, in the animal kingdom, the first sub-class of mammalia known as the "Placentalia," the class of which man is the most prominent member.

Further, that while it is not positively proven beyond a doubt that the second and third sub-classes of mammalia, those of "Marsupialia" and "Monotremata" are subject to its infection, it is the opinion of this committee that they are, and that further investigation will undoubtedly establish the truth of this opinion

That birds, also, especially the domesticated, are liable to its infection.

Its hereditary character.—It has long been known that tuberculosis is hereditary; but while in former years it was believed to be hereditary only, recent years have developed the fact that it is so in a very limited degree.

Its infectious character.—Since the discovery of the *Bacillus tuberculosis* by Prof. Koch, of Berlin, in 1882, and the experiments of such men like Herbst, Pfeffer, Eisenberg, Villemin, Ernst, Prudden, Sawiskey, Stone, Cornett, and many others, who have carefully tested the infectious character of the disease by injecting tuberculosis matter into lower mammalia from man, and in that way have produced tuberculosis in all of its manifestations and fatality that question has been settled for time to come.

Other causes than the Bacillus.—We recognize two distinct causes in its production, the predisposing and the existing, both of which are equally operative. Of the predisposing causes first of all deserving mention is "heredity." The inheritance of a weak, enfeebled constitution from the ancestors, may be looked upon as a prime predisposing one. Chronic or acute weakening diseases in earlier or later life; weakening habits of all kinds; insufficient and unsuitable food; sedentary habits; lack of cleanliness; too close application to physical or mental labor; and any and all influences lowering the normal standard of strength and vitality.

The exciting cause.—The introduction into the body, either by inhalation, by infection through wounds or otherwise, of the *Bacillus tuberculosis.*

Preventive influences.—Vigorous constitution: and non-exposure to infection.

Modifying influences.—Of these there are many; sunlight, pure air, nutritious, wholesome diet; well lighted and ventilated dwellings; general hygiene; an abundance of out-door exercise; sufficient rest; perfect respiration; regular and good habits; and anything and everything that will raise and maintain the standard of health and vigor to a normal condition.

Latitude and altitude as modifying influences—Altitude has a wonderfully modifying influence in tuberculous diseases, and if resorted to in their earlier stages, before the breaking down of tissue has begun, has been the means of curing thousands of cases. The first scientific test of this fact was made by Dr. Hermann Brehmer, who established a hospital for consumptives near the little mountain village Gorbersdorf, in the Thurringer Wald

mountains in 1856, and which is to-day the oldest and most frequented hospital of the kind in the world. Here, at an altitude of two thousand feet above sea level he practically demonstrated his ideas of the modifying and curative influences upon tuberculosis, thousands of sufferers having been benefited and other thousands cured. But it must be understood that altitude can only be thought of in connection with latitude. In the tropics for instance, altitudes of two thousand feet and less, could not be thought of as exerting any modifying influence, whereas under latitudes 50° to 60° north or south it does, as demonstrated by Dr. Brehmer and others.

Beginning on the American continent with the high plateau of the City of Mexico, with its altitude of seven thousand eight hundred feet, and from thence moving northward on this plateau to Guanajuato, seven thousand six hundred; to Zacatecas, seven thousand two hundred feet; Torreon, Chihuahua, El Paso del Norte; then from the border line of the United States and Mexico through western Texas, New Mexico, Colorado, Wyoming, Idaho and Montana, with its varying altitudes of from five thousand to fourteen thousand feet, many locations may be found that offer perfect immunity from tuberculosis and many others that would modify and even cure it.

Temperature as a modifying influence.—High altitude means lowering of temperature, and it is this condition of things, *per se*, that recommends altitude to the tuberculous as an ameliorating means The problem of the proper selection of altitude for a given case can only be solved in connection with special reference to temperature, for in the earlier stages of the disease a higher altitude with lower temperature will prove beneficial that in the more advanced stages would be absolutely injurious It is of special interest to consider that while in some high altitudes the temperature may be modified by the general topography of the country, other lower altitudes may show a lower temperature from like causes.

In Europe where careful observations have been made for many years, and where statistics have been carefully kept, we find the following:

At Oldenburg, altitude from twenty to eighty feet, death rate from tuberculosis, thirty per cent; Marseilles, sea level, twenty per cent; Hamburg, forty-eight feet, 23¼ per cent; Gewf, one thousand two hundred and fifty-three feet, 16⅔ per cent; Munich, one thousand six hundred and twenty-nine feet, 10,⅞ per cent; Black Forest, two thousand feet, of rare occurrence; Switzerland, at altitudes above two thousand very rarely.

This shows that in Europe at altitudes of two thousand feet tuberculosis is very rarely, and in the higher mountain regions is never developed. It is a significant fact that in the high mountain regions of the earth so far as they have been inhabited by man, such as the Ural mountains of Russia, the high Alps of Tyrol and Switzerland, the Black Forest, Harz and Thurringer Wald mountains of Germany, the Rockies of the United States and Mexico, the Andes and Cordilleras of South America, the Himalaya mountains of Asia, have never developed a case of tuberculosis. These highest mountain regions, where snow and ice are nearly continuous, where the fiercest storms rage, offer immunity from this disease.

Heat as a modifying influence.—It is asserted by some authors that a temperature of 160° Fahrenheit will kill the *Bacillus tuberculosis*; some say that 120° will do it.

This proposition, however, is of but little practical value in the cure of the disease, though it may be of value in the laboratory, or in the disinfecting chamber, since the temperature of the mammalia cannot be brought up to and maintained at a temperature so high. On the contrary, we believe that if the bodily temperature could always be maintained at its normal of 98° Fahrenheit, the bacillus, even if introduced into the body, would perish, because a higher temperature is required for its propagation. The great German pathologist, Virchow says that, "through the injection of tuberculin (which, as has been repeatedly demonstrated, elevates the bodily temperature from two to six degrees), bacilli are developed in the remotest parts of the body where ordinarily they have not been present."

Since the above has been written the following item of interest has appeared in "The Doctor of Hygiene," page 167, Vol. VIII, No. 9, referring to the temperature most congenial to its propagation it says: "It may be cultivated on the ordinary culture media, and makes the best growth at 100° to 102° Fahrenheit. A temperature of 158° Fahrenheit for ten minutes is fatal to it."

Referring to its vitality it says: "It can hold its own for a length of time against destructive agencies. It retains its infectious power for nine or ten months in dried expectoration." (Koch, Schill, Fischer, De Thoma.)

These are facts worth knowing, and for that reason I have incorporated them here.

It is further well known that while in the hot and warm climates of the earth tuberculosis is everywhere found and developed, in the colder and cold climates of the earth it is nowhere developed.

From such experiences and those derived from the study of altitude as lowering the normal temperature of a region we conclude that low and medium, rather than high temperature exert an ameliorating or preventive influence in the development of tuberculosis. This, no doubt, is due to the fact that continuous heat lowers vitality, while cool and cold increases vitality.

Electrical tension as a modifying influence.—Electrical tension, within certain limits, has, no doubt, an invigorating, and consequently a preventive influence in the development of tuberculosis; whereas too great an amount, especially in the more advanced stages of the disease, exerts a more rapid disorganization upon the diseased tissues. This assertion is founded upon observations made in the higher mountain regions, where tuberculous patients have been sent by thousands into altitudes ranging from five thousand to ten thousand feet indiscriminately as to condition, and where some were benefited and cured while others were sent into death. In these high regions the Volta Electrometer often changes from positive to negative in short intervals, changes which the advanced case cannot endure, and which can only exert a curative effect in the earlier stages of the disease.

These studies and observations go to show that great caution is needed in the selection of altitude and latitude for consumptives, and further careful investigations are an urgent necessity if we would benefit that class of sufferers by a change of climate.

Dr. Becker also submitted the following suggestions respecting the restriction of the disease:

SUB-REPORT.

The adoption of the following is respectfully recommended.—The Iowa State Board of Health recognizes in tubercular consumption an infection, and consequently a preventable disease, and would recommend to the citizens of Iowa, and to all local boards of health the careful observance of the following rules:

First.—So soon as the disease is recognized by the physician in attendance to be tubercular consumption, it shall be his duty to at once report the same in the same manner and to the same authorities as other contagious and infectious diseases, as prescribed by the statutes of the State of Iowa.

Second.—It is further recommended that books of registration be provided and properly kept, in cities and incorporated towns by their respective recorders, and in townships by the township clerk, for the registration therein of every and all cases of tubercular consumption occurring within the jurisdiction of said cities, incorporated towns, or townships, into which each and every such case shall be recorded by name in full, of the individual thus diseased, with his or her respective age, residence, occupation, social condition and every other matter of interest connected with each case; finally duration of disease, date of recovery or death, date and place of death, date and place of burial, etc.

Third.—When as any such case of tubercular consumption shall have been thus reported for registration, the city or town recorder or township clerk under whose jurisdiction it shall have been reported shall, so soon as possible thereafter, furnish the relatives of such person, or the householder in whose residence such diseased person shall reside, with such printed information for the care and management of such person as the State Board of Health may provide, and shall see to it that all rules for the disinfection of excreta of all kinds and of the apartments of such person shall be duly and conscientiously carried out, in order to prevent the multiplication and spread of the disease.

Fourth.—It is further recommended that after removal, or death of any person dead from tubercular consumption, all articles of wearing apparel, bedding and premises shall be thoroughly disinfected the same as after all other contagious and infectious diseases, and local boards shall exert the same supervision in the disinfection of premises as in other contagious and infectious diseases

Fifth.—It is recommended that all recorders of cities and towns, and clerks of townships, report to the secretary of the State Board of Health within ten days after having received notification by any physician of any existing case of tubercular consumption, and they shall keep a record of all cases thus reported, and furnish the sick with such printed rules and regulations as the State Board may provide for that purpose.

Sixth.—It is recommended that the State Board of Health, at the earliest possible date, prepare and order printed rules for the general management of the tuberculous sick, and for disinfection of excreta, clothing, utensils, and premises, both during the sickness and after recovery or death of the infected.

These few simple rules, and as many more as this honorable body in its wisdom may see fit to adopt, we respectfully submit to your earnest consideration.

This report and the recommendations accompanying it were received by the Board, and the committee was continued with instructions to report further at the next meeting.

In connection with the report of Dr. Becker upon tuberculosis, Mr. J. Christian Bay read the following, which was received and ordered printed in the IOWA HEALTH BULLETIN:

GENTLEMEN:—I have the honor to present herewith a preliminary report on tuberculosis in cattle and its relations to public health:

I. *Visit to infected herds.*—Having had some correspondence with Dr. Stalker, state veterinary surgeon, I concluded to visit a herd infected by tuberculosis, and belonging to a farmer and dairyman. Last Winter said farmer observed that his cattle were suffering from swellings at different parts of their bodies; four or five died, and some were very sick, and remained so for as long a time as they remained in the stable, until they were turned into the fields. Here the majority of them recovered, and only a few remained sick and died. A village surgeon attended to the herd, but, as he was uncertain as to diagnosing the disease, the farmer applied to the state veterinary surgeon, who turned the matter into my hands, as he thought the disease could be but tuberculosis. I wrote to the farmer and stated that so far as I could judge from what I heard about the condition of the cattle, the disease was tuberculosis. The symptoms were local swellings, general debility, copious discharge of spit, discharges of pus from swellings after operation, and death. However, I stated that unless I had some of the pus, or sputum, for examination I could say nothing definite. The farmer again wrote the veterinary surgeon could not diagnose, and local injections with dilute carbolic acid did not do much good.

So I visited the place and found one cow with a swelling upon its hind leg. I opened the swelling, and preserved some of the blood and pus which was discharged. Subsequently I found in the pus and blood, beside common pus-bacteria, the tubercle bacillus, which shows that the affection was, no doubt, tuberculosis. The particulars of the disease, as recorded by the farmer, fully satisfied me about this point, with the investigation made by me. *I made, however, other observations* which throw light upon the subject in question.

One of the heads which had died from tuberculosis had been thrown before the swine. The latter had devoured it, after it had been opened. A few days later some of the swine were walking around with swelling on their backs and limbs, similar to those known from the cattle. The local veterinary surgeon wisely had advised the farmer to destroy the hogs. I could not ascertain whether this had been done or not. What became of them I do not know.

The barns and stables were extremely dirty; the filth was thick upon the walls and posts. I said that *if the herd were, next Winter, kept in the stable while it was in such condition, where the tumors had been opened, and where the sputum from the diseased animals was still, although dried, on the floors, a new outbreak might be expected.* The farmer sold all his milk for the city restaurants, and I had reason to believe that very little had been done in order to protect the public against the milk from the tuberculous cows.

The farmer knew that something was wrong, for he asked me not to mention that there was any contagious or infectious disease in the herd. His reasons were that such statements would "hurt the business"—of which I entertain no doubts.

But the farmer did not know that tuberculosis in cattle is a danger to the community; he had no knowledge of hygienic measures in stock-breeding; he did not know that tuberculosis, which is much more dreaded than cholera and small pox, *could be transferred* from the sick cows to those who handled them; from the tuberculous carcasses to the swine; from the animals to those who refreshed themselves in the town restaurant.

So I promised to diagnose the case, and then I advised to clean the stables and barnyards, where filth and dirt, probably many years old, had accumulated, even in the immediate neighborhood of the dairy. I also advised a thorough cleaning with disinfectants, such as carbolic acid (phenol), formalin, and others.

If the barnyards and stables had been allowed to remain in the described condition, the coming Winter would have witnessed a fresh outbreak of tuberculosis in the herd. Since my return I have heard of no further cases of tuberculosis in cattle in or around the town.

II. *Tuberculosis as related to public health.*—In the interest of the committee on tuberculosis, I have, at my own expense, procured a number of books and papers on this subject, in order to be able to state, so far as possible, what we know at present.

Tuberculosis infects a number of animals, more than is generally suspected. *Cattle* are evidently the most susceptible, but *chickens, rabbits, swine* and *goats* may also contract the disease, and *dogs, cats, sheep* and *horses* are not immune, for they will have tuberculosis, if inoculations be made. The latter are, however, not so much exposed to infection as the former.

Lions, kangaroos, deer, elk, antelope, and a number of *birds*, which all are kept in cages, very often die from tuberculosis, and *cats* and *mice* should not be excluded from the list. As *prominent* bearers and disseminators of tuberculosis, CATTLE, FOWLS and PIGS should be considered.

If the five thousand five hundred deaths which occur yearly in New York City could be brought together in an epidemic of but one week, no small pox scare or cholera panic would amount to anything, compared to the terror thus created. Statistics demonstrate that all deaths from war, cholera, yellow fever, diphtheria and small pox are very insignificant, when compared to the deaths from tuberculosis.

Ruhling considered (1774) tuberculosis as contagious, and it is well known this hypothesis has received the signature of many eminent men in our day. We shall be much mistaken, I feel sure, if it shall not, in the course of time, be demonstrated that tuberculosis is both contagious and infectious, both in animals and in man.

How is bacillus tuberculosis destroyed?

Heat.—A temperature of 162°-163° F. will, when maintained for some hours, kills the bacterium.

Sunlight.—It has recently been demonstrated that *direct* sunlight kills the infectious agent, when the latter has been exposed for a sufficient length of time.

Freezing.—Ordinary freezing temperature will not destroy the bacterium.

Salting.—Heavy salting of meat will not destroy the life of the bacterium.

Chemical agencies.—The mineral acids will, in certain dilutions destroy the infectious agent. Phenol, and the other commonly employed disinfectants known will do the same when properly employed. As entire books have been prepared on this subject I shall not go into details, but shall be glad to do so at special request.

Burning.—Exposure to the flame will not fail to destroy the infection.

The primary cause of tuberculosis is, as is universally recognized, the bacillus. But we must also remember the *secondary* or *accessory causes* which arise from the condition of the living beings liable to contract the disease. Such secondary causes arise from the man or animals themselves, or from their surroundings. Both may contribute to retard or to promote the facilities for the spread of the disease. The secondary causes can in no way generate tuberculosis when the bacillus is itself absent, but they can as is said, retard or favor the disease; they are almost uniform in most of the contagious and infectious diseases. Such causes are:

Hereditary predisposition.—Tuberculosis is hereditary, but not essentially or altogether so, as has often been said and written. In cattle, only ten calves out of many thousands borne by tuberculous cows had tuberculosis. When tuberculosis occurs in calves its infection is limited—as a general rule—to the bowels and adjacent glands which show that infection has taken place through the milk after birth.

In man tuberculosis is very often hereditary only so far as *susceptibility* to the disease.

Hygienic conditions of surroundings.—Macormac looks upon air rendered impure by repeated breathing as the sole cause of the propagation of tuberculosis.

Prof. Law, of Cornell University, has called attention to the fact that a herd of cattle was suffering from tuberculosis, and condemned after having passed the Summer in pasture, and then returned to the barn, and he also mentions that said disease attacks dairy cows in cities much more easily than those in the country. I was, therefore, right in predicting that the herd I visited was liable to be subject to tuberculosis if they should next Winter return to the filthy stable and unfavorable hygienic conditions described above. Macormac is thus far right in his hypothesis just mentioned, that a climate with pure air is unfavorable to the disease and has some degree of preventive action upon the disease, both in animals and in the human family.

Dark dwellings and stables.—An Italian bacteriologist published two months ago experiments which demonstrate that a prolonged exposure of the *Bacillus tuberculosis* to direct sunlight is mortiferous to the bacterium. Dark dwellings or dark stables lower the general health of their inhabitants and aid in predisposing them to tuberculosis. Darkness deprives the different tissues of the animal body of the regular and accessory supply of air because of its retarding or even prohibiting the formation of red pigment in the blood globules.

Other secondary causes are *unwholesome food, ill health* and *breeding too young of the cattle.* As these causes are, however, obvious, and as the Board is well acquainted with their effects in this regard, I shall only mention them.

In regard to *the danger of infection from animals to man* I wish to call attention to the following:

This question has two sides. In the discussion at the last meeting of the Board I tried to demonstrate that meat and milk from tuberculous animals are dangerous to consumers in two ways: first, by the transmission of the bacillus itself, and, second, by the transferring of the poisonous substances —*in casu* the poisonous substances (*ptomaines*) not named, but described in regard to origin and effects by Hammerschlag and by Crookshank—to the human body.

A number of German, French, English and American bacteriologists and pathologists have recorded feeding or injections with tuberculous matter among Guinea pigs, swine, cows, rabbits, goats, sheep, dogs and cats, as well as birds. These were all susceptible, but the susceptibility varied greatly with the genus, species, or even with the individuals.

If the animal which was experimented upon had a vigorous digestion, infection did, as a rule, not take place, because the bacillus suffers death when introduced in an acid liquid such as the contents of the stomach during vigorous digestion. But if the infecting pabulum passes the stomach in water or at a time when the contents of the stomach are neutral or slightly acid, infection does generally not take place. During a period of indigestion, or when the stomach becomes overloaded, infection is also possible. Through open wounds in the mouth or throat infection takes place very easily.

According to the source of infection, the bacillus is more or less virulent and more or less liable to cause an infection. Any material which contains tubercles or the bacillus alone, is, of course, liable to become the source of infection.

a. Blood.—When injected in the veins, the infectious agent will live only for a short time, or retain their virulence only for a while. This fact does, as is evident, not infer that the blood can not be a source of infection. Bang, in Denmark found that the blood was infecting from two out of twenty tuberculous cows, when inoculated. Nocard demonstrated something similar. The bacilli must and do pass the blood when they form secondary tubercles, which are often distant from the source of infection in the animal.

So, even if we know that the blood of tuberculous cattle is not always infecting—and so is the case of other infected animals—precaution dictates us to recognize the blood as infectious in any stage of the disease, or wherever and whenever the disease be rooted.

b. Milk.—As the udder is often infected, and as the milk is generally consumed without having been cooked, milk should be regarded as one of the principal sources of infection. Klebs has found that milk from cattle suffering from abdominal or pectoral tuberculosis may contain the *Bacillus tuberculosis;* when cows are suffering from tuberculous ulcers, it is a very easy matter for the infectuous agents to come into the milk; if the udder is infected, explanations are, of course, in order.

In the medical annals, cases of infection in children, from the milk, are often mentioned. I shall mention only one:

"At Amorback, N. Y., a well-developed boy, five years of age, from healthy parents, and whose ancestors had been free from tuberculosis, died from acute milliary tuberculosis of the lungs (and enormously enlarged mesenteric glands), after a few weeks' illness. Shortly afterward the family cow was killed, and was found to have been suffering from pulmonary tuberculosis."

Koch's tuberculin consists mainly of attenuated tubercle virus. Its effect upon tuberculous animals is to cause a rise of the body temperature ("fever"), and it does also impair some of the normal life activities in the body, such as assimilation and secretion. This condition of the animal body has been recognized as favoring and promoting the development of a tubercular affection. It has also been demonstrated that if the toxalbumin produced by the bacilli be separated from the bacilli themselves, by means of filtering through a Pasteur—Chamberland bougie—filter, the toxalbumin will produce a condition similar to that of Koch's tuberculin.

Even if the bacilli be absent from certain muscles, or from the blood, the toxic products may—and have been—found both in the blood and in the muscle juice, and we consider what has been said of their effect upon the animal (including human) body, the danger of having them introduced into the human body is quite clear.

These statements will explain my standpoint in regard to the difference between tubercular *infection* and tubercular *poisoning*. Both have equal importance to be considered, and it is of the greatest importance when devising the means of preventing tuberculosis.

Recommendations: (*a*) In general: 1. The whole matter should be referred to the State Board of Health. Agricultural boards should coöperate. Pamphlets and circulars should be spread among the farmers, stock-owners and dairymen all over the State through the local boards of health: Tuberculosis should be deemed a contagious disease and treated as such by the State Board of Health.

2. A competent man should be elected by the State Board of Health, and have charge of the matter in the State. The latter should be divided into districts, district inspectors should be appointed, and they should make monthly reports to the State inspector, who should prepare a quarterly and annual report to the State Board of Health. The former report should be read at the regular board meeting, and the annual report should be embodied in the reports from the State Board of Health.

3. Each district should have a quarantine station where suspicious cattle could be kept, and where infected cattle should be killed and properly destroyed. The district inspector should have charge of this station in every district, and the State inspector should have the general supervision.

4. Owners of killed cattle should be reimbursed by the State.

(*b*) In special: 1. Stock breeders and stock owners shall receive a license from the State inspectors, free of charge, provided that his establishment is in accordance with the rules and regulations established by the State Board of Health.

2. They shall be required to submit to the decisions made by the district inspectors, and in cases of doubt they shall refer the matter to the State inspector, who shall lay the matter before the State Board of Health.

3. The decisions of the State Board of Health shall be conclusive.

4. Stock breeders and stock owners shall be required to:
   - *a*, Keep each animal in its own stall and let it have its own manger.
   - *b*, Not allow any suspected animals to drink from the same trough or bucket used by healthy cattle.
   - *c*, Keep suspected animals in such a way that they can have no communication with the healthy ones. The seclusion shall be perfect, and prescribed by the local inspector.
   - *d*, Submit the herd to the tuberculin test whenever so ordered by the local inspector.
   - *e*, Not purchase from a herd in which tuberculosis has appeared less than one year preceding.
   - *f*, Not add newly purchased cattle to the stock unless it has been submitted to the tuberculin test.
   - *g*, Not admit strange cattle to the barnyard or field unless same is free from tuberculosis.
   - *h*, Submit all animals in or around the farm (swine, goats, sheep, horses, rabbits, cats, dogs, fowls) to the tuberculin test whenever tuberculosis has occurred on or around the farm in such a way that infection has become possible.
   - *k*, Kill all tuberculous animals and burn the carcass.
   - *l*, Disinfect stables, barns and their surroundings thoroughly if cases of tuberculosis have occurred in the herd.
   - *m*, Allow no consumptive person to attend the cattle or live stock, or prepare the food.

bb. Regulations for dairymen.

1. Buy milk only from licensed breeders.

cc. Regulations for railroads

1 Allow animals bred in stock only when they have come from licensed breeders.

If the named regulations for breeders be made and enforced, dairies would not need to be subject to rules and regulations established by the dairy commissioner.

dd. Regulations for inspectors.

1. He shall make periodical, but irregular, visits to all licensed breeders within his district.

2 He shall test cattle with tuberculin, and have power to condemn them, and he shall have the power to send suspected cattle to the district station.

3. He shall advise in regard to disinfection.

4 He shall conduct an inspection of all meat sold for human or animal food, and furnish it with a stamp.

5. He shall grant licenses to breeders if the following points have been observed by the breeder. (See also Rules for Breeders):
   - *a*, The barns must have a space of at least six hundred cubic feet for each animal.
   - *b*, The barns must have sufficient ventilation.
   - *c*, The barns must have sufficient light.
   - *d*, The floors must be cemented.
   - *e*, The barns must be reasonably clean, and the manure must not be allowed to lie against the walls, but in a reasonable distance from the houses.

f, The water shall not be used by the cattle, unless it can pass the examination provided by the State Board of Health.

6. The work of the State inspector, and of local inspectors, in regard to tuberculosis shall be, as above outlined, additional to their work in regard to other animal diseases.

I recommend that the question of tuberculosis be laid before the legislature, after having been considered by the State Board of Health.

The Pennsylvania State Board of Health, at its regular meeting held at Lancaster, May 10, 1894, passed the following resolutions respecting tuberculosis, and instructed its secretary, Dr. Benjamin Lee, Philadelphia, to transmit a copy to the Iowa Board of Health for its consideration. Communication was read by the secretary, and its consideration laid over until the November meeting. The following are the resolutions:

Resolved, That this Board considers the evidence in favor of the doctrine of the communicability of tuberculous diseases, and especially of that form known as consumption of the lungs, to be of so convincing a character as to demand recognition by sanitary authorities; and, therefore,

Resolved, That tuberculosis (including consumption of the lungs) be added to the list of communicable diseases dangerous to the public health in the regulations of this Board, and, further,

Resolved, That this Board strongly recommends to all local boards of health that they require returns of tuberculosis, when it has reached the infective stage, from all physicians and householders, in the same manner that returns of other infectious diseases are now required.

Resolved, That the State Board of Health of Pennsylvania declares itself strongly in favor of the establishment of public hospitals for the care and treatment of the consumptive poor in or near every large center of population.

MILK CONTAMINATION.

Dr. Becker asked what the dangers were from the use of milk kept by a family, one or more of whose members were sick with an infectious disease, provided the milk was kept out of the house. It was thought pretty generally by the Board that such milk should not be used—that the dangers of contamination are many, some of which could not be guarded against, and that the sale of such milk should be prevented as dangerous to the public health.

"DRY CLOSET SYSTEM."

Dr. Conniff offered the following resolution, which was adopted:

WHEREAS, At the November (1893) meeting of this Board, upon the report of a special committee, the use of the so-called Smead Dry Closet System, was, by resolution, condemned as unsanitary in principle and unhygienic in practice; and

WHEREAS, It is believed the same objection obtains against other similar systems; therefore, be it

Resolved, That this Board extend the objections heretofore made to the Smead system to any and all dry closet systems, so-called.

NOVEMBER MEETING, 1894.

At the meeting held October 31 and November 1, 1894, all members were present.

Mr. Warren Dickinson presented his commission as civil engineer of the Board to succeed J. L. Loring who had resigned.

SMALL POX.

The secretary reported that notice had been received September 10th, of a suspected case of small pox at Tabor, in the family of B. F. Swatman, a druggist. He had been in Chicago, August 21st, on business, came home and was taken with a chill. An eruption appeared September 5th. There was a dispute among the local physicians as to diagnosis. Dr. J. A. Scroggs, on behalf of the State Board was called to investigate and to decide the dispute. He pronounced it small pox. Quarantine had in the mean time been wisely established, and the disease confined to that family and one outside case—seven cases, none fatal.

The secretary presented numerous communications from local boards, and school boards regarding the order of the State Board requiring vaccination of school children, in which were cited conditions and circumstances, suggesting a modification of the rules. After due consideration the Board decided to make no change in the rules.

As incident to the general powers granted to the State Board and to local boards to prescribe regulations with reference to vaccination, and that they may require vaccination whenever in their judgment the interest of the public health demand it a case was cited wherein on the 28th of August, 1894, Judge Bartlett, of the supreme court of New York, at Brooklyn, made a decision relating to compulsory vaccination. An application was made for a writ of mandamus by the Anti-vaccination League to compel the admission to the public schools of unvaccinated children, on the ground that the statute excluding them was unconstitutional. The court held that the law was a valid exercise of the public power of the legislature. "A common school education," says the court, "under the existing constitution of the State of New York, is a privilege rather than a right. It is created by legislation and subject to legislative regulations. It follows that the State can certainly exercise this discretion by debarring from attendance at the public schools such persons as are unwilling to adopt a precaution which, in

the judgment of the legislature, is essential to the health of the large body of the people." The writ was refused and the rule established that a principal of a public school has the right to exclude children who have not been vaccinated.

On examination of the statutes of Iowa regarding public schools, it is discovered that there is no statute requiring school boards to make any regulations whatever for the government of schools under their control, whereas in nearly every other State they are required by statute to do so. That they have done so in this State has been a voluntary rather than a compulsory act.

TUBERCULOSIS.

Dr. Becker presented the following report on tuberculosis which was read and referred to the Committee on Contagious Diseases:

To the Honorable State Board of Health:

GENTLEMEN:—Your committee had intended to prepare and offer rules and regulations for the management of consumptives with a view to the limitation and prevention of the disease, at the August meeting of this honorable Board, but for reasons then stated it was not done.

It would be useless to offer recommendations for the quarantine of those sick, for on account of the prolonged continuation of the disease such a procedure would be wholly impractical and could not be successfully carried out.

On the other hand, we recognize the urgent necessity of making an effort on the lines of prevention, and submit the following for a possible printed circular for distribution:

CIRCULAR.

In recognition of the great and constantly increasing prevalence of tubercular consumption, and in recognition of the fact that it is a contagious and infectious, and consequently a preventable disease, therefore the Iowa State Board of Health would urge upon all local boards of health, corporations for public transportation, church and other organizations, directors and teachers of public and private schools, keepers of hotels and other public houses, and all householders within the State of Iowa the careful observance of the following recommendations:

So long as there is no breaking down of tissue in tubercular consumption so long there is no danger of transmitting the disease to the well; but so soon as this process begins there is. The nature of the disease being such as not to confine patients even during this period, they may become the disseminators of the disease germs and endanger the health and lives of those with whom they come in contact.

The contagion of tuberculosis is spread in two ways: first, by the moist expectoration and excreta being eaten by animals and producing the disease among them; and second, by the dried expectoration and excreta being pulverized and converted into dust containing the disease germs and being then inhaled by the human being into the air passages and lungs direct. It is estimated that each consumptive individual in whom the breaking down of tissue has begun expectorates at the rate of from two to three millions of disease germs daily, which endangers the health and life of others.

To prevent this the sputum of consumptives should be carefully collected, in public places indoors, into cuspidors partly filled with a disinfecting fluid; and out of doors into papers or cloths. The cuspidors should be thoroughly cleansed daily, and their contents either burned or buried in the ground not less than one foot deep; the papers, after use, burned, and the cloths either burned or thoroughly boiled for half an hour and then washed for future use. It is safest to subject cuspidors also to a boiling process before they are used again.

All wearing apparel, bedclothes, rugs, furniture and floors accidentally soiled by a consumptive person should be at once carefully cleaned, and so far as possible should be subjected to either moist or dry heat, at a temperature of not less than 200° Fahrenheit, for not less than half an hour, or should be subjected to an antiseptic solution before they are used again.

All excreta should, if possible, be received into boiling water or disinfecting fluid, and should be buried in the ground not less than one foot deep, and in no case should they be deposited where animals of any kind can have access to them.

The living and sleeping rooms of consumptives should be located to the southeast, south or southwest. They should be well lighted and thoroughly ventilated. They should be free from all unnecessary furniture, drapery and carpets, and should contain only such furniture as is needed for the comfort of the patient. Rugs that can be easily removed and cleaned should take the place of carpets, so that floors, walls, windows and doors can be easily and thoroughly cleaned with wet cloths, instead of sweeping and dusting with brooms. All cloths used for this purpose should at once be subjected to boiling before they are used again.

Consumptives leaving home, attending public gatherings or taking outdoor exercise should be provided with all needed conveniences in order not to be obliged to deposit their expectoration in places frequented by the public, on floors, on the ground, or anywhere where it may become a source of infection to man or beast.

In case of removal or death of any consumptive person the apartments occupied should be thoroughly disinfected and cleaned under the supervision of local health officers in the same manner, and with as much care, as in other contagious or infectious diseases. All wearing apparel, bedclothes, rugs and textile fabrics of any and all description used by any consumptive person while sick should be disinfected either by disinfecting fluid or boiling, or by dry heat or steam process, at a temperature of not less than 200° Fahrenheit, and be thus exposed for twenty or thirty minutes.

Corporations of public transportation and keepers of public houses should provide a sufficient supply of cuspidors partly filled with disinfecting fluid to accommodate passengers and guests.

Conductors of passenger trains and sleeping cars should see to it that every person on board of their respective trains or cars suspected of tubercular consumption be provided with a cuspidor partly filled with disinfecting

fluid, and that berths occupied by such persons be thoroughly cleansed and disinfected before subsequent occupation.

These rules, in connection with those offered at the August meeting of this Board, for the registration of consumptives, if properly carried out, are believed to be restrictive and preventive to the spread of tuberculosis, so far as our present knowledge of the disease reaches.

FRED'K BECKER, *Chairman.*

Dr. Becker submitted the following supplementary suggestions:

"In view of the extensive prevalence of tuberculosis among cattle it would seem advisable that local boards of health of cities and towns within the State of Iowa have some kind of supervision of dairies furnishing milk and other dairy products to families, hotels and restaurants within the State of Iowa.

"It would be necessary to know: First, that the animals from which such products are derived are healthy; that is, free from tubercular diseases of every kind; second, that they are properly fed on good feed; third, that they have access to an abundant and pure water supply; and fourth, that they are well stabled during inclement weather in clean, well ventilated and well lighted stables.

"For this purpose it would seem advisable that regular monthly inspections be made of all dairies within the jurisdictions of local boards of cities and towns furnishing milk and dairy supplies to the inhabitants of their respective cities and towns, by the local health officers, especially by the president of the board and the health officer."

Professor Stalker, on the subject of Tuberculosis in Cattle, laid before the Board the following report:

"I think it is a fact easily comprehended by the members of this Board that a man with a fair share of the activities of life falling to his daily lot will find little time that he can devote to the personal work of investigation; even under the stimulating influence of State Board remuneration However, a portion of my regular duties carry me along in that direction. It has so chanced that I have come in contact with a class of cases since our last meeting that has given some exercise in the direction of work prescribed for our special committee on tuberculosis. Whether this work has furnished any fresh contributions to the cause of science or not it may not be unprofitable to consider it in this meeting.

"Some time during last Winter I received information from a dairyman in the vicinity of Waterloo that he had been having some trouble among his cows. Correspondence followed, and in the course of time a portion of a lung from one of the dead animals was sent to the college for examination. The tissue was clearly tuberculous. An unqualified opinion was given as to the nature of this case, and the probabilities of a general infection of the herd suggested. When spring weather came on the cattle went to the pastures and nothing more was heard of the case for some months. About August the owner of the herd gave notice of further trouble, and arrangements were made for testing the herd with tuberculin. On the night of

September 15, the temperature of the individual members of the herd was taken four successive times at intervals of two hours. This gave a fair average register for each individual. Coincident with taking the temperature the last time, the injection of tuberculin was made. Two c. c. for one thousand pounds live weight were used. At eight o'clock the following morning the work of testing temperature was again begun. This was kept up at intervals of two hours till four P. M. By this time twenty-seven out of fifty-one individuals under test gave unmistakable evidence of fever reaction. Of the twenty-seven cases, all had shown a raise of two degrees or more above normal. Seven others showed a raise of between one and two degrees above the normal test. The twenty-seven were pronounced tuberculous, and the seven were classed as suspicious.

"The cattle were housed in a close bank barn, the building being kept in a very fair condition for a dairy barn. In the portion of the building most remote from doors and windows nearly all were affected while a greater number had escaped infection among those more favorably situated for ventilation. The cattle were mostly in good condition and comparatively few gave any evidence of disease that could have been recognized by ordinary clinical methods of examination. A few showed symptoms that would suggest tuberculosis and probably in some instances an unqualified opinion to that effect might have been given without the confirmative tuberculin test. But in many cases an expert could not have detected its presence without such aid.

"I recommended the destruction of the diseased stock as the only safe method of procedure. The owner after much deliberation consented voluntarily to the slaughter. The first animal destroyed was one showing evidence of the disease aside from the rise of temperature. There was swelling in the inter-maxillary space (a very common symptom in bovine tuberculosis) and difficult breathing. The difficulty, however, was much more laryngeal than pulmonary. On post mortem examination the laryngeal glands were found to be enormously enlarged with tubercular deposits. Nodular masses were found in the substance of the lungs and the mediastinal glands were the seat of excessive deposit.

"The next on the list to be destroyed was a fine looking cow that showed no signs of the disease whatever, except that under the reactionary effect of tuberculin the temperature had gone up to 107°. The post mortem evidence was no less certain than in the previous case. Mesenteric, intestinal and bronchial glands, as well as the lung substance, showed tubercular deposits in an unquestionable form. Yet to all external appearances this cow was in perfect health and giving a good flow of milk. Four animals were destroyed with uniform results. I was obliged to return home that night and left assistants to complete the examinations the following day when the remainder were to be slaughtered. After I left the farm the owner changed his mind, sold the cattle to a shipper and they were at once sent to the Chicago beef market. I have not been able to learn that one of these was condemned. I placed the remainder of the herd in quarantine (only the diseased ones having been sent away) and gave notice to the board of health of the facts in the case.

"Certainly two facts of importance to the sanitarian were brought out in the examination of this herd.

"*First.*—The large proportion of cases that can not be recognized by ordinary methods of examination. There were probably twenty individuals in this lot that would have passed even a fairly critical physical examination with a clean bill of health. Yet the milk and dairy products of these animals are to be regarded as little less a source of danger than the corresponding products from those in more advanced stages of the disease. The unsuspected case is the dangerous one for the reason that no precaution will be taken.

"*Second.*—The evidence of higher infective power than we have been accustomed to attribute to tuberculosis. The disease can in no sense be referred to heredity, as the dairy was comprised of a miscellaneous lot of cows, mostly grade Short-Horns, with no special relationship existing among them. They evidently had as good power of resistance to disease as the average dairy herd. The history of the disease in this herd clearly shows that the infection was gradually being extended, and if it had been allowed to go unrestrained till the following Spring doubtless every animal would have become a victim.

"The owner had purchased the herd about fourteen months before from another dairyman. Evidently the herd was infected at the time of the purchase, as some ten cows had died between that time and the date of examination."

The report was received and referred to the Committee on Contagious Diseases.

AMERICAN PUBLIC HEALTH ASSOCIATION.

Dr. Shrader presented a report of his attendance at the meeting of the American Public Health Association as a delegate from this Board, which was received and ordered published.

"As your delegate to the American Public Health Association, which met at Montreal, Canada, September 25, 1894, I beg leave to submit the following report:

The Association was called to order Tuesday, September 25th, at 9:30 A. M., by President E. P. LaChapelle, of Montreal.

The meetings were held in the Y. M. C. A. building, which was beautifully decorated for the occasion by the escutcheons of the countries represented, viz.: United States, Dominion of Canada, and Mexico.

The members from Canada seemed to vie with each other in adding to the comfort and pleasure of all who were fortunate enough to be present at this meeting, composed of sanitarians from each of the three countries represented; all of whom seemed imbued with the grand idea of doing all in their power as humanitarians, as well as sanitarians (for the terms are nearly synonymous), to alleviate the suffering, and prolong the lives of all members of the human family, by the prevention of disease, by studying its multifarious causes in all their various ramifications; the best means to be adopted for their prevention, or extension, whether through air, water, or the habitations of men, their daily contact by immigration, or from whatever source disease may be caused, or disseminated.

Thus we have a broad base from which to study the different phases of the great subject of sanitation. The members present represented the army and navy of the different countries; the members of the different State Boards of Health from Maine to California, in the United States; from the different States of Mexico; and from Nova Scotia to Vancouver of the Queen's dominions in North America; also other distinguished citizens representing all the learned professions, doctors, ministers, engineers, chemists, lawyers, judges, and statesmen; *all* interested in the great questions of state medicine.

Dr. E. P. LaChapelle presided with grace and dignity, ever courteous in his bearing, and prompt in the dispatch of business. In the evening of the first day the grand official opening of the meeting took place in Windsor Hall. Addresses of welcome were delivered by Dr. Robert Cruik, chairman of the local committee; his honor, the mayor of Montreal, Hon. L. P. Pelleteir, provincial secretary, and Lieut.-Gov. Chapliou. Dr. Cruik, in his address made use of these words: "Let us, regardless of all artificial lines of separation, join together as one great family striving earnestly to prevent, so far as may be, human misery, disease, and premature death, and to increase by every means in our power the sum of human health, happiness and prosperity."

The president then delivered his annual address—a valuable paper, full of thought worthy of the author, and stating the object and aims of the association; urging upon all sanitarians, and especially the members, the necessity of renewed efforts and increased zeal in the cause of preventive medicines.

There was a large number of valuable papers read—too many, in fact, to allow of their being discussed as their merits really demanded—sixty-six in all. One of the most valuable papers read before the association was the report of Dr. Chas Smart, major and surgeon of the United States Army, chairman of the committee on the

POLLUTION OF WATER SUPPLIES.

The report was a very lengthy one, being a continuation of one read last year on the same subject. In view of the interest now being taken in this important subject, I cannot refrain from giving you a synopsis of the most vital points.

The report held that artificial filter beds are of material value in removing microbes, and that this removal has a protective value against typhoid fever, is shown by recent experience at Lawrence, Massachusetts, where a lessened death-rate from this fever followed the careful filtration of the Merrimac water. One of the strongest pleas on behalf of the efficiency of artificial filter beds has been made by a royal commission, in its report on the water supply of London, England. The commission considered the quality of the water of the Thames and Tees, in relation to the propagation of typhoid fever from the standpoint of both theory and experience. It showed first that the typhoid fever cases occurring annually in the valley of the Thames, above the intake, are so few in relation to the volume of the water, that the excreta of each case would have a body of water five miles long, one hundred yards wide, and six feet deep, for their dilution, while each case in the valley of the Tees would have a mass equal to three miles, of the same width and depth.

"Secondly, the limited durations of infectivity of typhoid dejecta were pointed out, the infectivity being found to seldom last longer than fifteen days in fecal matter. Lastly, the vital action of the filter removes, or destroys, any pathogenic organisms. A new filter of perfectly purified sand has little effect in producing either chemical or bacteriological purification, but, in course of use, a layer charged with living microbes is deposited on the surface, and it is by these organisms, which constantly increase in number and also penetrate the sand to a slight distance that nitrification and the arrest of other microbes are effected. Hence, the longer a sand filter has been used the more efficient it becomes. The filtration by the London Water Company removes ninety-eight or ninety-nine per cent of the microbes contained in the river water. The risk of the propagation of typhoid fever by the filtered metropolitan water is therefore regarded as very small."

The report next referred to Professor Koch's statement that, "in one street which forms the boundary between Altoona and Hamburg, Germany, during the great cholera epidemic, the disease prevailed on the Hamburg side, but did not pass to the other. The Altoona water is filtered; the Hamburg water is not. According to the eminent German bacteriologist, the conditions of efficient filtration, such as preserved Altoona from cholera, are a layer of sand at least thirty centimetres (twelve inches) thick, the restriction of the filtration to one hundred millimetres (about four inches) per hour, and the freedom of filtered water from germs in excess of one hundred per cubic centimetre. The slime deposited from the water is the true filtering medium, the sand layer forming merely the basis on which it is spread. Reference was made to several systems of filtration on this continent.

"In Lawrence, Mass., the annual death rate from typhoid fever for the five years preceding the filtration of the Merrimac water, was one hundred and twenty-seven per one hundred thousand of the population. Since the filtration has been in progress the rate has been reduced to twenty-four."

The report continued: "No matter how pure the general supply may be, we seldom find the death rates lower than twenty-five to fifteen per one hundred thousand of the population. This is to be attributed to the fact that typhoid fever may be propagated in other ways than by an infected water supply. It may, for instance, be imported into a city by individuals who have traveled during the period of incubation. In crowded and unclean tenements typhoid may seem to be directly contagious by the inhalation, or swallowing of infected dust from soiled bedding or other articles; or by the transference of typhoid germs by washerwomen and others who have washed the infected body linen of fever patients.

"The propagation of the disease by the leakage of sewage into wells is fully appreciated, but the infectious character of sewer air, for so long a firmly established belief, is now laid aside, in view of bacteriological experiments. Nevertheless it is possible that typhoid bacilli may be present in sewer exhalations, particularly when the exhalations are taken in their full strength, as in the steaming outflow from a sewer ventilator."

The report then suggests that if every municipal health officer would calculate the typhoid death rate of his city with the understanding that any annual death rate over twenty-five per one hundred thousand of the population is due to preventable causes, and probably to the character of the water supply, he would be in a position to urge important improvements in connection with that supply. The report condemned wells as sources of city water supply in these words: "We may fill our wells with sand, and every drop of surface water may be efficiently filtered, but the dangerous leakage may be from some subsoil channel, between a leaking sewer and the well. Hence we consider that our municipal health officers have done well in closing up all subsoil wells within their jurisdiction, because it is not surface inflow which we fear, but subsoil inflow." The report drew attention to a proposition emanating from the McGill University of Montreal, for which credit is to be given to Profs. J. G. Adami and Wyatt Johnson. Impressed with the difficulty of reconciling observations made upon water bacteria with the descriptions of the various species that have been published up to the present time, and recognizing how much good and useful work is lying *unpublished and incomplete* from the fear lest publication, after all, result in renaming species that have already been described, and in adding to the confusion already existing, these gentlemen desired to do something to aid in remedying the present unsatisfactory conditions.

"As the task of establishing order out of the present chaotic state of the literature of the water bacteria is too great for one man to undertake, the idea of a coöperative investigation offered the only prospect of a speedy advancement in this line of work. The idea was that one group of water bacteria were to be assigned to one laboratory for study and classification, and each laboratory was to send to the investigator of one special group every distinct variety of that group making its appearance in the waters studied in that laboratory. The mass of material so gained would form an ample basis for an authoritative monograph upon the subject, and would of necessity become the standard of reference. The committee considered that a great advance might be made by the practical *development of this suggestion*, and to further the accomplishment of this it recommended that when its membership for the coming year is announced it may be authorized to increase the number of its members by adding to its list the names of such investigators as may be willing to coöperate in this scheme of bacteriological study."

There were a number of notable papers read on kindred subjects and at the conclusion of the discussion which followed on water supplies these three resolutions were offered and adopted.

(*a*) "That this association approve the suggestion for coöperative investigation into the bacteriology of water and commend the efforts of the committee in carrying out this work to the State and municipal boards to the individual members of the association, and to all persons interested in the purity of the water supplies for such special assistance as they may be able to render."

(*b*) WHEREAS, It is the sense of the American Public Health Association that the pollution of potable water in America has reached such a point that the National Government should be asked to take cognizance of the matter with the view of devising means of prevention and relief; therefore, be it

"*Resolved*, That this association memorialize the congress of the United States, and ask that they shall authorize the appointment by the President of a competent commission, clothed with power to fully investigate the whole subject of the pollution of rivers and lakes by municipal and manufacturing waste, and provided with sufficient means to enable them to conduct the examination in such a manner as shall be deemed best, the results

of said examination to be published from time to time for the public information."

(c) "*Resolved*, That in view of the danger to the public health by the sewage contamination of our fresh water lakes, rivers and streams, this association memorialize the different federal governments, as well as the State and provincial governments, to pass laws prohibiting the contamination of these water supplies by sewage from cities, towns and villages, and compel them to provide some means for the treatment and oxidation of this sewage before emptying it into these places "

TUBERCULOSIS.

Valuable papers were read on tuberculosis. The first by Dr. N. E. Wordin, on the restriction and prevention of tuberculosis. He advocated the placing of that disease on the contagious list, and the compulsory disinfection of all places where patients from tuberculosis have passed. No tuberculous female should ever nurse a child. No consumptive should ever spit on a floor, and the spittle should be immediately burned. No consumptive should ever sleep with another person, and in general hospitals such patients should be isolated.

TUBERCULOUS MILK.

Dr. F. O. Donohue, president of the New York State Board of Health, spoke of the examination of the milk supply for tuberculosis. The statistics of New York State show that tuberculosis is the cause of one-eighth of the deaths, and it was not questioned that many of these cases of consumption originated from tuberculous milk. Since 1892 there has been a law in New York State providing for the slaughter of cattle found to be suffering from tuberculosis.

Examination of animals immediately began, and out of twenty-two thousand cattle seven hundred were ordered to be killed. The proof that there were so many diseased cattle was sufficient to require the formation of a special commission to inspect the milk supply, which has not yet made any official report.

TUBERCULOUS MARRIAGES.

Dr. Paul Paquin, of the State Board of Health of Missouri, undertook to deal with the question: Should marriage of consumptives be discouraged? He held positively that the marriage of a consumptive with a healthy person must lead to the infection of the latter, and that the children born of consumptives are always naturally predisposed to tuberculosis Thus the centers of infection are increased, and the danger to society is made much greater. The conclusion is obvious. No consumptive should marry, and it is perfectly proper for science to interfere and use all its influence to prevent such marriages.

CAR SANITATION.

Dr. G. P. Conn, of Concord, N. H., as chairman of a committee on car sanitation, reported:

"It is now twenty years since the State Board of Health of Massachusetts instituted an investigation into the condition of passenger coaches. They found that the atmosphere of the ordinary coach contained from one to six times as much carbonic acid gas as other public assembly rooms, such as churches, theaters, and public halls. Experiments made in Europe on animals which were inoculated with a preparation from the dust beaten out

of the cushions of railroad cars in ordinary service, and which cars were not known to have carried sick people, showed that the most of these animals inoculated died of violent diseases. Few of them lived long enough to die of tuberculosis—none of them survived. As all these micro-organisms are in the air, and simply settle on the dust, all goes to show how very necessary indeed it is to carry off the foul air of passenger coaches. The destruction of oxygen by gas or kerosene lighting increases the amount of carbonic dioxide in the atmosphere of these houses on wheels, and often to a dangerous extent, and it is in that way the health of the passengers is seriously threatened. Many cases of typhoid fever of mysterious origin could be traced to the filthy water tanks as found in railway cars and other public places. Often they are filled with water and ice of doubtful purity, and refilled from day to day without cleansing."

SMALL POX AND VACCINATION.

The prevention of small pox claimed a fair show of the time of the association. Dr. Ralph Walsh, of Washington, read a paper on "Vaccine and Vaccination," the conclusions of which were as follows:

"The selection of lymph and the operation of vaccination has not received from the profession at large the thought the subject deserved. During scares vaccinations are hastily performed, and often there is no after inspection. The lymph used may be feeble or the work badly done.

"What are the remedies? An honest observation of responsibility upon the part of the propagator of vaccine and the physician who should use it.

"The physician should see that each infant brought under his care is successfully vaccinated during the first year of its life, and at least again at sixteen. The ideal protection can be secured by vaccinating to the point of saturation. I mean to vaccinate at six months of age, or earlier, and then each succeeding six months until no result is obtained, making test vaccinations at intervals of a few years thereafter. The lymph should be used direct from the propagator, holding him responsible, *not* after it has passed through the hands of second and third-parties and all responsibility lost.

"The accumulation of unvaccinated material, and consequently the increased danger of outbreaks of small pox, is caused by the general practitioner neglecting to perform his duty at the proper time."

YELLOW FEVER.

Dr. Felix Formenta, of New Orleans, presented the report of the International Committee on the "Prevention of the Spread of Yellow Fever." He pointed out that since the modern health regulations adopted by the State of Louisiana have been in force, yellow fever has practically disappeared from the State; and that with an efficient system of quarantine the dreaded disease can be absolutely excluded.

DISPOSAL OF GARBAGE.

Mr. Rudolph Hering, C. E , of New York, presented the report of the committee on the "Disposal of Garbage and Refuse." The gentleman has just returned from Europe, and found there that incineration is about the only system employed to get rid of garbage. There are great differences in the refuse of Europe and of America, and for that reason systems which are efficient in one place may not be in the other. He had no faith in the schemes for the disinfection of garbage. The plan of separating or reducing the garbage also offers dangers, and, all things considered, incineration seems to be the best of all systems.

Dr. Durgin, of Boston, reported that he had discovered a process for drying the garbage, as it is produced, in the kitchen; after which it can readily be burned in an ordinary stove, thus doing away with the whole

question of the disposal of garbage. The apparatus, to secure this result, would not cost over three or four dollars. It consists of a sheet iron box fitted with grates and connected with the stovepipe. The heat passing from the stove to the chimney dries the garbage.

But lest I weary you with this report of this twenty-second annual meeting, I shall only further say that I have tried to condense the work of the four days' session as much as possible by giving you a brief synopsis of some of the papers read, and especially those that are of vital interest to us in Iowa. I have touched upon most of the subjects that came up for consideration, but have of necessity mentioned only a few of the persons participating, or of the papers read; but I will say that the others were none the less worthy. There were so many papers to be read within so short a time that, in my opinion, there was not a sufficient amount of time for discussion.

And now, Mr. President and gentlemen, allow me to thank you for conferring upon me the honor to represent you in so grand a convention of sanitarians.

ETIOLOGY OF SMALL POX.

Mr. J. C. Bay, bacteriologist of the Board, presented a report of the progress of his investigation of the etiology of small pox, which was received and ordered published:

To the members of the Iowa State Board of Health:

GENTLEMEN: The experimental work concerning the etiology of small pox has been the main object of my efforts during the three months past. Although I intimated at the last meeting that no report might appear by this time, I venture to call your attention to some facts brought forward, which will throw some light upon the etiology of small pox, and, at the same time, allow you to see my work as reflected by other investigations.

In my first report I mentioned that I had found the *Micrococus vaccinæ* in the contents of the vaccine vesicles. This micrococus was, since 1868, considered the primary cause of small pox. But in 1882 H. von Plaut threw some doubt upon this assertion, since he failed to observe this particular organism in sheep pox. Careful reading of the original descriptions of the *M. vaccinæ* taught me that Chauveau, Cohn, Klebs, Crookshank and other scientists had found, in the small pox or vaccinia, numerous cocci-shaped, refractive cells, which could be cultivated. But it must be remembered that this was said ten or twenty years ago, and that our methods and our interpretation of revelations in bacteriology have, during that period, undergone wonderful modification.

Cocci are, as a rule, not usually refractive, and, since so much weight has been laid upon this part of the description of the *Micr. vaccinæ*, I deem it very probable that what was described and figured under this name is merely the spores of the organism, which I consider the primary cause of small pox, and which I named *Dispora variolæ*. The microscopic picture of these spores corresponds very well with the pictures and descriptions of the alleged *M. vaccinæ*. The latter name, and the ideas connected therewith, should hence be abolished. But the presence of many common pus bacteria in the pustules, vesicles and scab is a fact not to be disputed, and which is not affected by the above conclusion, which, you will understand,

embraces only this: *Micr. vaccinæ* is no specific organism; it is the spore stage of the *Dispora variolæ*.

At the last meeting of the Board, I called attention to the description of the specific small pox bacteria given by Dr. L. C. Martin, as a fine bacillus with rounded ends and a luminous spot at each end.

You are well aware that a very conspicuous feature of the vaccine virus is that when kept in a well dried condition after having been taken from the vesicles, it retains its virulence for a long time. You are also aware that it would be out of place to deny that small pox is a bacterial disease. You also know that this disease does not break out until after a period of twelve to fourteen days after exposure to the contagion. The latter fact suggests to my mind the possibility that small pox virus, whether virulent or attenuated contains the contagion in the form of *spores*. To present my theory of the origin and cause of small pox in a condensed form, I will thus express it:

Whereas, my investigations, so far as they go, reveal that *Dispora variolæ* is an aërobic bacillus found constantly both in small pox and vaccine virus; that it is capable of bearing spores, and that in old cultures very few bacilli, but great numbers of free spores, are present; and

Whereas, it is generally known that the contagion of small pox is able to retain its vitality under conditions very unfavorable to its existence; and

Whereas, vaccine stations recognize that lymph taken from calves on the fifth, sixth and seventh day after inoculation much more certainly retains its efficacy than when taken at an earlier date; and

Whereas, bacteria spores are known to retain their vitality under very unfavorable conditions, and that they are mostly found in old cultures,—

It becomes more than probable that the contagion of small pox is present and efficient mainly in the form of spores produced as a natural link in the development of the *Dispora variolæ*. I could furnish much additional proof of this conclusion, but will not take up more than necessary of your valuable time.

The life history of the *Dispora variolæ* has been worked out, and one of the most remarkable facts in this connection is that spores are found not only in old cultures, but also—although less copiously—in young cultures. The bacteria will not grow on gelatine plates, as Koch's method cannot be employed here. In bouillon-gelatine (ten per cent) in plates they will not grow, but in test-tube cultures they grow abundantly.

TUBERCULOSIS AN INFECTIOUS DISEASE.

The committee to whom was referred the reports of Dr. Becker and Professor Stalker presented the following report, which was adopted:

1. The committee declare tuberculosis a communicable disease.
2. They recommend the adoption of a modification of the Pennsylvania preambles and resolutions respecting hospitals, for the treatment of tuberculosis and other infectious diseases.
3. They recommend the formulation of a circular in accordance with the recommendations of Dr. Becker, as set forth in his report, and of the Rhode Island circular.

The preambles and resolutions of the Pennsylvania Board, to which reference has been made in the foregoing are as follows:

WHEREAS, The State Board of Health of Pennsylvania has formally expressed its conviction that tubercular consumption of the lungs is a communicable disease, and

WHEREAS, It has been proven that the germs of this disease attach themselves to clothing, furniture and apparatus, retaining their vitality for very considerable periods, and

WHEREAS, All general hospitals refuse to receive consumptives from a desire to exclude the infection, as well as to avoid elevation of their death rates, therefore

Resolved, That the State Board of Health of Pennsylvania declares itself strongly in favor of the establishment of public hospitals for the care and treatment of the consumptives in or near every large center of population.

Resolved, That, in view of the continued prevalence of contagious diseases throughout the State, it is recommended to all cities and boroughs that temporary hospitals be provided to which patients suffering from small pox, diphtheria, scarlet fever and other dangerous contagious diseases may be removed in all cases in which they can not be properly and thoroughly isolated at their own homes.

The circular of the Rhode Island Board referred to by the committee is as follows:

RHODE ISLAND STATE BOARD OF HEALTH.

SUGGESTIONS FOR THE CARE OF SPUTUM IN CASES OF CONSUMPTION.

It is now generally believed that the disease commonly known as consumption is a disease which is communicable from one person to another, and is caused by minute living organisms which are always found in great numbers, in whatever portion of the body may be invaded by the disease.

These small germs or seeds are brought to the surface in the sputum or mucus, which is coughed up and which, when carelessly thrown upon the ground, or collected in cloths, becomes dry and crumbles into dust. In this dust the organisms are, at times, still alive, and when blown about in the air may be breathed into the lungs and air passages by other persons.

If the lungs are in a weakened condition as the result of exposure to cold air, or by general weakness of the whole body, or when made sore by irritating substances such as fine particles of steel, in such industries as file making or steel grinding, or by breathing in fine coal dust, or by lack of fresh air, as in mills, the organism is then provided with a soil where it can grow. It is undoubtedly breathed into the mouths of many healthy persons daily, but does no harm as long as the mucous membrane is in a healthy condition.

In the lungs of a consumptive who is improving the breathing in of this dust starts new points of the disease.

Knowing that the sputum contains the germs from which the danger comes, it can be readily seen that if they are destroyed before it turns into dust, that it can not produce fresh cases of the disease.

Therefore, all sputum or spit of consumptives should be treated in some way in order to destroy the germs which may reproduce the disease.

It is desirable that the sputum be received in some light cup, or receptacle, containing some form of disinfectant, such as a solution of bi-chloride of mercury in the strength of one part to one thousand.

If received into handkerchiefs they should be immediately placed in this disinfecting solution or under water and so soon as possible thoroughly *boiled* for half an hour. It is better to use pieces of old cloth which may be *burned*. The cloths or handkerchiefs should not be tucked under a pillow or into the pocket, nor allowed to lay aside and dry and then shaken out to use again, as this throws the organisms into the air. A small bag made of cloth which can be boiled and washed may be used to hold the cloths until ready to disinfect or burn them.

No person having consumption should spit upon the floor at home or in cars, nor upon the street.

No mother with consumption should nurse an infant, and children ought never to be taken care of by a consumptive patient.

In view of the presence and prevalence of tuberculosis among the cattle of the State in certain localities, Drs. Carter, Conniff and Scroggs were appointed a committee to devise ways and means by which the most effective restrictions can be placed upon the spread of bovine tuberculosis. The committee recommended that as an emergency measure an effort be made to secure through the State Executive Council a special appropriation to continue the investigation inaugurated respecting the restriction of tuberculosis among our cattle. Dr. Shrader, Prof. Stalker, Dr. Carter and the secretary were appointed a special committee to present the subject to the Executive Council. The Council was convened by the Governor, when Dr. Shrader made the following address to the council:

Your Excellency and Members of the Executive Council:

GENTLEMEN:—At the last meeting of the State Board of Health a committee was appointed to confer with you, hoping that some way might be devised whereby the investigation of the great herds of cattle in the State might be more fully undertaken and prosecuted for the purpose of ascertaining the sanitary condition of the cattle found therein. That tuberculosis exists in some of our best herds, we have the indisputable testimony of our State Veterinary Surgeon, Dr. Stalker (who will lay that part of the subject before you). In the New England States and New York, consumption causes one-eighth of all the deaths from all causes. In the city of Philadelphia, we are informed by Dr. W. H. Ford, president of the Board of Health, that tuberculosis causes one-twelfth or more of all the numerous deaths. It is a well established fact that cattle can and do have consumption, whether of the lungs, the udder, or other tissues. Such being the case you must see, gentlemen, to what fearful risks the people of this great State are daily being subjected.

It is a well-established fact that milk is a common carrier of the seeds of disease. Well authenticated outbreaks of such diseases as scarlet fever, typhoid fever and diphtheria have been traced to this source.

Tuberculosis, that dread disease of the human race, can be, and is, communicated by the use of milk from tuberculous cows. The public are beginning to appreciate these views, and anxiety is now betrayed to have a better protection against infection through this medium than has heretofore been evinced. Tuberculosis is a very prevalent disease among cattle, and the milk of tuberculous cows can communicate disease to those who partake of it.

In the absence of protective laws what safeguards are there against the continual propagation of this dreadful disease through this common channel?

What test has the consumer, or can the consumer have, to show that the milk does not contain the germs (seeds) of tuberculosis? None, whatever. He must rely absolutely upon a more or less trustworthy guarantee of the authorities, who alone can have jurisdiction over the dairy farms and herds of cattle, and can satisfy themselves that no communicable disease exists among the cattle, and that no other source of contamination exists. But when no such official supervision is provided by law, the consumer is left entirely helpless, and this is the position in which communities are left to-day.

We fold our arms in despair over the waste of life from consumption, which, as I have stated, causes about twelve per cent of all the deaths, while a means but recently tried, but none the less certain in lessening this frightful mortality, is within our control if we would, or could only use it. We shudder at the cup that contains poison, for we know its prompt consequences, yet we complacently drink milk, and offer it to our children, when every intelligent person knows full well that it too often contains the insidious germs that will ingraft upon the system a disease that will cause lingering suffering and ultimate death.

If the public health is to be protected from the dangers that lurk in milk, intelligent, rigid and complete scrutiny must be observed, and a careful examination made of the cattle of the State by those perfectly competent and thoroughly honest in the prosecution thereof.

At a late meeting of the American Public Health Association held in Montreal, papers were read on this subject. Dr. F. O. Donohue, president of the New York State Board of Health, after speaking of the great number of deaths from this cause, stated that since 1892 they have a law providing for the slaughter of cattle found to be suffering from tuberculosis. Examination of cattle immediately began, and out of twenty-two thousand cattle examined, seven hundred were found diseased and ordered killed. A special commission was appointed for that purpose. Massachusetts also has a commission, and the results there obtained from their examinations vary but little from those in New York. We have very briefly alluded to this matter from a sanitary standpoint. But there is another which should also be considered, *i. e.*, the commercial.

It is a well established fact that this disease is communicable from one animal to another, as well as to the human family. Such being the case, one diseased animal in a herd may soon contaminate the rest. Hence, from a financial standpoint the herds should be inspected, the diseased separated from the healthy, or what is better, slaughtered before the great cattle interest of the State suffers enormous loss.

Now, gentlemen, we as a committee of the State Board of Health, whose great duty it is to protect the health and lives of the people of the State, ask you, in the absence of the legislative power, to assist us in furthering this most important matter. We are without the means financially to send out our State Veterinarian and his assistants to commence the inspection of our cattle. Every day this matter is delayed our people are exposed to danger, and our stock interests depreciated in value. Other States are already moving in this direction, and we most deeply feel that Iowa should also look after her interests.

Professor Stalker will give you a detailed statement of what has been done, and the means adopted for determining the presence of tuberculosis.

Thanking you for your attention and hoping you can see a way to meet this great emergency, and thereby enable the Board to protect the lives and interests of the people, we do most humbly pray.

Prof. Stalker was called upon and made an interesting verbal report as to the infected localities in the State, and also as to the result of his experiments with tuberculin as a diagnostic agent. He also read several reports and conclusions arrived at by eminent veterinary surgeons, including the U. S. Bureau of Animal Industry, showing the great value aud reliability of tuberculin as a test of the presence of tuberculosis. He also spoke of the source from which the tuberculin was obtained, and the cost of the same.

As to the infectiousness of tuberculosis he had not the least possible doubt, and of the danger of the use of tuberculous meat and milk he was well convinced.

So far as an expression was made, it was the opinion of the entire Executive Council that this matter should be carefully and thoroughly investigated, so as not only to ascertain to what extent the disease prevails, but also to use every rational and legitimate means not only to prevent its spread, but to stamp it out entirely; and the State Veterinary Surgeon was authorized to use all the means, financial and police, given him under the law, to secure for Iowa at as early a date as possible, a clean health bill for Iowa cattle, by ridding the State of this insidious and fatal disease.

One serious obstacle presented itself to a very thorough and extensive investigation—that of the payment of the investigators, including the expense of obtaining tuberculin, or providing a plant for making it. The veterinary department of the State is limited to three thousand dollars annually—a special appropriation. The "providential fund," ten thousand dollars annually, can only be used for expenses "not otherwise

provided for," and as the expenses of the veterinary department are "otherwise provided for," none of this money can be thus expended. However, the veterinary surgeon was advised to go ahead and do his duty under the law, and should the emergency be such as to demand it, it was thought the Governor would be justified, by the concurrence of the Executive Council, in borrowing the money and trusting to the General Assembly to repay it. In this connection the Governor enunciated a proposition that we believe is eminently wise, and that was: "The genius and design of all law is to impose no duty upon an official without implying, at least so far as his official acts are concerned, the placing within his reach, under specified conditions, the means, financial or otherwise, of discharging his duty."

A SPECIAL DISINTERMENT PERMIT

was asked for the removal, by railroad, of a body dead from scarlet fever. The Board declared that it was best in all cases of bodies dead from prohibited infectious diseases to stand by the rules and regulations adopted heretofore by the Board and required by the railroads. The request was not granted.

VENTILATION.

The committee to whom was referred for review the circular issued by the Board on ventilation, reported as follows:

Your committee on ventilation would respectfully report that they have made careful examination of the circular on ventilation, prepared by Mr. Andrews, assistant to the secretary, and find it a very valuable treatise on that subject—concisely and intelligently stated. We further deem its publication advisable and beneficial to the public.

[Signed] R. E. CONNIFF,
M. STALKER,
WARREN DICKINSON,
Committee.

The report was received and adopted.

FEBRUARY MEETING, 1895.

At the meeting held February 5th and 6th, 1895, all the members were present. Dr. Shrader was heartily congratulated upon his reappointment for a third term of seven years. Attorney-General Milton Remley was present for the first time as successor to Hon. John Y. Stone.

The secretary's report was read and referred to committees.

VACCINATION.

The secretary presented the following taken from a local newspaper:

The question of compulsory vaccination has at last been carried into the courts and there decided. The circumstances are of interest. The local board of health of Shelby, in compliance with the directions of the State Board of Health, ordered all the scholars in the Shelby public schools to be vaccinated on or before January 1, 1895, or be excluded from the schools. About two hundred and fifty children complied with the order of the local board, while the parents of some ten of the pupils put on war paint and refused to have their children vaccinated, whereupon they were duly sent home and forbidden to re-enter school until they should be vaccinated. Their parents carried it into the courts, suing out an injunction against the local board of health of the town of Shelby, and on last Saturday the local board and their opponents appeared in court at Harlan before Judge Macy, who after hearing the evidence, sustained the local board of health of the town of Shelby.

This, we believe, is the first case in the State of Iowa, and the fight was made on the constitutionality of the regulations of the State Board of Health as having the power to exclude children from school who refuse to be vaccinated. This is a very important decision, and will tend to quiet those who are always ready to oppose good health regulations.

A request was made of Judge Macy for a copy of his opinion in the case above cited, to which he replied as follows:

HARLAN, IOWA, February 4, 1895.

Dr. J. F. Kennedy, Des Moines, Iowa:

MY DEAR SIR—Your letter at hand. I can only hurriedly answer. The opinion I rendered was oral, and I have not before me even the notes and citations I used. I have no doubt about the points involved. The legislature provided for the State Board of Health, and committed to it general powers with regard to health protection. That legislation does not contravene the principle of constitutional law that the right of authority of the legislature to pass or enact laws does not give that body authority to delegate the power to another body or branch of the government. The protection of health and morals of the citizens come within police regulation, and the State Board can enact rules and regulations upon the matter of preserving the public health, and if they are not oppressive, whimsical, discriminating, but reasonable and just, and apply to all, will be sustained.

N. W. MACY.

POLLUTION OF STREAMS.

The secretary presented the following communication:

KANSAS CITY, MO., January 27, 1895.

Dr. J. F. Kennedy, Secretary State Board of Health:

DEAR DOCTOR—At the National Conference of State Boards of Health, held at Washington, D. C., December 13, 1894, the following resolution was introduced by this Board and unaminously adopted:

WHEREAS, The increasing pollution of bodies of water contiguous to cities and towns has become a menace to the health of communities of such gravity and extent that it is a question of national importance; therefore be it

Resolved, That it is the sense of this conference that the whole subject of the contamination of such lakes and streams as are the source of water supply to more than one State should be investigated by a commission created by act of Congress, and that the conclusions reached, together with suggestions for legal remedy and control, should be published from time to time for the information of interested communities.

A bill to create a commission with duties in the line of this expression of a national sanitary need was introduced in the House (H. R. 8481), January 12, 1895, by the Hon. Richard Bartholdt, of Missouri.

You are respectfully urged to call the attention of the senators and congressmen of your State to the bill and urge their coöperation in securing its passage, if possible, during the present session of Congress.

Very respectfully,

WILLIS P. KING, *Secretary*.

ST. LOUIS, January 19, 1895.

Dr. J. F. Kennedy, Secretary State Board of Health, Des Moines, Iowa:

DEAR SIR—Enclosed herewith please find newspaper clipping containing text of a bill introduced into the House of Representatives on the 12th inst., by Hon. Richard Bartholdt of Missouri, for the creation of a federal commission to investigate the pollution of potable waters where such pollution tends to the sanitary injury of the people of more than one State.

Mr. Bartholdt advises me as follows:

"I think that if the State Boards of Health, or local health officers of localities interested in a measure of this kind, would appeal to their Congressmen for assistance in this matter, I may succeed in passing the bill this session."

Will you not kindly interest yourself in the manner indicated, and at as early a date as possible?

Very truly yours,

GEORGE HOMAN, *Health Commissioner*.

A BILL to appoint a commission for the investigation of the pollution of water supplies where such pollution affects or threatens to affect the sanitary condition of the people of more than one State.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled. That a commission shall be appointed to investigate fully the subject of the pollution of rivers and other natural sources of water supply where the sanitary condition of the people of more than one State is affected or threatened to be affected by such pollution, this commission to consist of three members, to be appointed by the President, by and with the consent of the Senate, whose compensation during the time when actually engaged in the performance of their duties under this act shall be ten dollars per diem each and reasonable expenses.

SEC. 2. That the commission shall meet in Washington, District of Columbia, within thirty days after the passage of this act to consider the methods to be adopted in the investigation, and it shall have authority and be empowered to make use of the services of chemical, bacteriological and sanitary experts, and of such persons as it may judge most competent by reason of their special knowledge and experience to afford it correct information on the subject of its inquiry, as well as in formulating its methods as in carrying them into effect. It shall meet thereafter from time to time at such places as it may consider best suited for the furtherance of its inquiry.

SEC. 3. That the commission shall report to Congress at its next session the progress made in the investigation undertaken under this act, and shall submit such suggestions as may seem desirable, with the view of remedying any insanitary conditions that have been developed by its work.

SEC. 4. That the sum of ---- ... thousand dollars, or so much thereof as may be necessary, is hereby appropriated, to pay the salaries and expenses of said commission and carry out the purpose of this act.

After a general expression of views by the Board, regarding the importance of congressional action respecting the purity of streams, Dr. Guilbert presented the following resolution, which was unanimously adopted, and the secretary directed to send a copy thereof to the Iowa delegation in Congress:

Resolved, That the Iowa State Board of Health is in full sympathy with the efforts of the Hon. Mr. Bartholdt to secure national legislation on the pollution of interstate water courses, and earnestly requests our senators and representatives in the national legislature to support the bill (H. R. 8481) introduced by Mr. Bartholdt into the House of Representatives on this all-important subject.

BACTERIOLOGY.

Mr. J. C. Bay, bacteriologist of the Board, submitted a report of the progress made in the investigation of small pox, as follows:

To the members of the Iowa State Board of Health:

GENTLEMEN:—At this meeting of the Board I have the honor of laying before you my first printed communication concerning the small pox organism. I further present a more extensive paper on the same subject, which will appear in the *American Naturalist*, and, in translation, in the reports of different European societies of which I am a member. Reprints of these communications will reach you in due time, so I need not take up your time in reading the paper to you, unless at your special request.

The investigations have demonstrated the presence of a constant bacillus in vaccinia and variola lymph. The next question will be to prove that this organism can produce vaccinia or variola when allowed to exert its influence upon animals susceptible to its influences. Since the bacilli constantly accompany the disease itself, as well as its modification, vaccinia, this is most probable, but must be proved if science and practice shall be able to make use of the results. If the results of such experiments will be visible in the form of a vaccine or an antitoxine, we cannot predetermine. But the problem is exceedingly interesting, since small pox, among all contagious diseases is inferior to none in interest, and epidemics thereof are feared none less than cholera. Sooner or later Jenner's discovery will receive its basis and explanation in the progress of preventive medicine.

I most ardently hope that the Board will provide for the continuation of the work, the results of which I have now laid before the public, which will expect to hear of the final results. This Board has taken so much interest in the solution of the first problem in the question of the etiology of small pox that I trust you will appreciate the benefit which the people at large may derive from a satisfactory and scientifically true solution of the rest of the problems in the same field, which are yet open to investigation.

I hope that the Board will provide for the continuation of the small pox investigations in such a way that I can be able to show the truth of the work now in print, and that I can be able to give my entire attention to the solution of this important problem.

I hereby lay before you both the paper already published and the manuscript of the more extensive communication which will now go into print, having awaited this meeting to be presented as the report of my work during the year past.

BOVINE TUBERCULOSIS.

Prof. M. Stalker, State Veterinary Surgeon, submitted the following report of his investigation of tuberculosis among cattle:

To the Honorable State Board of Health, Des Moines, Iowa:

GENTLEMEN:—Since the last meeting of the Board the work of testing herds of cattle affected with tuberculosis has gone on with a good deal of activity. Both local boards of health and individual owners of cattle, especially the owners of dairy stock, have begun to realize the importance of the work, and from various quarters requests are coming in for tests to be made. So far we have been able to keep fairly up with the work of testing herds kept for the purpose of supplying milk to the public. I have been obliged to adopt the plan of declining to test individual cows, kept for family purposes. The demand for such work would overwhelm the department, if an attempt were made to answer all the calls for this class. Most of these parties, however, are anxious and willing to meet the expense of the test, provided they can secure the services of a reliable and experienced operator. I have attempted to supply demands of this kind, and have in the majority of cases succeeded in doing so.

The work has gotten quite beyond the experimental stage. The only question that remains for settlement is: How rapidly and how thoroughly can the work of exterminating the disease be carried on? The uniform certainty of the tuberculin test has had abundant confirmation in my experience with some twelve hundred cases and has dispelled all my misgivings. I have never found anything else in the whole range of medical science from which so nearly uniform results can be expected. In but one single instance of all the cases coming under my observation, has it been necessary to use the microscope to confirm the finding of the tuberculin test. Its demonstrations have convinced the most skeptical and the most obstinate disbelievers. Those who started out to oppose the test have abandoned this line of attack and have fallen back on the advice to the public to close their eyes and swallow the contaminated food products from these diseased brutes; or rather to dispose of the rotten stuff and allow the other fellow to eat it without knowing what it is. The very least that sanitary precaution and ordinary decency could demand, would be to require that all such products should be distinctly labeled, setting forth the fact that the animal from which they were obtained was affected with tuberculosis. This would place the purchaser in a position to decide for himself, just as he can now decide whether he wishes to purchase and use oleomargarine on his table. No fair-minded man will attempt to maintain that the consumer is not entitled to

this information. If he were so advised, the demand for such contaminated products would not long serve as an incentive to justify placing them on the market.

But if common decency did not revolt at the suggestion, the vital statistics of localities where such diseased food products are allowed in the open market, should at least afford a warning. Denmark has sometimes been referred to in justification of the sale of tuberculous meat. But the mortuary statistics of Copenhagen show that between forty and forty-five per cent of all deaths occurring among males between the ages of twenty-five and thirty-five, and all of the females between the ages of fifteen and twenty-five must be referred to tuberculosis. Vienna shows a still more alarming state of affairs. But we need not go outside of our own country for statistics equally startling, where little or no precaution is taken to prevent infection from tuberculous food products.

An interesting case came under my observation a few days ago, while making a post-mortem examination of some cows that had been slaughtered as tuberculous. One of these had been selected for the purpose of supplying milk to an infant. The child died. The cow was placed under test and reacted, showing the presence of the disease. She was slaughtered and the carcass subjected to careful examination. A large portion of the udder proved to be a granular mass of tuberculous deposit, though not a trace of disease could be detected from the external appearance of that organ. This proved a good illustration of the fact that the danger line is not to be drawn at the constitutional collapse of the animal. If the animal is diseased in never so slight a degree it is a menace to public health. On this point the experiments of Ernst and Peters of Harvard, for the Massachusetts Board of Agriculture, are conclusive. One hundred and fourteen samples of milk from tuberculous cows, with apparently perfectly healthy udders were tested, and a little over thirty-one per cent of these samples proved capable of producing tuberculosis. The Ottawa health board has made a most exhaustive series of experiments to determine the infectious nature of milk from tuberculous cows, without regard to the region of the body affected. They are unequivocal and emphatic in their declaration that milk may prove infectious, no matter in what portion of the body the manifestations of the disease may appear This is but duplicating the observations of experimenters in every quarter of the world where scientific research is carried on.

So far as I have been able to follow the development of the disease among the cattle of our country, it obtained its first extensive foothold from imported stock placed in our breeding herds. From these herds individuals went out to other herds, usually of the same breed, and to the yards of the common farmer. These early centers of infection became distributing points for the disease, and in the course of time, through such means and other avenues of communication, the disease became widespread. Just how general the infection has become in our own State would require a good deal of work to determine, in addition to what has already been done. I am of the opinion it has not yet become general among the herds of the common farmer. Usually their modes of caring for their stock are not favorable to the dissemination of contagious disease. The conditions prevailing among breeding herds and dairy stock tend in a much stronger way to

spread infection of any nature when once introduced. And it is from these two sources that we are to anticipate the greatest danger, and over which we are justified in exercising the most careful scrutiny.

As to the manner in which the work is received, I believe that boards of health have uniformly regarded the investigations with high favor. Many have been most emphatic in their expressions of confidence in the test, and their gratification at the results attained. And what is rather unexpected is the fact that in most instances the owners of condemned stock have cheerfully acquiesced in the results. The loss has been considerable in some instances, but the feeling has prevailed that the owner was better off for having made the discovery in time to avert a greater disaster. There are a few instances where the owner, under the influence of unwise counsel, would have preferred to unload the diseased animals on an unsuspecting purchaser and permit him to pocket the loss, where a hearty coöperation was not indulged in. From this source, and from others similarly situated who are anxious to make sales before detection, the work is meeting with objections. It is but a repetition of the old fight against the extermination of pleuro-pneumonia, but in which there are vastly more important issues.

But in the end the results will be the same. It took almost a half century for a handful of sanitarians to convince the world of the importance of exterminating that scourge in this country. But conviction came at last. Results are going to come much more quickly in this instance.

Dr. Guilbert presented the following resolution, which was unanimously adopted:

Resolved, That this Board, largely basing its action upon the active, extensive and satisfactory experience of our State Veterinarian, Professor Stalker, hereby emphatically reaffirms its confidence in the tuberculin test as an essential measure toward the end of a thorough stamping out of tuberculosis in animals in Iowa.

Resolved, That in future work Professor Stalker be and is hereby requested to furnish, so far as possible, our bacteriologist specimens of diseased products for examination in our laboratory.

In addition to the above report, Professor Stalker gave verbally a number of interesting facts relating to his investigations in various parts of the State.

Dr. Shrader reported to the Board the result of the interview of the special committee with the Executive Council relative to bovine tuberculosis, especially from a human sanitary standpoint. He said the State Board desired help independent of the well directed efforts of the State Veterinary Surgeon, which were largely in the interest of the stock breeders. The efforts of the veterinary department were for the protection of the *cattle*. The efforts of the State Board of Health were for the better protection of the *people* who consumed the meat and milk of these cattle.

The following communication was received from the Iowa State Veterinary Association:

OSKALOOSA, IOWA, January 15, 1895.

Dr. J. F. Kennedy, Secretary State Board of Health, Des Moines, Iowa:

MY DEAR DOCTOR—Enclosed herewith please find copy of resolution adopted by the Iowa State Veterinary Medical Association at their annual meeting, held in Des Moines, November 15 and 16, 1894, relative to the spread of tuberculosis in this State.

Very respectfully,
JOHN E. BROWN,
Secretary I. S. V. M. A.

WHEREAS, It is demonstrated that tuberculosis in cattle is widely distributed throughout this State, and

WHEREAS, The disease can be communicated to mankind through the consumption of the flesh of tuberculous cattle, and

WHEREAS, The disease can be communicated to mankind through consumption of the milk from tuberculous cattle; be it

Resolved, That it is the sense of the Iowa State Veterinary Medical Association that the Iowa State Board of Health should immediately make such rules and regulations as in their best judgment will eradicate this disease from the herds of the State.

(Signed) G. A. JOHNSON,
S. STEWART,
J. MILLER,
Committee.

The secretary reported that early in January, 1895, in the Davenport papers, notice was given of an examination of cows used for dairy purposes in and around that city, and stating that nine hundred and sixty-nine cows had been examined.

Knowing the scarcity of tuberculin and the time required for a thorough and reliable test of that number, inquiry was made of Dr. A. W. Cantwell, health officer for the city of Davenport, as to the facts respecting this alleged examination to which he replied as follows, and enclosed a copy of the report of the veterinary surgeon who made the examination.

In consideration of the late action taken by this Board respecting bovine tuberculosis, the matter was referred to Prof. Stalker as properly coming within his jurisdiction. Dr. Wright's report gives only the result of external inspection, which was accepted by Dr. Cantwell, as evidence of "no tuberculosis in any of these cattle." Such a decision based upon such superficial examination tends unintentionally on the part of Dr. Cantwell, to mislead the public into a false security.

DAVENPORT, IOWA, January 22, 1895

Dr. J. F. Kennedy, Secretary State Board of Health, Des Moines, Iowa:

DEAR DOCTOR—I received a letter from your office in regard to the examination of our dairies in and about our city.

To give you a full history of why this examination was made: seeing and reading of the condition of cattle in various parts of the country, especially tuberculosis existing in so many parts of the United States in cattle, and feeling that something ought to be done, I laid the matter before the Board of Health the first Tuesday in December, asking permission for me to secure the services of John Wright, Deputy State Veterinarian, to examine the

various herds of cattle supplying milk to our city. They authorized me to do so, with the result as stated—not finding any evidence of tuberculosis in any of these cattle.

As a matter of course we did not go to the extent of carrying the inspection so far as the use of tuberculin, knowing it to be a scarce article and quite an expense, unless we found it absolutely necessary. Dr. Wright was therefore, given instructions to make the inspection as thorough as possible, see that the cattle were all healthy, which he says he did. He spent about two weeks or a little over in making his examination. Now, it is not our wish to deceive our people at home or abroad, and we do not think we have done so. Should any evidence of tuberculosis show itself in these cattle we would then be willing to make a more thorough inspection with tuberculin or under your directions. It requires one specially trained—an expert to use the tuberculin. We do not wish to do anything wrong or misleading. We are willing to be guided at all times.

Respectfully yours,

A. W. CANTWELL,
Physician Board of Health.

ANTI-TOXINE.

A communication was presented from the State Board of Health of the State of Tennessee, transmitting the following resolution adopted by that board, and recommended for consideration:

Resolved, That for the purpose of securing reliability and uniformity in whatever is used, this Board do petition the United States Marine Hospital Service, either alone or in coöperation with the Animal Industry Bureau at Washington, D. C., to have prepared "anti-toxine" for distribution through boards of health, as are now tuberculin and mallein by the Bureau of Animal Industry.

The resolution was unanimously approved and adopted as the sentiment of the Iowa State Board.

Mr. Adair, who had been reported to the Board as suspected of being affected with leprosy, presented himself, and after a thorough examination it was declared by the Board that no leprosy was found to exist.

Warren Dickinson, civil engineer of the Board, submitted a paper on "House Drainage," which was accepted, and is given in another place in this report.

BARBAROUS QUARANTINE.

Dr. Becker called attention in a vigorous and emphatic manner to what he denominated barbarous quarantine, or rather that the methods of maintaining and enforcing quarantine in many instances are inhuman and barbarous. He was in favor of quarantine, and an effective quarantine, but not such as to work an unnecessary hardship upon those who are unfortunately subjects of it. He spoke of cases where an infectious disease and quarantine was established, that during the entire quarantine of thirty-five days the local board of health did not once

visit the quarantined premises, and no effort was made to see that the wants of those quarantined were fully, or even partially met—and cited instances coming under his observation where there was actual suffering for the common necessities of life. He said such practices brought quarantine into disrepute and misrepresented the spirit of quarantine and the position of the State Board in respect thereto. Several other members of the Board spoke on the same subject and all heartily concurred in Dr. Becker' remarks. The consensus of opinion was that whenever the head of the family could be safely exempted from the operation of quarantine it was proper to do so, though only upon conditions and restrictions specified by the local board, as represented by the mayor and local health officer. In all cases it should see that there is no suffering from lack of food, fuel, clothing, medical attendance or nurses.

SMALL POX.

The secretary reported that since the last meeting of the Board small pox had appeared at several points. At Sperry there were five cases; one fatal, that of Mr. Buhrmaster, first attacked through exposure in Chicago. He had been vaccinated when a boy, and showed a typical scar upon his arm. This case shows the necessity of revaccination, and, further, that a previous vaccination will not always render an attack, should it occur, so mild and varioloidal in character as to be free from danger. All the patients convalescent.

Dr. Hunter of Remsen reports that all the small pox cases there, three in number, are convalescent, and that there will be no other cases. No deaths.

On the 18th of January small pox was reported at Pioneer, in Pocahontas county, in the person of a Mr. Kent, exposed in Chicago while disposing of live stock. Dr. Belt of Gilmore City was called and found the patient in the eruptive stage. All the family had been exposed, and they were at once vaccinated, and the patient isolated. A nurse was employed who had small pox, it was said, when he was eighteen months old. He had since been vaccinated, and is said to have produced the characteristic signs and symptoms of vaccinia. Before entering upon the charge of Mr. Kent as nurse, he was revaccinated, and Dr. Belt says it "worked." This is a most remarkable history, if correct, and is exceptional. There were three cases in the family; one fatal, a babe.

MAY MEETING, 1895.

At the annual meeting held May 1st, 1895, there were present Drs. Becker, Conniff, Carter, Emmert and Guilbert, Civil Engineer Warren Dickinson and State Veterinary Surgeon Stalker.

The minutes of the last meeting were read, amended and approved.

Communications were read from Drs. Shrader and Scroggs explaining cause of absence, and expressing regrets for inability to be present.

An invitation was read from the Sisters of Mercy, of Mercy Hospital, inviting the Board to visit the Hospital at its convenience. On the motion of Dr. Carter the invitation was accepted and the interim between the morning and afternoon sessions was fixed as the hour.

GREETINGS.

On motion the secretary was directed to send greetings to Dr. Shrader, who, because of illness, was absent.

The following telegram was sent accordingly:

"The Iowa State Board of Health, in annual session assembled, send most cordial greetings to their esteemed colleague, Dr J. C Shrader, regretting his enforced absence, and wishing him a speedy return to health."

SMALL POX.

The secretary reported that there had been three cases of small pox at Sperry. There was one death. The remainder had recovered, and the quarantine had been removed. There were three at Bedford, also recovered, and one at Muscatine. The notification to this office of the last case was received by telegram April 16th. The patient was a tramp who had gone there from West Liberty on a freight train. He gave his name as Chas. Shea, and his home as Atchison, Kansas. He was, on his arrival at Muscatine, immediately removed to the pest house, about two miles from the city. He was, when taken there, in the eruptive stage. He is now convalescing, and no further cases have occurred. He had with him a comrade who continued on west over the Rock Island railroad, of which fact this office was notified by the mayor of West Liberty. The facts were laid before Supt. Stillwell, who immediately notified by telegraph the trainmen and station agents to be on the outlook for him. As no other case has been reported, and nothing further heard from this man, it is evident he either escaped the

infection or has gone beyond the State. There is now no case of small pox within the State.

Too much praise cannot be awarded to the local health boards of the State for the prompt and efficient manner in which this and other contagious diseases are combatted and successfully resisted. We believe this has been largely brought about by the circulation of the Bulletin and the prompt and generous distribution of circulars pertaining to such diseases, and the best best means of restricting their spread.

SUGGESTIONS ON QUARANTINE.

The president, Dr. Becker, presented the following paper on quarantine, which was received and ordered published:

Since the creating of the State Board of Health and of local boards by statutory enactment, about fifteen years have elapsed. These years have been years of experiment, founded upon known principles in sanitary science, and have been changed or modified with sanitary science itself. They have been years of experience, also, not only for the local boards of Iowa, but for the State Board as well. Many problems have met their intricate solution; others have been partly solved, while still others have not been solved at all. The reason of this is that new experiments bring forth new light and result in various experiences under new and untried circumstances; constant changes of things and circumstances create again new demands.

Quarantine is one of the many problems with which the State Board and local boards alike have been wrestling for years. The question of how to make it effective and at the same time humane under any and all circumstances is a question not easy of solution. The intention of quarantine is to protect the well from the danger of contact with contagious and infectious diseases, and this demands the seclusion of those sick or threatened with contagious and infectious disease, for a period long enough to insure complete recovery from any of the diseases known as contagious or infectious, and which is usually forty days, if it results in recovery, or until thorough disinfection has been practised if it results in death.

The first experiments on the line of quarantine met with serious antagonism on the part of those placed under these restrictions, and even now it does not meet with universal favor. For years the State Board of Health has endeavored to instruct the people of the State in the causation of many of our epidemic and endemic and most fatal diseases, and has endeavored to instruct the local boards of health throughout the State in their respective duties to the sick and to the well. Much good work has been done on these lines, and it is a significant fact that many widespread epidemics have been prevented and thousands of lives have been saved to the State by painstaking and effective quarantine. In large cities and incorporated towns it is being handled with good and satisfactory results, but in smaller towns and many rural districts it is still imperfectly understood and more imperfectly handled.

For the instruction of the local boards in matters of quarantine, the State Board, several years ago, published a circular in which it called the attention of local boards to the fact that wherever quarantine had been established against any individual or family it became the duty of said Board to provide in every way necessary for those quarantined, in the furnishing of the necessities of life and in providing attendants and nurses, if needed, for the proper care of the sick. And again in 1894 two circulars were published, one entitled, "Instructions to Local Boards of Health in the State of Iowa," where on page 3, under the item of "expenses" the following sentences are found: "They (the local boards) must furnish food and other necessary supplies, medical aid (if needed) and nurses for the sick." And farther on it says: "Where well persons are quarantined with the sick, they also must be furnished with food and other necessary supplies " In the other circular referred to and entitled, "Restriction and Prevention of Scarlet Fever, Diphtheria and Membranous Croup," the following is found in regard to quarantine, on page six, under "Rules and Regulations:" "and to provide for the proper care and maintenance of the sick and all quarantined persons."

These suggestions and instructions mean a great deal more than simply placing the danger signal upon the premises of those afflicted with dangerous, contagious or infectious diseases. The placing of the placard on any person's door should mean to the local board under whose jurisdiction it is done that they, as a board, shoulder a great responsibility, a two-fold sacred trust, namely: *First*, that the well do not become endangered to the contagion by coming in contact with the sick; and: *Second*, that those stricken with disease are properly cared and provided for, so that want is not added to disease. With the invasion of disease in a household the needs multiply, and if death should be the result they increase still more. It is, therefore, self-evident that these needs must be supplied, and that it is somebody's duty to see that they are, and this responsibility is vested by law in the hands of our local boards of health. To accomplish this two-fold purpose, it is necessary that regular visits be made to the infected premises, first, that quarantine may be effective; and second, that the needs of those quarantined be supplied regularly and punctually. Every city mayor or township clerk should especially inform himself in regard to his duty as a health officer, for in no other branch of his office is as much circumspection and wisdom needed as in his responsibility as a health officer. He should provide himself with one or more trusty person or persons to carry out his supervision of quarantine so long as needed, and to render any and all service needed to the quarantined. To make quarantine effective, as well as human; to make it a credit to the civilization of this nineteenth century, and not a burlesque and a curse, is the aim and anxious desire of the Iowa State Board of Health. To accomplish this purpose it is necessary that local boards understand the statute under which they are to act, and adopt such rules and regulations as may be needed under their respective jurisdictions, to secure respect for the law, and to facilitate its enforcement, if needed. To better accomplish this it is necessary that the rules and regulations of the State Board, as well as the decisions of that Board and of the supreme court, be well known. This accomplished, coupled with wisdom and human feeling for a fellow sufferer, and nothing more needs to be said. The time is, or ought to be, passed, when an American family can be, or is expected to be, secluded for forty days or more without even being looked after. Our local boards of health throughout the State ought to understand this, and they further ought to understand that such treatment of those under quarantine does more to make it disreputable with the people than all else combined, and is a main factor for secreting the existence of contagious and infectious diseases. Local boards should never be guilty of such barbarism, which strongly savors of ancient times when, during epidemics of small pox, plague, etc., the well, awe-stricken, would flee from the sick and dying and leave them to their fate. Proper attention to the quarantined on the part of local boards will make quarantine bearable as well as reputable, and it is strongly urged upon all local boards that they do their full duty to the afflicted and quarantined under their jurisdiction.

The secretary was directed to prepare and present at the next meeting a circular on disinfection in general, giving due prominence to its importance as a preventive of puerperal fever.

BOVINE TUBERCULOSIS.

Professor Stalker gave an interesting account of observations now in progress under his department (veterinary) at the experiment station in connection with the State Agricultural College at Ames. He has under observation nine pregnant cows which are tuberculous, having responded more or less decidedly to the tuberculin test. The pre-natal influences upon the calves will be noticed. The calves will not be permitted to suck their dams at all, but will be brought up on milk from cows known by proper tests to be free from tuberculosis. They will be placed with healthy animals or in such sanitary conditions that the danger of infection will be the least possible. If these calves, under these circumstances, later respond to the tuberculin test it will render a strong presumption at least that the disease is hereditary. Then calves from cows known to be untainted by tuberculosis will be fed on the milk of the tuberculous cattle, and the influence of this milk upon them will be noted. An endeavor will thus be made to determine what, if any, danger there is in the use of milk from tuberculous cattle. The bacteriologist is also to examine the milk biologically.

Upon the motion of Dr. Emmert, Professor Stalker was requested to report to this Board the result of his experiments and to furnish Mr. Bay with milk and other products for investigation by microscope and culture-methods, and that Mr. Bay also be requested to report his findings.

TRANSPORTATION OF CATTLE.

The secretary called attention to the recent quarantine proclamation by the Department of Agriculture, and to the rules and regulations adopted to restrict the spread of the southern cattle plague, and stated that the rules and regulations in force by this Board were in conflict with those promulgated by the United States government. Prof. Stalker was instructed to revise the rules and regulations respecting cattle quarantine and transportation, so as to have them conform to those of the government, and to report his revision to the next Board meeting for adoption.

POTABLE WATER.

The standard of the Board for potable water was changed so as to permit a much less per cent of "chlorine" and "nitrogen in nitrates." The following is the standard as adopted:

	Maximum Limit of Impurity. Parts per 1,000,000	Grains per U. S. Gallon
Total solids	600.000	35.000
Loss on ignition	Qualitative	
Chlorine	8.000	1.4665
Free ammonia	.080	.0046
Albuminoid ammonia	.150	.0087
Nitrogen in nitrites	Trace	Trace
Nitrogen in nitrates	1.000	.0583

TUBERCULOSIS AND MILK INSPECTION.

Mr. Bay the bacterologist of the Board presented the following report, which was read, accepted and referred for publication:

GENTLEMEN: The question of milk inspection with special reference to tuberculosis has often been considered by this honorable body; therefore, I am not here to present to you well-known facts, but the *status quo* of late results bearing upon this important problem.

As regards the conveyance of infection through milk, the broad fact was hitherto established that a tuberculous cow may give tuberculous milk, and will do so if the udder is affected. No doubt the dissemination of this intelligence causes the great majority of people to infer that, generally, there is not much danger connected with the consumption of raw milk in the cities or in the country.

It has been proved, however, beyond any doubt whatever, that the bacillus of tuberculosis may be found in milk, even when the animal has not been attacked by tuberculosis of the udder, and when tuberculous lesions are not generalized.

The facts proving said conclusion are very instructive. Dr. Schroeder, of the United States Bureau of Animal Industry, reports that out of nineteen specimens of milk obtained from the general milk supply of Washington, one contained the bacillus of tuberculosis in numbers sufficient to give

rise to infection, and that the milk from one of twelve tuberculous cows—an animal practically in the stage of generalized tuberculosis—was decidedly tuberculous. Dr. Schroeder concludes his report by expressing the opinion that now and then the presumably mixed milk of dairies may contain enough tubercle bacilli to infect the animal system.

Prof. O. Bollinger, of Munich, has thrown a great deal of light upon the artificial production of tuberculosis as induced by the consumption of diseased milk. He holds that the milk of such animals is especially contagious, and reproduces the disease in certain animals from that point of view. He also proved that such milk, even when boiled, still retains its injurious properties.

This may be able to substantiate, in some way, what I mentioned at the August meeting last year of *tuberculous poisoning* The toxin produced by the tubercle bacillus has been isolated by Zuelzer, who found that the injection of one centigram or less of this substance subcutaneously in rabbits and guinea pigs causes after three to five minutes, increased frequency of respiration (to about one hundred and eighty per minute) and an elevation of temperature of about one-half degree. From two to three centigrams kills rabbits in two to four days.

The question whether or not the bacterial poison is killed by the temperatures under which the tubercle bacilli are killed is yet open. It is, however, probable that the poison is not rendered immune by ordinary milk sterilization. It being true that the toxin cannot produce tuberculosis, of which the tubercle bacillus is alone capable, the toxin produces, however, such an effect upon living organisms that the latter become quite predisposed to tuberculosis.

Fleming maintains that the use of milk from tuberculous cows should be altogether prohibited. As we know how to find both the tubercle bacilli and their poisonous products in the milk, this is no impossibility.

I also call attention to the work of Dr. Ernst, of Boston, just published, and carried out under the auspices of the Massachusetts Society for the Promotion of Agriculture. A large number of statements have been collected from authorities in the State, and there have been made large numbers of bacteriological milk analyses, which all led to the conclusion that

First—Milk from cows affected by tuberculosis in any part of the body may contain the bacilli.

Second—There must not necessarily be a lesion of the udder before the milk can be contaminated.

Thus, the udder may be perfectly healthy, and yet the milk drawn therefrom may contain the bacillus of tuberculosis. In an article recently published, Dr. Roth, of Switzerland, calls attention to the same, and further proves that the tubercle bacilli may be transferred from the milk into the butter prepared therefrom. In two out of twenty samples of butter from the market he found the bacilli; likewise in milk. When the tuberculous butter was inoculated into the abdominal cavity of guinea pigs, the latter very soon died from violent attacks of tuberculosis. Thus it seems that the ripening, churning and salting of the butter did not impair the life, activity and faculty of propagation in the bacteria.

Considering butter as one of the most common and necessary household articles, the transmission of tuberculosis *hac via* is quite alarming, and

these facts are especially interesting in view of the close inspection of cattle in Switzerland, and of the good hygienic surroundings generally reserved for the cattle, namely, the pastures in the mountains and the excellent barns.

It appears as if the numerous cases of consumption in the human being —infants as well as adults—can now be far better accounted for than before. We err very little when surmising that a quite considerable number of cases occur as results of tuberculous milk, butter and cheese.

All innovations are met with opposition and with the suspicious eye of the public. In order to suppress some opposition, and to ascertain to some extent the distribution of the disease throughout the different domains, the boards of some of the eastern States have worked quietly, for about a year, and obtained facts in regard to contamination of dairy products and of dairy herds. Afterward, they have laid such facts before the respective legislatures and recommended measures for the eradication of the disease in cattle.

This Board having adopted a similar plan, I have seen fit to make a proposition to the State Dairy Commissioner to the effect that I volunteered to test every sample of milk received and tested by the Dairy Commissioner for the tubercle bacillus. The facts obtained by those means should be used by our committee. The Dairy Commissioner receiving about twenty-five samples of milk every month, we shall hereafter be prepared to meet inquiries regarding the contamination of milk.

I am also contemplating to collect samples of butter and cheese, and to test them similarly. Hitherto I have examined only a few samples of milk from the Dairy Commissioner's office.

I hardly need emphasize the necessity of a good and reliable milk inspection, especially in the large cities and towns. But it should be said, in connection with emphasizing this need, that the present system of inspection is by no means ideal.

It has been recognized long since, and repeated several times in this country by Geo. W. Rafter and others, that an exclusively chemical analysis of water suspected of contamination is sufficient. A hygienic water analysis comprises both chemical and biological examination of the water. A microscopical survey of an average sample is by no means sufficient beside the chemical analysis, for there is something more to be considered in bacteriological work beside the microscopical studies. Still, there are water analyses made every day, and condemnations of Iowa wells declared while a bacteriological study of the water has not been at all attempted. This is certainly the reverse of the ideal.

We may speak similarly of the milk inspection as practiced in Iowa to-day. Chapter 50, Laws of the Twenty-fourth General Assembly, says: No *unclean, impure, unhealthy, adulterated, unwholesome or skimmed milk shall be sold.* Chapter 47, of the said assembly, provides that the Dairy Commissioner use the Babcock test in order to ascertain that the samples forwarded to his office are not unclean, impure, *unhealthy*, etc.

It is a fact, however, that the Babcock test can furnish no evidence as to the unhealthiness of the milk; consequently it is, with all its merits, insufficient for the purpose aimed at by the law. Truly, one supply of tuberculous milk is a greater menace to public health than fifty samples failing to reach the standard of butter fat.

Mr. Bay presented a paper on "Hospitals for the Treatment of Tuberculosis in Man," which is given in another part of this report.

The following were elected officers for the ensuing year:
President, E. A. Guilbert, A. M., M. D., LL. D., Dubuque.
Secretary, J. F. Kennedy, M. D.

Mr. J. Christian Bay was re-elected bacteriologist, and Mr. L. F. Andrews re-elected.

Dr. J. F. Kennedy was re-elected editor of the IOWA HEALTH BULLETIN.

The time of holding the meetings was changed to the first *Thursday* of February, May, August and November, annually.

President Guilbert announced the following standing committees for 1895-96:

Auditing—Dickinson, Shrader, Scroggs.
Animals—Stalker, Becker, Carter.
Contagious Diseases—Emmert, Becker, Secretary.
Corpses—Scroggs, Conniff, Secretary.
Food and Water—Carter, Emmert, Dickinson.
Kerosene—Secretary, Shrader, Becker.
Legislation—The Board.
Library—Conniff, Carter, Secretary.
Plumbing—Dickinson, Carter, Conniff.
Publications and Papers—Secretary, Shrader, Emmert.
Rules and Regulations—Attorney-General, Stalker, Secretary.
Schools—Shrader, Becker, Carter.
Ventilation—Conniff, Stalker, Dickinson.

SMALL POX.

OUTBREAKS IN IOWA IN THE YEARS 1894-95.

During the biennial period there was an invasion of small pox in several parts of the State, and with two or three exceptions, under the vigorous and prompt action of local boards the disease was confined to the original case, or to the family wherein it originally occurred.

AT MARION.

On the 9th of January, 1894, a case was reported from Marion in Linn county, in the person of a young man employed in the freight depot of the Chicago, Milwaukee & St. Paul railway. The source of infection was traced to infected freight belonging to foreign immigrants in transit over the road, which he had been handling. It was of mild form and recovery was had. General vaccination was had of all exposed persons, and there were no more cases. The patient had no knowledge of pre-vaccination.

AT COUNCIL BLUFFS.

About the 20th of January, 1894, a man returned from Chicago to his home, which was in a building in Council Bluffs in which there were several families. The following week he became sick and the case was diagnosed as small pox. The inmates of the building, twenty-five persons, were immediately vaccinated and rigidly quarantined. Of these sixteen developed small pox, of whom three died.

AT NEW HAMPTON.

On the 22d of January, 1894, a case of small pox was discovered at New Hampton, in Chickasaw county, in the pustular stage, in a man who had come from Chicago, where he had been stopping at a boarding house, wherein had been several cases of small pox, with unrestricted intercourse of friends and relatives. There was extensive exposure before the true nature of the disease was known. General vaccination was practiced,

especially of those immediately known to have been exposed. The premises were quarantined. Owing to the advanced stage of the disease before discovered the incubation period of vaccination was too long for protection; but fortunately it did protect the wife and three others. There were five deaths, the original case; a babe twenty days old; the wife's mother, who refused to be vaccinated; and two others. There were twelve pre-vaccinated persons directly exposed, including the attending physician. They were promptly re-vaccinated, and though none responded to the re-vaccination all escaped the disease. There were about one hundred and fifty suspected exposures in which vaccination was had. The seven cases were in four different houses, four where the disease first appeared, one in a daughter's home, one in the home of a neighbor who had visited the first house before the disease was known for about three minutes, and one in the home of another neighbor.

AT FORT MADISON.

February 5, 1894, a bridge carpenter on the Atchison, Topeka & Santa Fe railroad, who had been at work on the road between Joliet and Streator, arrived at Fort Madison, having small pox well developed. He was at once removed to the hospital where he died. His family and eight other persons were vaccinated and quarantined. No other cases appearing quarantine was released February 28th.

On the 9th of May, 1894, a railroad switchman came from Chicago and stopped at a hotel and soon after his arrival symptoms of small pox appeared. He was removed to the pest house with the bed and bedding used by him at the hotel. All persons exposed were vaccinated. He made a good recovery and was released in thirty days. No other case occurred.

AT KEOKUK.

February 6, 1894, a stranger arrived at Keokuk, as he said, direct from Des Moines. He was sick and was taken to the hospital, where the following day small pox developed, and he was removed to the pest house and recovered. Vaccination of all exposed persons was had and no other cases appeared.

AT CARSON.

April 24, 1894, a case of confluent small pox was discovered at Carson, in Pottawattamie county. The patient was a woman eighteen years old. There were eight persons in the family.

The house was favorably situated for isolation, being one-half mile distant from the town center. Three members had been previously vaccinated and five not. The latter were immediately vaccinated and as the result they had varioloid instead of the severe form of the disease. There was no further spread of the disease and all recovered.

IN TAMA COUNTY.

February 23, a peregrinating, impecunious telegraph operator drifted into Belle Plaine during the evening from a Chicago & Northwestern train. He was sick and reported in person to the mayor, suggesting that he might have been exposed to small pox in Chicago. The mayor sent him out to find the city marshal, but failing in his search he took the cars and went to Chelsea, and thence on foot he went to Tama, where he took lodgings at a hotel. The following morning he was taken to the city lock-up and a physician called, who diagnosed a typical case of varioloid. On one arm was a well defined cicatrix of vaccination had thirty years previous, and which had not been repeated. He was at once quarantined, and all places where he had been disinfected. On the 7th of March he had become convalescent and was released. There were no further cases.

AT SALT CREEK TOWNSHIP.

March 10, 1894, a tramp came to a farm house in Salt Creek township, Benton county, bringing small pox with him. The family consisted of the mother and five children. Two had been previously vaccinated, but all were vaccinated on discovery of the nature of the disease, except two adult daughters who refused to be vaccinated, claiming that they had been vaccinated when little children. These two persons died from confluent small pox, as did also the tramp. Those who were vaccinated after exposure had varioloid, or modified small pox, and recovered, and April 10th quarantine was removed.

AT MARENGO.

April 9, 1894, several tramps were arrested at Marengo, in Iowa county. A few days after one of them became sick. The health officer was called to investigate the case and pronounced it small pox in the eruptive stage. A room in an isolated location was prepared, to which the patient was removed three days after. The six prisoners confined with him were on the day of

the removal of the patient, vaccinated, the bedding and the clothing of the inmates burned, and the cells thoroughly disinfected. The health officer and attending physician, who were susceptible to varioloid, were also vaccinated. None of the six inmates had been previously vaccinated, yet neither they, nor the two physicians, nor jailor and his family, who were also vaccinated, manifested any sign of the disease. The patient died on the fourteenth day, of confluent small pox. There were no other cases.

The history of this outbreak affords the most conclusive and irrefutable evidence of the protection of vaccination against small pox of any reported. There were six unvaccinated persons confined in the narrow limits of a jail cell, with a person in the eruptive stage of small pox for six days. They were not vaccinated until six days after exposure. Two physicians were re-vaccinated. The jailor, also directly exposed, was vaccinated, and not one of these nine persons had a sign of the disease. It may be presumed the vaccination was thoroughly made, and with fresh, reliable virus.

IN PLATTEVILLE TOWNSHIP.

In Platteville township, Mills county, embracing the town of Pacific Junction, Pacific City, and Bethlehem, in April, May, and June, 1894, occurred the most serious and extensive outbreak of small pox known in this State.

About the 1st of April a tramp butcher arrived at Pacific Junction from Chicago, and was employed by a local butcher to assist in his shop. He boarded with the butcher's family. Several days after he was taken sick, but attended to his duties, going and coming at will—a walking pestilence. Soon after members of the butcher's family and others were taken sick, and the disease was diagnosed as chicken pox by some physicians, while others treated it as typhoid fever. Meanwhile, the exposures were multiplying rapidly. The tramp had been an indeterminate source of infection, while the mistaken physicians had carried it from house to house, until there were fully one hundred exposures before the true nature of the disease was clearly determined. The seed of infection already sown quickly germinated, and the infection was widespread, embracing three villages and several farm residences. Isolation of the sick, quarantine, and general vaccination was had, but so firmly seated had become the infection it was not until August

that the disease was fully eradicated. The reports of the local officers are destitute of details sufficient to give the vaccination history, but sufficient is known to demonstrate that vaccination protects against small pox. The importance of re-vaccination was shown in one case where a person had been vaccinated at the ages of four and nineteen years. He had small pox in modified form, and recovered. Five persons who had not been vaccinated at all recovered. Of the total number of cases, twenty-three were modified by vaccination after exposure. Of the nine fatal cases, none had been previously vaccinated. The tramp had been exposed, in Chicago, and subsequently vaccinated, which resulted in varioloid, or modified small pox, not necessitating his going to bed.

AT CLINTON.

On or about the 5th of April a brakeman on a railroad running from Chicago was taken sick at Clinton. The diagnosis by the physicians was small pox. As he had been making his trips regularly on the road, many persons were exposed. All exposed persons were immediately vaccinated, and the home of the brakeman was quarantined. There were four cases caused by exposure to the brakeman, one fatal. Three were modified by previous vaccination and one by subsequent vaccination.

On the 4th of April a young man came to Clinton, was taken sick, and the disease was pronounced small pox. He was taken to the pest house, where he died a few days after. There were six cases in this outbreak, two being fatal.

AT DUBUQUE.

May 16, a resident of Chicago arrived at Dubuque in search of work. He became sick, which was pronounced small pox, and was removed to the pest house, where he died on the 21st. There were no further cases.

AT TAYLOR TOWNSHIP, BENTON COUNTY.

About the 15th of June, a stock dealer in Taylor township, Benton county, went to Chicago with cattle. Soon after his return he was taken sick, and on the 22d the disease was pronounced small pox. He was quarantined, together with two other very aged persons, who had been previously vaccinated and were re-vaccinated. The disease progressed to convalescence and quarantine was released on the forty-third day. The

two old people developed mild symptoms of varioloid three days after vaccination.

AT JEFFERSON TOWNSHIP, POWESHIEK COUNTY.

June 12, 1894, a young man from Cleveland, Ohio, came to visit relatives in Jefferson township, Poweshiek county, and was soon after taken sick with confluent small pox. The family was at once quarantined, and exposed persons vaccinated. The patient recovered, and there were no more cases. He claimed to have been vaccinated sixteen years before.

AT MOUNT PLEASANT.

June 21, 1894, varioloid was discovered in the jail at Mount Pleasant, Henry county, the patient being one of two inmates of a cell. One was immediately vaccinated and both were removed to the pest house, from which they escaped a few days after. Fortunately the prompt vaccination of one and the speedy convalescence of the other prevented any further spread of the disease. Both were recaptured in another city and returned to the pest house.

AT TABOR.

September 5, 1894, a man returned to Tabor, in Fremont county, from Chicago, where he had been on business, and soon after was taken sick with what was pronounced German measles, but which finally proved to be varioloid. There were two cases of varioloid and one of small pox in his family. There were a large number of exposures and the disease spread to several other families before it was got under control. There were two cases of small pox and eight cases of varioloid, one of the latter, a young child, resulting fatally.

During the period of invasion a young man came from Pine Bluff, Nebraska, to work in a brickyard, and immediately was taken sick with varioloid. The indications were that he brought the infection with him. No details regarding vaccination during the outbreak have been reported. January 8, 1895, the disease was reported as having subsided.

AT REMSEN.

November 16, 1894, a case of small pox was reported at Remsen, in Plymouth county. The patient had been in Chicago a short time previous. Quarantine and general vaccination was

had. Two other cases developed in the family and all recovered, and about the 15th of January the quarantine was released.

AT SPERRY.

November 30, 1894, small pox was reported at Sperry, in Des Moines county, in the family of a man who had returned from Chicago a short time previous. There were four persons in the family, two of whom had been previously vaccinated. The three others than the patient were immediately vaccinated. Those who had been previously vaccinated manifested no sign of the disease. Those vaccinated after exposure had modified small pox and recovered. The original case terminated fatally in fourteen days. February 19th following, the disease had subsided.

AT PIONEER.

About January 15, 1895, small pox was reported in a family of seven persons, parents and five children, at Pioneer, in Humboldt county. The father had been to Chicago with a lot of cattle. The mother and three children had been previously vaccinated, but were re-vaccinated. These gave no sign of the disease. A boy vaccinated after exposure had varioloid. Members of a neighboring family, who were exposed to the original case, five persons, were immediately vaccinated and quarantined.

The nurse afforded a peculiar case, if his history, as given by himself, is reliable. He had small pox when he was eighteen months old, in St. Joseph, Mo. Five years later he was vaccinated, and it "worked." He was re-vaccinated in 1890, and it "worked" again. On entering upon his duties as nurse, on this occasion, he was again re-vaccinated, and it produced the characteristic vaccinia symptoms, and a typical cicatrix.

A babe eighteen months old died. There was no further spread of the disease.

AT MUSCATINE.

February 16, 1895, a tramp from Chicago arrived at Muscatine. Being unwell he applied to a physician, who at once diagnosed small pox. He was promptly removed to the quar antine cottage, where he soon after became convalescent and was released.

AT BEDFORD.

Early in March, 1895, a young woman, whose home is in Bedford, Taylor county, visited friends at Maryville, Missouri, where she was exposed to small pox. She was vaccinated at once and returned home, where she had varioloid and soon recovered. Six members of the family were vaccinated immediately, and there were no further cases.

AT DAVENPORT.

About the 1st of May a woman returned to Davenport from Chicago, where she had nursed a son sick with small pox. She was taken down with small pox, and was reported at once to the health officer, whereupon she, her husband and one son were taken to the hospital, where they remained until discharged.

SMALL POX IN IOWA DURING THE YEARS 1894 AND 1895.

LOCALITY.	1894.	1895.	Variola.	Varioloid.	Vaccinated.	Unvaccinated.	Vaccinated after exposure.	Died.	Recovered.	Number of cases.	Houses infected.	Source of infection.	Duration of invasion —days.
Marion, Linn County	January 9		1	....	....	1	....	....	1	1	....	Immigrant freight	20
Council Bluffs, Pottawattamie County	January 20		1	15	....	15	25	3	13	16	3	Chicago	80
New Hampton, Franklin County	January 22		7	....	7	7	4	5	2	7	4	Chicago	40
Fort Madison, Lee County	February 5		1	1	....	1	....	1	....	1	1	Chicago	27
Keokuk, Lee County	February 1		1	....	....	....	....	....	1	1	....	*	....
Tama, Tama County	February 23		....	1	1	....	....	....	1	1	*	Chicago	20
Salt Creek Township, Benton County	March 10		4	2	2	3	5	3	3	6	1	Chicago tramp	40
Platteville Township, Mills County	April 1		26	11	3	8	26	9	28	37	9	Chicago	120
Clinton, Clinton County	April 5		5	1	3	2	1	2	4	6	1	Chicago	30
Marengo, Iowa County	April 9		1	....	2	6	9	1	....	1	2	Chicago tramp	17
Carson, Pottawattamie County	April 24		1	5	3	1	5	....	6	6	1	*	40
Fort Madison, Lee County	May 9		1	....	....	1	12	....	1	1	1	Chicago	30
Jefferson Township, Poweshiek County	June 12		1	....	1	....	....	....	1	1	1	Chicago	....
Taylor Township, Benton County	May 16		1	3	2	1	3	1	3	4	1	Chicago	43
Dubuque, Dubuque County	May 16		1	....	*	*	*	1	....	1	*	Chicago	*
Mt. Pleasant, Henry County	June 21		....	1	*	....	1	....	1	1	1	Hannibal, Mo.	30
Tabor, Fremont County	September 5		2	8	*	*	*	1	9	10	5	Chicago and Neb'ka	120
Remsen, Plymouth County	November 16		1	2	*	*	*	....	3	3	1	Chicago	90
Sperry, Des Moines County	November 30		1	2	2	1	2	1	2	3	1	Chicago	120
Pioneer, Humboldt County		January 15	3	4	6	1	4	1	6	7	*	Chicago	*
Muscatine, Muscatine County		February 16	1	....	*	*	*	....	1	1	1	Chicago tramp	*
Bedford, Taylor County		March 19	....	1	*	*	1	....	1	1	1	Maryville, Mo.	40
Davenport, Scott County		May 1	1	....	*	*	....	....	1	1	1	Chicago	*
Total			61	56	32	48	98	29	88	117	36		

*Unknown.
NOTE.—This table is as correct as possible to compile from imperfect returns made to the board.

The history of this outbreak demonstrates conclusively the the prophylaxis of vaccination. Of the deaths, all were of those unprotected by pre-vaccination. Of the ninety-eight persons vaccinated after direct exposure fifty-six had the disease in mild form, except two young babes, who died, while of the thirty-four post-vaccinated, all escaped.

It further shows that more than one-half the population are without the benefit of this protection. Considering the constant menace to them from epidemics in large cities, vagrants and tramps, foreign immigrants, the rapid means of transit, the constant shifting about of the unemployed, outbreaks of the disease are liable to occur simultaneously in different parts of the State, and an epidemic started difficult to suppress.

The practical experience of nearly a century has demonstrated that small pox is within the control of man absolutely; that wherever compulsory vaccination is enforced small pox gets no place; that the mortality of non-vaccinated persons is nearly fifty-one per cent, while in post-vaccinated persons it is about four per cent, depending almost entirely upon the lapse of time of vaccination preceding the exposure.

The opposition to vaccination is founded on ignorance and prejudice. During the recent epidemic in Chicago, of over one million vaccinations, but two deaths could possibly be ascribed to vaccination. Medical experience, the world over, has proven that when vaccination is properly done, with pure vaccine lymph, there is positively no danger of death, serious sickness nor hurtful consequences, either in its operation, complications or sequalæ.

In a State like Iowa, with a comparatively sparse or segregated population, and few large cities, compulsory vaccination would be expensive and difficult to enforce, but there can be made the requirement, by legislative enactment, that no pupil or teacher shall enter the public or private school without furnishing proof of successful vaccination. The statutes already provide that the expenses of this disease shall, in certain cases, and they are the majority, be paid out of the public funds. It is, therefore, only equitable and just that the public shall be protected so far as possible against this disease, and that it should be prevented. With vaccination compulsorily applied to the schools, in a few years almost complete immunity would be secured.

INVESTIGATIONS CONCERNING THE ETIOLOGY OF SMALL POX.[1]*

[With Plate I.]

The etiology of small pox is one of the most interesting problems in bacteriology, and has been the subject of considerable investigation for thirty years and more. A brief historical sketch, illustrating what has hitherto been done in this line should, naturally, precede this preliminary record of my own work, the progress of which may be traced in the Iowa Health Bulletin, published by the State Board of Health of Iowa, under whose authority these investigations were carried out during the past year.

Numerous writers have investigated the small pox and vaccine lymph, and some have recognized specific micro-organisms, both animal and vegetable, as the primary cause of the disease, or of the specific eruptions.

One of the micro-organisms heretofore more or less generally recognized as the effective agent is the *Micrococcus vaccinæ* and *variolæ;* Bareggi who, among others, studied these, states[2] that the micro-organisms of small pox and those of vaccine are identical.[3]

In 1868, Chauveau[4] proved that vaccine virus is deprived of its active substance by filtration. Hence, it became more than probable that the contagion was a living organism, and no gaseous or diffusible product. "For when he carefully poured a stratum of water upon a layer of lymph, in tiny tubes, he obtained a diffusion of the dissolved material into the water, but this clear solution could not produce pustules like the insoluble residue."

In the same year, Hallier[5] described micrococci "of a singular appearance from human small pox, cow pox and vaccine eruptions, the diameter of these bacteria being $\frac{1}{25000}$''' $\frac{1}{15000}$''': they exhibited motion except when covering the lymph-particles.

Previous to this, G. Simon[6] found, in human small pox, round particles which were insoluble in acetic acid. Salisbury[7] also

* By J. Christian Bay, Bacteriologist of the State Board of Health, in "The American Naturalist," August, 1895.

[1] Published in abstracted form in the "Medical News," January 26, 1895. Presented to the Iowa State Board of Health, February, 1895, and read before the Des Moines Academy of Sciences.

[2] Sui microbi specifici del vajuolo, del vaccino e del varicella. Gaz. med. Ital-Lomb. Milano (5) VI. 489, 506, 519, 529, 545; with plate.

[3] Confer Crookshank, Manual, p. 209; Klein, Micro-Organisms and Disease, pp. 79-80.

[4] Comptes Reindus LXVI, 289, 317, 1868.

[5] Aerztl. Intelligenzbl. XV, 75; Virchow's Archiv. XLII, 309, 1868.

[6] Muller's Archiv., 1846, 185.

[7] Schmidt's Jahrbuecher, 1871.

claimed to have demonstrated a specific small pox organism which he named *Jos variolosa;* it was described as quite polymorphous; its alga-stage was seen in cow pox eruptions; "fructification" was reached in small pox eruptions.

Luginbuehl[8] discovered, in sections cleared with acetic acid, micrococci which formed colonies at certain places in the skin, near the epidermis, in cases of small pox eruptions. Beale[9] found "vast multitudes of minute particles of living matter or bioplasm" in the small pox vesicles, but he did not attribute to these the name of *causa morbi.*

Cohn[10] showed the presence of minute cocci in vaccinia and small pox lymph; when the lymph is fresh, the cocci were moving freely, propagated themselves by division, and, after 16–32 hours of cultivation, aggregated in masses, afterward in films, the formation, of which seemed to be the terminal phase of their life history.[11] Cohn named this organism *Microspharia vaccinæ,* which was a specific coccus and no representative of some stage of development of some other organism. The name was later changed into *Micrococcus vaccinæ,* which Cohn, in his system of bacteriology, described in the following way[12]: "Cells bell-shaped, 0.5–0.75 μ. in diameter, or united two and two or more in chains and masses, also forming a zoogloea, in fresh lymph from cow pox and small pox as well as in the pustules in confluent variola."

Weigert, a short time before Cohn, found[13] "vessel-shaped, irregular, often ramified formations of 0.1–0.2 mm. in diameter, with granulated, well marked contents which were not affected by the acetic acid, sodium and glycerin. He interpreted these formations as lymphatics filled with bacteria. They were found in the neighborhood of small pox pustules, and at their edges, where also hæmorrhagical herds, and arteries with the same contents were observed. Cohn declared that Weigert's granules were identical with his *Microsphæria.*

Thus it was beyond doubt that vaccinia, cow pox and variola were caused by attacks of bacteria. Burdon-Sanderson also confirmed this view. The history of the cases also show

[8] Verhandl. d. phys. med Ges. in Wurzb. IV, 99, 114; 1853, w. pl.

[9] Disease-germs, their nat. and orig., 1872, 148; pl. XVIII, fig. 84.

[10] Virchow's Archiv. LV. 229-2 8, 1872.

[11] The same aggregations had been observed by Keber.

[12] Beitr zur Biol. d. Pflanzen, vol. I, part II, 161.

[13] Ueber Bakterien in der Pockenhaut. Centralbl. f. d. med. Wiss. IX, 606-611, 1871. Ueber pockenaehnl. Eruptionen in innern Organen. Deutsche Zeitschrift f. prakt Med. I, 367-369, 1874. Anatom. Beitr. z. Lehre von den Pocken, part I, 1874.

that the disease is caused not only by a *contagium fixum*, but also by a *contagium halituosum*.

Weigert's observations concerning the lymphatics were repeated and confirmed by Klein.[14]

Klebs[15] set forth the statement that the organism (micrococci) in vaccinia and variola exhibits peculiar physiological and morphological properties. The cells are placed four and four together and assume, ontogenetically, no other shape than that of the coccus. The size of the cell diameter was 0.5 *p*. This organism received the name *Micrococus quadrigeminus*. The literature on hand does not elucidate whether this bacterium had, by virtue of its characteristics, any diagnostic value.[16]

In 1883, C. Quist found that vaccine lymph could be artificially propagated in various nutritive media,[17] but such a dilution of the lymph had nothing to do with the bacteria, so far as these experiments went. It is indisputable that Quist propagated the vaccine *virus* along with the dilution of the lymph; the preservation of the virus in glycerin and other media, as done by practitioners, is, therefore, in spite of Pfeiffer's views, no simplification of Quist's method, inasmuch as propagation and preservation of efficacy (life activity) are not absolutely identical. Small pox is unquestionably a bacterial disease, and we know that bacteria can live without propagating themselves; the ultimum temperature of propagation is lower than that of life, in both directions from zero.

Pfeiffer[18] found, in 1885, a sprouting fungus which he named *Saccharomyces* seu *Cryptokokkus vaccinæ vaccarum*. This fungus is not very much different from the so-called *Saccharomyces apiculatus*, and is no *Saccharomyces*.[19] It belongs to the group *Torula* in the sense of Pasteur and Hansen. In small pox lymph I have occasionally met a *Torula* which corresponds to Hansen's fifth species.[20] Pfeiffer's fungus did not bear endospores, and has no causal relation to small pox. This *Torula*, as well as the saprophytic bacteria and the animalculæ which

[14] Phil. Trans. Lond., 1871; Micro-Organism and disease, 1886, 69.

[15] Arch. f. experiment. Pathol. und Pharm. X, 222, 1879.

[16] Conf. Loeffler, Vories. ueb. d. gesch. Entwickelung der Lehre von den Bakterien I, 132, 1887.

[17] Finska lak. sallsk. handlingar XXV, 271, 1883. XXV, 341, 1883. Berl. klin. Wochenschr., 1883, 811-813. Hygiea (Stockholm) XLVI, 194, 203, 1884. See also Medical News.

[18] Correspondenzblatt d. allgem. aertzl. Vereins von Thuringen., 1885. No. 3. Sep. 12 pp.

[19] See my paper in THE AMERICAN NATURALIST, XXVII, 685-696, 1893.

[20] See Jœrgensen, Micro-Organisms and Fermentation, 1893, p. 190; and Bay. Amer. Monthly Microscop. Journal, XV, 42; 1894.

Pfeiffer reported from pustules, will appear in many other eruptions and ulcerations. It appears that some of Pfeiffer's drawings,[21] as well as Beale's "bioplasts" (loc. cit.) indicate serious misrepresentations of the microscopic pictures.

L. Voigt described, in 1885,[22] three different forms of cocci from small pox pustules. All of them would liquify gelatine, and one of them was considered the probable carrier of the contagion. No definite results were, however, obtained. There were two cocci, and a diplococcus.

Pohl-Pincus also studied the micrococci found in specific eruptions, and showed their passage through the epidermis of a calf after inoculation.[23]

Hlava,[24] Bowen and Garré have succeeded in isolating a streptococcus (*Streptococcus pyogenes*). They considered the united attack by these pyogenic cocci the cause of the disease. Koch and Feiler were, however, of the opinion that although some of the saphrophytic micro-organisms found in vaccine lymph are pathogenic, they do not carry the contagion.

Protopopoff[25] succeeded in finding a streptococcus which corresponds, both macro- and microscopically, to the descriptions of the *Streptococcus pyogenes*. Samples from pure cultures were injected in rabbits, dogs and cats, but without effect. Although this does not imply that this organism cannot affect man, it seems improbable that it could have any causal relation to variola.

Crookshank[26] and Copeman[27] found, in vaccine lymph, great numbers of common saphrophytic and of some pathogenic bacteria, but no specific organism.

Rille[28] observed cocci in the vesicles and blood of persons suffering from varicella, but did not apply himself to bacteriological studies of these organisms.

Probably Sternberg was right in stating[29] that the etiology of small pox is still undetermined. Still, some of the investigations above cited furnish very interesting points which are of value to those who wish to reinvestigate the matter.

[21] Correspondenzblatt d. allg. aerztl. Vereins von Thueringen, 1887, No. 2, Sep. 12 pp. 2 plates. Monatshefte f. prakt. Dermatologie, VI, 1887, No. 10. Sep. 13 pp. 2 pl. Die Protozoen als Krankheitserreger. Jena, 1890.

[22] Deutsche med. Wochenschrift, XI, 895-897, 1885.

[23] Pohl-Pincus, Untersuch. ueb. d. Wirkungsweise der Vaccination, 1882.

[24] Sbornik Lekarsky, II, 96-105, 1887. Cblt. f. Bakt. II, 688, 1877.

[25] Zeitschrift fur Heilkunde XI, part 2, 1890. Sep. 7 pp.

[26] Transact. Seventh Internat. Congr. of Hyg. and Demogr. II, 326, 1892.

[27] *Ibidem*, 319-326.

[28] Wiener klinische Wochenschrift, No. 38-39, 1889.

[29] Manual of Bacteriology, 1892, 528-529.

Micrococci of different shape and characters are, however, not the only bacteria which have been observed in small pox and vaccinia. A few statements point toward the presence of other bacteria, namely, bacilli. Crookshank (loc. cit.) mentions that he has found *Bacillus pyocyaneus*, *B. subtilis*, different *Bacterium*-forms (one yellow), and a bacillus resembling *Bacillus subtilis*. Martin[30] has described a bacillus of vaccine lymph. The ends of this bacillus are round or square, and it may form micrococci (!) which are arranged in chains of five or six cells. The author admits the possibility that both a bacillus and a micrococcus were present.

Coze, Feltz and Baudoin[31] have demonstrated the presence of bacilli in the blood of variola; upon the injection of this blood into the veins of a rabbit, the typical symptoms of variola were produced.

In sheep pox lymph examined by *Zimmermann*[32] three bacilli were found, one of which had almost the same appearance as *Bacillus amylobacter*. A second investigation showed the presence of a short-limbed bacillus; *Micrococcus vaccinæ* (or *variolæ*) occurred in both series of investigations. All of Plaut's plates demonstrate bacilli which he was able to cultivate.

Toussaint's studies, which also resulted in a discovery of bacilli, are mentioned by Plaut (loc. cit.)

In April, 1894, vaccine "points" were procured from Dr. Hewitt's vaccine station at Red Wing, Minn. A watery dilution of the lymph adhering to the "point" contained, when examined by one thousand one hundred and sixty diam. m. (Bausch and Lomb, Oc C_3, Obj. $\frac{1}{12}$ oil imm.) a few amorphous bodies which assume a yellow color with IIKa, a few round bodies and irregular masses (probably nuclei or fragments of cells), dispersed in a clear fluid. I could distinguish no micrococci or other bacteria, and no staining revealed any living organisms. Some of the round bodies observed in ten different examinations may have been spores or micrococci, but their nature was not revealed by the microscope.

A series of plate cultures upon "Pasteur gelatine"[33] was then arranged, but there occurred no development. These plates were prepared from ten parts of gelatine to ninety parts of Pasteur's fluid. So, test-tube cultures in Pasteur's fluid alone, and

[30] Boston Med. and Surg. Journal, CXXIX, 589, 1893.
[31] *Fide* Magnin-Sternberg, Bacteria, 1884; 410, 464.
[32] Plaut, Das organisirte Contagium der Schafpocken, 1882; 22.
[33] See Salomonsen, Bacteriological Technology, pp. 460 and 464.

in bouillon (beef; one pound of meat to one liter of water) rendered alkaline by Cl Na. were made. The points were grasped with a forceps, passed through a flame, and dropped into the medium which had been, previously, submitted to a very thorough fractional sterilization, as by the usual preparation of medium supplies. Great care was exerted in order that no infection from without should take place.

By a temperature of 24°C. the culture fluid would, on the next day after inoculation, become slightly turbid; on the second day the turbidity increased, a thin film being formed on the surface, and on the third day a grayish, highly tenacious film made its appearance. Microscopic investigation showed the presence of *bacilli* The latter are colorless; they exhibit no motion, are devoid of cilia; their long diameter measures 0.6–1.0 μ. and the short diameter .2–.3 μ. During the first and second days, they seem to develop in colonies of 20–200 cells, although, under the cover, many cells appear to be free and isolated.

The zoogloea (surface film) has, to a great extent, the same appearance as the film-growth of the yeast-like *Mycoderma*, being folded, and of a greasy appearance. It is so tenacious that it resists the weight of the column of the culture medium which was observed as one of the cultures chanced to be inverted. Its connection with the culture vessel is quite intimate. On the fourth days, fragments of the zoogloea began to descend to the bottom, and the microscopic appearance of the culture remained, after this, unaltered for three weeks and more. During this period, however, the microscopic appearance of the bacillus was gradually much modified.

This organism was found, with three exceptions, in sixty-five cultures from vaccine points hitherto made. Buttersack, whose recent investigations will be mentioned in due time, ventures the supposition that the specific organism of vaccine was not hitherto detected, because of its index of refraction being identical with that of the medium (lymph). I see no reason for this supposition, and I am prepared to explain Buttersack's theory from my own observations.

This bacillus has, to a great extent, the same appearance as those found by Plaut[34] and Zimmermann in sheep pox.

Already at the beginning of the development, while the medium is well stored with nutrition, *the bacilli* bear spores. This being the most conspicuous feature of the organism, I

[34] Loc. cit. Beilage I-IV b; especially II a.

named it *Dispora variolæ*. The systematic side of the description is as follows:

Genus: DISPORA.

Dispora: Kern, 1882.

Kern (Botanische Zeitung, 1882, No. 16) founded this genus upon one species which was found in kephir, and which was characteristic mainly by having two spores in each cell. The genus belonged to the bacillus group. Kern's *D. caucasica* has not been rediscovered by later students of the kephir-organisms (Beyerinck, M. Ward, Mix), and the genus-name vanished into *Bacillus* (Crookshank, Manual, 312).

Dispora variolæ nov. sp.

Syn. The spore stage was described under the following names: *Microsphæria vaccinæ* Cohn, *Micrococcus vaccinæ* and *variolæ* Cohn, *Jos variolosa* Salisbury.

Habitat: In vaccine and small pox lymph constant. Descr. Bacilli 0.6–0.1μ by 0.2–0.3μ. Two spores in each cell, one at each end. Aërobic.

On the sixth days of cultivation, *free* spores begin to make their appearance, both in the fluid and in the zoogloea. They are globular, highly refractive, and may be mistaken for what appeared to me, by a little over two thousand d. m., as vacuoles. The latter are, however, larger, and their shape is oval or rectangular.

The same organism was found also in the lymph of variola confluens kindly furnished by the small pox hospital in Chicago. Out of forty bouillon-cultures made from this lymph, only two failed to show the presence of the *Dispora*.

To prove that *Dispora variolæ* was not accidentally caught in the cultures from the atmosphere, gelatine-plates (10% gel., 90% beef-bouillon) were exposed to the air at the tables and windows for different periods of time. Among the numerous organisms thus obtained, none presented the characteristics of the above named bacillus.

When cultures were examined on the eighth day after inoculation, the cells seemed to be crowded together in separate masses, each cell being surrounded by a rather thick layer of a gelatinous mass, free spores being abundant. As the cultures grew older, the cells gradually became more and more lengthened, forming rows, and on the fourteenth and fifteenth days, the culture presented the appearance shown in fig. 4. The cells were lengthened and formed long, thin threads. Spores were abundant, both in the cells and free. The number of cells was now gradually diminished, and, on the thirtieth day, very few were seen, the number of spores being altogether predominating. When traces of this last stage of development were transferred, with the usual precautions, into new medium, development promptly followed, as above described.

The following method of staining gave good results: A small drop of the culture was placed between two covers and slightly pressed between them. The covers being separated in the usual way, were placed, moist side upward, under a bell glass. When some of the fluid had evaporated, the clean side of the covers were placed three times, for a period of about one second, in the immediate neighborhood of a flame. When completely dried in the temperature of the room, the covers were placed in alcohol for two or three minutes, and again dried; then they were floated, film-side down, upon aniline blue or aniline violet for twenty-four hours, washed, dried and mounted in the usual way.

While this organism had the appearance of being a specific bacillus-form, I was not thoroughly convinced thereof until I had made a fractional culture in bouillon which resulted in the development of the one form described. The *Micrococcus vaccinæ* I have never found in vaccine or small pox lymph.

Regarding the polymorphism of this species I can state that I have observed no such swellings at the middle or ends of the long cells in old cultures as Martin (l. c.) noticed in the bacilli found by him, or as Hansen[35] described for acetic bacteria.

From the figures of *Micrococcus vaccinæ* and *variolæ* which I have seen I am inclined to believe that this organism is not specific, but merely free spores of *Dispora variolæ*. I also believe that the facts in regard to the spread of small pox, as well as the observations stated above, point toward the conclusion that the spores are the main source through which the disease itself, as well as vaccinia, are reproduced.

The organisms from small pox and vaccine lymph are morphologically identical. The physiological difference consists mainly in the attenuation of the form found in vaccine lymph, so far as has been hitherto ascertained.

[35] Comp. Rend. Laboratoire de Carlsberg III, 265-327, 1894.

Buttersack[36] published, a short time ago, an account of certain bodies which occurred constantly in vaccine lymph, and which may have some relation to vaccinia. He allowed lymph to dry on covers; having fixed the latter to the slides by means of bees-wax, he inspected the film by immersion and observed a net-work of threads with small, refractive, round bodies. Landmann[37] and Dräer[38] interpreted Buttersack's discovery as threads of fibrin and other albuminates. I would assume that B. had seen the "thread-stage" of the organism found by me. Having not yet seen B's illustrations, this is a mere supposition.

The diagnostic value of my discovery is yet uncertain. I hope to be able to report upon the progress of the work, especially concerning inoculations upon animals and the preparation of vaccine in the laboratory, at some future time, when the work now in progress has reached completion.

Explanation of Plate I.

Fig. 1. $\frac{1000}{1}$. *Dispora variolæ* nov. sp., two days old growth in Pasteur's fluid.

Fig. 2. $\frac{1000}{1}$. Same; four days old. Specimen from surface film.

Fig. 3. ca. $\frac{1500}{1}$. Same; eight days old culture in bouillon. A few spore-bearing cells.

Fig. 4. ca. $\frac{1500}{1}$. Same; eleven days old culture in bouillon. Spore-bearing cells numerous.

Fig. 5. $\frac{1000}{1}$. Same; twenty-five days old bouillon-culture. Some free spores; chains.

Fig. 6. T. $\frac{600}{1}$. Same; one month old bouillon-culture. Cells almost disappeared; free spores in excessive numbers.

[36] Arbeiten a. d. Kais. Gesundheitsamte IX, 96-110, 1894.
[37] Hygienische Rundschau, 1894, 433-34.
[38] Centralblatt f. Bakt. and Parasitenkunde XVI, 561-564, 1894.

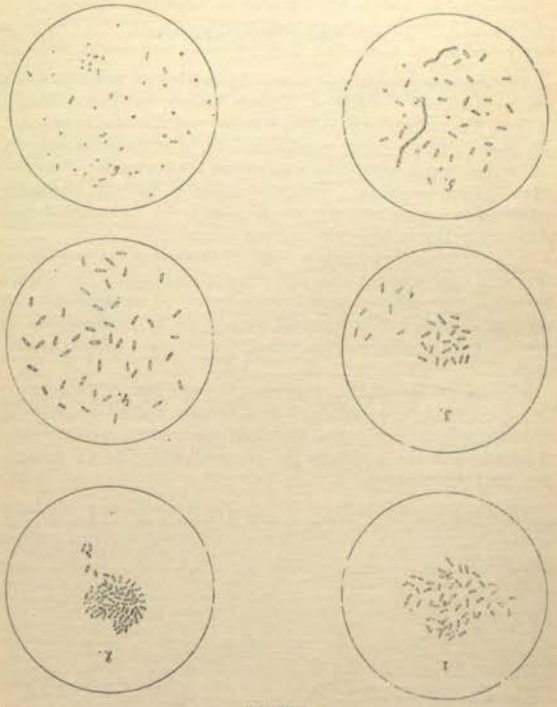

PLATE I.

VACCINATION.

The success of vaccination as a preventive of small pox has has immortalized its founder, William Jenner, and places him in the fore front of the world's benefactors. And yet, strange as it may seem, there are anti-vaccinationists, who, because one in a million has been supposed by vaccination to have contracted some other infectious disease, not only refuse to have the benefits extended to themselves, but would gladly aid in securing and enforcing a law making vaccination a crime.

It is true there are but few such. Yet because many of them are feeble in intellect and powerful in self-esteem, to attract attention, they are noisy and clamorous. An experience with the disease, either by a personal attack, or by its presence in the family, would be a splendid and lasting cure for such nonsense

The following article, reprinted from "Harper's Weekly," Oct. 28, 1893, by consent, is so well written, and so graphically and succinctly describes the benefit of vaccination; the immunity it affords and the necessity for re-vaccination, that it is commended to all persons:

The appointment by the Board of Health of New York of a temporary vaccinating corps of fifteen physicians calls to mind the fact that there exists in this city such an epidemic of small pox as has not visited it before for many years. That fact, however, has excited little comment and no general solicitude, even though small pox is known to be one of the most virulent of contagious diseases For it is also known as the most preventable of diseases, and as one whose terrors are traditional rather than actual. Every one knows, in greater or less detail, the facts of its history. Up to the last decade of the eighteenth century it was a dreaded pest, sweeping the world in never-ending epidemics, claiming by death one-tenth of our race, and disfiguring a large proportion of the remainder. A bit of doggerel that has come down to us bears witness of its power in the assertion that "from small pox and love few men remain free." The companion malady here linked with small pox has in no wise abated, but a pock-marked face is as rare to-day as a smooth one must have been a century ago.

Every one knows, too, that the change has been wrought through the genius of a single man, who, just a century ago, worked out the problem of the antagonism of cow pox and small pox—a belief traditional among the English peasantry for generations before—and added the illuminating thought of voluntary inoculation with the virus of the one in order to prevent the other. The world doubted, and then believed. The people were

ready to listen to anything that could promise to banish the dreadful scourge. In less than a decade after the first inoculation, vaccination had circled the globe, thousands of lives had been saved, and the name of Edward Jenner had been by common accord placed high on the lists of the immortal benefactors of the human race. It is pleasing to recall that before Jenner died all Christendom did him homage. He was even a prophet honored and rewarded in his own country. Great men had opposed him, it is true, but the murmur of opposition was soon drowned in the tumult of approval. Intellectual robbers strove to take to themselves the credit of his discovery, but these were soon confounded and forgotten, while the name of the true discoverer gained fresh lustre day by day. The work he inaugurated has gone steadily on, until the dreaded scourge of small pox has all but relinquished its hold on the race, claiming at most a mere handful of victims. The record of that decline is the grandest chapter in the history of medicine.

And yet if the truth were known it would probably appear that vaccination has not accomplished all that Jenner hoped for it. Seeing his discovery so universally accepted at the outset, seeing it nip epidemics of small pox in the bud, and so vastly reduce the mortality within a few years, he would have been strangely unimaginative had he not dreamed of a day when vaccination should so fully have triumphed as to have banished small pox from the world forever. In theory such a hope found ample warrant. The human body furnishes the only soil, so far as known, on which the germs of this disease can multiply and retain their virulence. Vaccination renders the body no longer habitable for these germs. If, therefore, the entire race could be given immunity through vaccination, time being allowed for the destruction of such unproductive germs as had found temporary lodgment elsewhere than in the body, small pox would cease to exist. Its last germ killed, there is no more reason to suppose that it would ever originate again, than there is to expect the reappearance of the great auk, the mammoth or the glyptodon. In theory such an achievement might require but a month or a year, but in reality a century has not accomplished it.

The chief reason why vaccination has failed of this ultimate ideal achievement is—paradoxical though it sounds—because vaccination has operated so efficiently. So nearly has it banished small pox that no one now fears that disease, and a general carelessness prevails regarding it. No better commentary in this regard than mention of the fact that two physicians recently contracted the disease in New York from a case which came to a dispensary where they were in attendance. If physicians fail to give themselves immunity, what shall we expect of the public at large?

The other chief factor which coöperates with carelessness to keep small pox in existence is ignorance. So little is small pox heard of now that many among the more ignorant classes scarcely know the meaning of vaccination. Health officers find many persons who suppose they are being vaccinated to "cleanse the blood." It does not matter much what they think, perhaps, so long as they submit to the operation. But many decline the boon, and these, of course remain susceptible to the disease. Our laws offer protection to all, but force it upon no one. Abroad, in many places, vaccination is compulsory, a fine being imposed if any child is found unvaccinated at a certain age. The result thus aimed at, is accomplished in this country in a more pleasant way by prohibiting unvaccinated children from attendance upon the public schools. This measure, together with the constant solicitation of health officers, results in the vaccination of a very large proportion of infants.

But vaccination in infancy is not enough. It gives immunity for a time, but with growth the tissues change, and after a few years the body becomes again susceptible. Re-vaccination must be practiced when the child is six or seven years old, again during adolescence. Even this third vaccination does not always give protection throughout life. Immunity should be tested every few years by repeated vaccinations, and only persons who have submitted to this test within a few years past can at any time feel fully assured that they are insusceptible to small pox. Ignorance of this fact is most potent in giving small pox a hold upon the community. Not alone the ignorant, but many people of intelligence suppose that so long as the scar of a

previous vaccination appears they are immune, and with confidence born of this delusional belief, go about the world almost as susceptible to small pox as if they had never been vaccinated. For such persons chiefly the present words, with their obvious moral, are intended.

Some time ago a great epidemic of small pox prevailed at Sheffield, England. One of the medical inspectors of the local government board of England, Dr. Barry, made a very able and elaborate report as a result of his investigation.

Dr. Thresh, an English health officer, compiled a table showing the relative liability of vaccinated and unvaccinated persons to take, and die from small pox during the epidemic of the disease.

Of every 1,000 unvaccinated children (under 10).....101 had small pox.
Of every 1,000 vaccinated children (under 10).....5 had small pox.

In other words *un*vaccinated children are twenty times more liable to an attack of small pox than those who have been vaccinated.

Of every 1,000 unvaccinated persons (over 10 years of age).94 had small pox.
Of every 1,000 vaccinated persons (over 10 years).....19 had small pox.

*Un*vaccinated persons over 10 years of age, are five times more liable to take small pox than vaccinated of the same class

Of every 100 unvaccinated children who took small pox.....44 died.
Of every 100 vaccinated children who took small pox.....5 died.

An *un*vaccinated child (under 10) is twenty times more liable to take small pox, and twenty-two times more liable to die, and its chance of death is four hundred and forty times greater than a vaccinated child.

Of every 100 unvaccinated persons (over 10) who took small pox... 54 died.
Of every 100 vaccinated persons (over 10) who took small pox..... 5 died.

An *un*vaccinated person (over 10 years old) is five times more liable to small pox, and twenty times more liable to die of it than one vaccinated, while his liability to death during an epidemic is fifty-five times greater.

Dr. Hewitt, secretary of the Minnesota Board of Health, in commenting on these statistics says:

So much for recent statistics collected under a brisk and bitter criticism, and undisputed as to accuracy.

To this should be added the important fact that blindness, deafness, deformity, and chronic ill health, are the fate of those unvaccinated persons who survive the unmitigated disease, and that our own experience in eighty outbreaks confirms both conclusions.

The following letters from local health officers tell their own tale and evidence the benefit of vaccination.

DECORAH, Iowa, April, 1884.

J. F. Kennedy, M. D.,

I am pleased to receive the BULLETIN of the State Board of Health. As regards the benefits of vaccination, allow me to sketch an interesting case in my own practice. In 1863, I was called to see a sick man five miles from the town in which I was then living. Found him semi-delirious from the effects of an inflammatory fever. In a large log house, with a lean-to behind, were congregated seventeen persons, two of whom had the small pox thirty or forty years prior to my visit. The next day I found this sick man had small pox. He was engaged in threshing, and recollected that in one of the families there were some German emigrants who had a sick child, but had no doctor. Here was an interesting state of things. Thirteen

persons who had never been vaccinated, and a case of confluent small pox in the same dwelling. I went back home, secured some vaccine quills, and returning vaccinated every member of the family. The result of which was that the vaccination ran out the small pox in every case. This, with proper sanitary precautions, confined the disease to the case in which it originated.

E. CARTWRIGHT, M. D.

CHELSEA, Iowa, April 10, 1894.

To the Honorable Board of Health, Des Moines, Iowa:

I again report concerning the small pox in Salt Creek township, Tama county, Iowa. In a more detailed statement, the five members, including the mother and children, as stated before, were infected. Now two older girls (children), at the discovery of the disease, refused under protestation to be vaccinated, upon the ground that they had been when small. The consequence was the two mentioned took small pox in an aggravated form. Each had confluent small pox, and both died. The remainder of the family, recently vaccinated, have escaped the malady only in the milder form, and are now convalescent, and no more cases at present.

C. P. COULSON, M. D.,
Health Officer.

TYPHOID FEVER.

FROM HAND TO MOUTH.

In previous reports of this Board elaborate and conclusive evidence has been given, showing that polluted and contaminated water is the most prolific means of communicating typhoid fever to human beings. In fact it has been the rule in the event of the appearance of this disease in a community to look to the water supply as the source. More extended observation and research have demonstrated that there are other possible, if not equally definite sources of infection, which not being recognized the mystery of many epidemics of the disease remained unsolved.

Several instances have occurred, showing the direct infection by food. In August, 1892, an epidemic of typhoid fever appeared in a particular portion of the city of Springfield, Mass., a detailed report of which is given in the report of the State Board of Health. The people, as well as the physicians, were perplexed, and various theories were put forth as to the source of infection; for it was in the best part of the city, where the environments apparently precluded the usually

accepted sources. First, the water of certain wells was suspected, but investigation showed that most of the infected families used only water from the city waterworks, which was uncontaminated. The drainage was suspected, but it was shown that the houses were mostly new, and the plumbing good. The sewer was suspected, but families living nearest the manholes of the sewers were not affected. The cemetery was also suspected, but it was found that a well in the cemetery contained less ammonia than wells in the typhoid district, where the disease was most prevalent. The theory of ice infection was also tested, and exploded. It was finally discovered that all the infected families were supplied with milk from one man; that in the most infected portion, one family was exempt entirely from the disease, and this family received milk from another milkman. On investigation of the farm of the milkman, it was found that early in the Spring the milkman's daughter was sick with so-called "bilious typhoid fever." Others of the family were also sick with a "slow fever." The excreta of the patients were thrown into a privy vault, and the contents of the vault were subsequently thrown upon a tobacco field. Near by was a well, not used for drinking purposes. Into this well the milkman lowered his cans of milk, letting them sink to the bottom, to remain until they were taken away to supply his route. In the well was an old chain pump. Over the well were loose planks. The men in wet weather tramped over the tobacco field, through the cow yards, and then to the well. The planks over the well were filthy with mud, and careless pumping washed the mud and filth into the well. The water in the well was dirty, and was found to contain *Bacilli coli communis* to an enormous extent. Nine milk cans were lifted from the well. They were stopped with wooden stoppers. On tipping the cans, milk ran out around the stoppers. This being true, the water of the well would run in. None of the cans were full. The facts, as developed in this investigation, left no room for doubt or question as to the source of this epidemic, wherein there were one hundred and fifty cases, with twenty-five deaths. Of the one hundred and fifty cases, one hundred and one had milk from the same man, and one hundred and thirty-five had access to the same milk.

Soon after the foregoing outbreak another appeared at Palmer, in the same State. Unlike that at Springfield, the cases did not come down at once, as if some poison had been scattered,

but one after another for a month. Investigation proved that the source was not in the water. In one house, the inmates of which were filthy in their habits, were found four people sick with typhoid fever in one room, and two others in one bed in another room. Some in the early stages were sitting up. These were children who would go out to the privy, come back, and without washing their hands, stagger up to a table on which was some food, finger a big piece of cake thereon, remove a piece, nibble a little and return it to the table, and walk sluggishly back to their seats. Another child, evidently from another house would come in and do likewise. From case A something was left upon the cake and it soon found its way into the alimentary canal of the next child. The children went from house to house—they lived pretty much together—the food stood on the table from day to day, and the children ate food in common. There was no question as to how the disease spread. It was found the first case was imported from a neighboring town.

Another noticeable instance occurred in Company F, of the Ninth regiment of Pennsylvania National Guards, during the encampment on the field at Gettysburg in August, 1894. The company comprised fifty-three men. There occurred twenty-two cases of typhoid fever among persons who messed in that company. They had no food different from that of the other eight thousand men comprising the encampment. The water supply to all was the same. The location of the camp was healthful. A searching investigation was made for the cause, and it was found that a private, the day following the arrival in camp, complained of having the diarrhœa. He was ordered to report to the surgeon, but instead remained in camp duty, at the mess-tent, where he arranged and distributed the bread and other food on plates, and distributed it to the men. He finally became so debilitated that he went home, where typical typhoid fever soon developed. That man was a typical "walking case" of typhoid fever, and the germs which caused the subsequent cases were conveyed to the food from his unsterilized hands. A son of the captain of the company, who was one of the sick, was taken home. His mother attended him, and also did her her other household duties. Three other cases developed in the family, clearly caused by the food which she handled. In all these cases four were fatal.

In October, 1894, the secretary of the board of health of Titusville, Pa., found three cases of typhoid fever on a farm. From this farm milk was taken to the city. The sale and delivery of milk were stopped. Within four weeks there were fifty cases of typhoid fever, all in families who had been using the milk from this farm. The first case on the dairy farm was brought from Buffalo. The mother took care of the sick and the milk at the same time.

In June, 1890, the Connecticut State Board of Health was requested to investigate an outbreak of typhoid fever at Waterbury. Attention was first directed to the water supply and drainage, which it was found were not the cause. There were thirty-five house invasions with fifty cases. Of these, twenty-six houses with forty-one cases, it was discovered were supplied with milk from the same milkman; that this milkman secured his milk from several farms; that the invasion followed the route of milk from a certain one of these farms. An investigation was made at this farm, and it was found that the farmer, his daughter and a farm hand had been sick with typhoid fever. The excreta of the sick were thrown upon the barnyard; the hired man defecated so long as able to be about in the cow stables. The barnyard was in bad condition. The milk was handled in a shed attached to the barn. In fair weather the milk cans were washed outside the shed; on rainy days inside the shed. A door opened from the shed into the cow stables on one side, and another door into the barnyard. In the yard was a tank in which the milk in cans was placed to cool. The can lids were tilted so as to admit air. There could be no question as to source of infection of the milk. The water used was from a spring and free from the typhoid bacillus. The mass of material of the barnyard was infected with conditions favorable for extensive multiplication. It was tracked into the milk room by the men, and there drying into dust was carried by air currents into the milk.

Among the cases in this invasion was one of a person who did not use milk. But it was found that two weeks prior ice cream had been eaten, and that the milk came from the infected farm, thus confirming the work of Prudden, and others that typhoid bacilli retain their vitality for months fast frozen in blocks of ice. The milk supply from this farm was stopped and the disease subsided.

In April, 1895, a serious outbreak of typhoid fever occurred in the city of Stamford, Connecticut. It was so sudden and widespread that Dr. Lindsley, secretary of the State Board of Health, was called to make an investigation as to the cause and assist in suppressing it. He reports that attention was first given to the water supply, but that was soon abandoned. So, also, the food supply. It was soon discovered that the sickness followed exactly the route of a certain milkman in various parts of the city. There were three hundred and eighty-six cases, of which three hundred and seventy-six were persons who used milk from this milkman, while in houses contiguous where milk from another source was used there were no cases. There were twenty-five deaths. The appearance of the disease was simultaneous over the district. So soon as the source of infection was discovered the milk supply from this man was stopped and the disease at once subsided. Investigation of the premises of the milkman revealed the fact that he washed his milk cans with water from a well which chemically showed, in parts per million,—

Residue on evaporation	330.
Chlorine combined	47.5
Nitrogen of free ammonia	1.236
Nitrogen of albuminoid ammonia	.102
Nitrogen as nitrates	21.
Nitrogen as nitrites	.368

Professor Prudden discovered sixty-nine thousand six hundred and ninety living bacteria in a single cubic centimeter of the water.

The water in the well was only one foot and nine inches below the surface, and overflowed in the Spring, and surface drainage was toward the well. A shallow privy vault, leaking at the surface, was twenty-five feet distant, and free of access to a walking case of typhoid fever. The conclusion was irresistible that the source of this outbreak was milk, and the source of infection of the milk was the water from this well, contaminated by drainage from this privy.

In October, 1894, an outbreak of typhoid fever appeared among the students at Wesleyan University, Connecticut. There were twenty-five cases, and the simultaneousness of attack indicated a common source of infection. Investigation was made by Prof. Conn, of the University, as to the cause. It was found that the sick were members of certain fraternities

who had held a banquet about twelve days prior. The plumbing in the fraternity buildings was suspected. The food and drink supplied at the banquet were suspected. Samples of every article on the bill of fare were procured and all were examined with negative results until the oysters were reached. It was found that all of the sick ate raw oysters taken from the bay at Middletown; that of those at the banquet who ate no oysters none were sick; the female students who, at their banquets, had no oysters served raw, were not sick; that all who ate cooked oysters were not sick. It was also discovered that other persons than college students who ate raw oysters from this bay were also sick with the disease. Four of the students died. So strongly did the indications point to the oysters eaten at the banquet, a thorough investigation was made as to their source, and the problem began to be solved at once. It was found that the oysters had been brought from deep water and been planted near the mouth of Quinnipiac river for three days. About three hundred feet from the oyster beds was an outlet from a private sewer from a house in which were two cases of typhoid fever, a woman and her daughter, at the time the oysters were collected which were served at the college fraternity banquet.

On the same evening of the banquet of the Wesleyans, a fraternity at Amherst college held a banquet and the oysters were from the same bed as those furnished the Wesleyan. Seven of the students who ate raw oysters were taken sick with typhoid fever. In still further evidence against these oysters was the case of a young man from Boston, while temporiarily in Middletown, ate raw oysters taken from this bed the same day as those sent to the colleges. He went home and developed a severe case simultaneous with those among the students.

The chain of evidence was considered complete that the oysters were the cause of the sickness.

It was also demonstrated that salt water would not destroy the bacillus of typhoid. Also, that it is customary to bring oysters from deep water and deposit them for two or three days in fresh or brackish water, as they thereby swell up, become plump, or "fatten" as the dealers call it, thereby adding not only to the possible danger of contamination from sewage, but the fraud of padding—or in other words, "watering the stock."

The facts demonstrated in these cases will have confirmation in all parts of the country; that above epidemics from water pollution; above epidemics from milk infection, there may be and is also infection from food carried by fingers; by dirt accumulated under the finger nails; by water used for washing milk cans. It is, therefore, of the highest importance that the water used in dairies be pure and free from contamination, and that physicians can not be too explicit in instructing those having the care of typhoid patients of the necessity for immediate disinfection of fæces, and constant disinfection of the hands, as well as the most scrupulous care respecting the utensils used for food by the sick.

In December, 1894, several cases of typhoid fever occurred in the family of a farmer south of Alden, in Hardin county, Iowa. Various suspected sources of the disease were traced with negative results. The well was finally examined, and the water therein was thickened with a mass of dead and living winged ants. The well was tight, and the cylinder at the bottom of the pump stock had strained out the ants, thus preventing their discovery; The well was thoroughly cleansed, and the disease subsided. It is not claimed that dead ants of any species can produce typhoid fever, unless by some means they become the purveyors of the typhoid bacillus.

DIPHTHERIA.

One of the most compact and instructive works upon diphtheria, from a sanitary point of view, is "A Treatise on Diphtheria," written by Dr. H. Bourges, of Paris, and translated by Dr. E. P. Hurd, of Boston, and from which the following extracts are taken.

CAUSES OF THE DISEASE.

As to the cause of the disease, Dr. Bourges says:

"It is to-day undisputed that the efficient cause of diphtheria is the Klebs-Loeffler bacillus." He says further: "Is contagion indispensable to the development of disease? In other words, may a healthy subject be attacked by diphtheria without taking the specific germ from a person afflicted with the disease? We cannot at present give a positive answer to this question. In studying, further on, the pseudo-diphtheric bacillus of

Loeffler, we shall see that there exists a bacterium which, not yet differentiated morphologically from the bacillus of diphtheria, is distinguished only by the absence of virulence. Now this bacterium is found very frequently in the saliva of healthy persons, and some have been disposed to identify it with the Klebs-Loeffler bacillus, which may also remain inoffensive in the organism until quickened into virulence by some unknown stimulus. We have here an hypothesis similar to that which tends to confound the *Bacterium Coli Communis*, a microbe constantly present in fecal matters, with the bacillus of Eberth, the pathogenic agent of typhoid fever. If this notion should be established, our mode of conceiving of the origin and manner of development of infectious diseases would have to be materially modified in many points. While waiting for such proof we may limit ourselves by noting that observation demonstrates the importance of contagion in many cases."

Croup and diphtheria everywhere in the book are treated as identical and the terms are used interchangeably. He does not at any point attempt to prove nor even to make the assertion that they are identical, but goes on the assumption that it is an established fact which everybody knows.

To cause diphtheria, the Loeffler bacillus must come in contact with an excoriated mucous membrane or cutaneous surface, thus prepared for the inoculation; fixing itself there, it provokes the development of a false membrane, in which it lodges; there it lives and multiplies, remaining in the most superficial strata; it lives always outside of the organism, which it poisons by the toxine which it secretes.

In regard to the *most infectious period of diphtheria*, Dr. Bourges says:

At what epoch of the disease is diphtheria contagious? Possibly before the appearance of false membranes; but it is so at the highest degree when the false membranes are present, and eminently so during convalescence when the diphtheritic products are cast off. We know that the saliva when the false membranes are gone, may still contain the bacillus with all its virulence. Naturally at such times the occasions for contagion are abundant, for the patient will have returned to his ordinary mode of life.

The above is a strong argument in favor of at least the forty days quarantine required by the State Board of Health.

In regard to the vitality of this disease germ the doctor makes this remarkable statement:

If the resistance of the diphtheritic bacillus is relatively feeble in the living organism, and if it cannot preserve its virulence longer than one or two months in a person convalescing from diphtheria, it has a longer vitality under other circumstances. The contagion may cling to objects of bedding, of furniture, etc , and keep all its virulence for years, as numerous examples prove. An instance in point is related by Sevestre. In a village of Normandy, in other respects healthy, a lad fourteen years of age, was

attacked by diphtheria; and several days later a number of cases broke out in the village. In investigating the cause of this epidemic, Dr. Legrand remarked that the houses, in which successively appeared the cases of the disease, were situated by the side of two roads which connected the several parts of the village; but he could not explain how the first case originated, for there had been no diphtheria in the region for twenty-three years. Several days before the outbreak the grave digger had dug up the ground in the parts of the cemetery where the children had been buried twenty-three years before, and had even handled the bones; in this work he had been assisted by his son, who was the first to be attacked with the diphtheria, about a week afterward.

PREVENTIVE MEASURES.

As to the best preventive measures, the precepts of the eminent doctor are given not only because of their intrinsic worth, but also to show how nearly the rules and regulations of the State Board of Health conform to the best European teachings. He says:

When the physician is called to a patient affected with diphtheria, what should he do? Even when there is some doubt as to the diphtheritic nature of the affection, the same precautions should be taken as if the diagnosis were certain. The carriage which the patient occupies in transit to the hospital must be disinfected immediately after. In Paris we have special carriages placed at the disposal of physicians for such purposes. If the patient is not to be removed anywhere, he must as far as possible be isolated, no one but his regular attendants being allowed access to him. If children live in the house they should not only be excluded from the room, but if possible sent away during the time of sickness and until after thorough disinfection of the house has been effected. These same children should be kept under observation and away from other children during the first fortnight. Nurses and attendants on the patient should vigorously observe the following rules:

Take no drink or nourishment in the sick room; keep the hands clean with a brush and soap-suds, and occasionally rinse them in an anti-septic solution; bathe after every contact with an infected object; renew these ablutions always on leaving the sick room and before eating. It would be a good plan for every attendant to wear a special suit while in the patient's room; this can be laid aside when he leaves the room. All cracks or abrasions about the hands or face must be instantly painted with collodion. The nurse should avoid taking the patient's breath, especially during fits of coughing. Nor should the nurse neglect to take a walk in the open air once or twice a day, or overlook the necessity of sleeping in a room apart from the patient. *Similar precautions are equally necessary for the attending physician.* * * * * * * * *

So soon as a case of diphtheria is recognized all curtains, carpets, wearing apparel, and every article of furniture which is not indispensable should be removed from the sick chamber, and immediately disinfected, either in the dry stove under steam pressure or by washing with a suitable solution or by sulphur fumigations. The bed should be located in the middle of the

room. Aëration of the room must be effected several times a day; sawdust with one of the strong disinfectant solutions should be sprinkled over the floor every day, the room then swept and sweepings immediately burned. The body-linen, towels, bed-clothing, dressings, etc., ought to be immersed for two hours in one of the strong solutions, and then kept in boiling water for half an hour before the final washing.

All objects that have been in contact with the patient may transmit the disease; care must, therefore, be taken that all surgical instruments, as well as domestic utensils, knives, forks, spoons, cups, etc., after being used be placed in boiling water and be kept there for five minutes at least. It will be well to destroy all books and playthings which have been handled by the patient.

The matters vomited or expectorated by the patient, the stools and the urine should be immediately disinfected by one of the strong solutions*. A cupful of the solution having been poured into the vessel, the vomitus, expectoration, or dejecta should immediately after passage be buried or poured into water closets which are disinfected twice a day with a strong solution of milk of lime. The better way would be to bury them in a deep hole in the ground, first covering them up with the strong chloride of zinc, or other disinfectant solution. A place should be chosen which is at a distance from any water source. The dejecta must not be thrown onto manure heaps or into water courses. It is important in the presence of a case of diphtheria that the physician should make a careful inquiry to determine its origin; he will thus often be able to circumscribe and arrest an epidemic. Moreover, every case of diphtheria should at once be reported to the board health. *All these precautions should be indicated by the physician at the date of his first visit.*

The Eighth International Congress of Hygiene and Demography was recently held at Buda-Pesth. F. Loeffler, M. D., the discoverer of the cause of diphtheria, professor of hygiene in the University of Griefswold, Germany, and chairman of the German committee, furnished to the *British Medical Journal* the following summary of conclusions arrived at by the committee upon diphtheria. The researches of Loeffler upon this subject have been so thorough, and have extended over so much time, that his conclusions fairly represent the latest and most reliable thought upon the cause and best means of restricting this disease.

1. The productive agent of diphtheria is the diphtheria bacillus. Dispute as to the etiologic definition of this bacillus exists no longer. We can therefore, henceforth indicate as diphtheria such forms of disease as are infested with the bacillus.

2. Not infrequently cases appear in the early stages to the clinical observer as true diphtheria, which, however, are caused by other organisms,

*Strong solutions. Corrosive Sublimate 1 to 1,000 parts. Sulphate of Copper, 5 per cent. Chloride of Calcium, 5 per cent. Chloride of Zinc, 1 per cent. Milk of Lime, 20 per cent.

as streptococci, staphylococci, pneumococci, and in light or graver form may be mistaken for diphtheria. But the differential diagnosis can be effected through bacteriologic research. Statistical compilations on the epidemic spread of diphtheria, as well as on the character of diphtheritic epidemics, cannot represent an exact definition so long as the bacteriologic investigation of cases suspected of diphtheria fails to mark a division between true diphtheria bacillus and cases merely resembling diphtheria.

3. Diphtheria epidemics show a various character, as do many other epidemics of infectious disease. The course of epidemics is very often light, but also much more severe, indicated by the high figure of the death rate, the rapid infection of the larynx and the nose, and by severe heart and kidney affections and consecutive paralysis. But also in the same epidemic instances of severe and light forms of disease frequently alternate irregularly.

4. The variation will be determined by several factors: *a*, by differences in the number and the virulence of the diphtheria bacilli; the causes of the latter are not yet absolutely known; *b*, by concomitant bacteria, and, indeed, as much by pathogenic as saprophytic; the processes of infection with regard to the diseased mucous membranes in the passages and in the nose appear to influence the course of the disease unfavorably, in part by increasing the virulence of the bacilli, in part by weakening the body through absorption of decomposition products; *c*, by individual tendencies not yet thoroughly recognized.

5. The diphtheria bacillus can appear in the passages, especially of the nose, of separate individuals, without causing indications of sickness, which it first induces when it has actually established itself. Lesions of the mucous membranes, small eruptions, catarrhal changes are favorable to its residence. In brief, meteorological conditions giving admission by the first approach to catarrh; especially cold, damp weather, appear to favor the sickening from this cause. But this influence has to be more closely observed.

6. Diphtheria is most rapidly communicated by direct contact between sick and well through spitting, coughing, sneezing, kissing and grasping of the hands, whereby the hands come in contact with fresh secretion, but also freely through utensils which the sufferer has fouled, with his excretions by beverages, food, eating and drinking vessels, cast-off washing, clothes and other articles, as pocket handkerchiefs, playthings, even long after their actual infection.

7. The sick is infectious so long as he has bacilli upon the mucous membranes. The bacilli usually disappear with or soon after the disappearance of the local signs, but they may be detected still lively and virulent in the passages or nose for weeks and even months.

8. In organic matters condensed and excluded from light the bacilli can maintain themselves for a period of months outside the body; accumulations of dirt, dark and close dwellings favor thus the preservation of bacilli and the extension of disease.

9. As a specially noticeable vehicle for the extension of disease is to be noted the crowding together of susceptible individuals, especially in families of many children. But other gatherings of people, apart from children,

where separate persons do not come into such proximity as the members of a family, may offer facility for the extension of infection, as schools, barracks and the like.

10. The diphtheria bacillus is so far not identified with certainty as the cause or inducer of other diseases similar to diphtheria or of other spontaneous disease of lower animals. The possibility of the conveyance of true diphtheria from sick animals to human beings is thus outside our present knowledge. It is desirable that the governmental investigating committees should combine with research regarding diphtheria coming under their notice the similar diseases of animals, and also the communication from animals to human beings of diseases resembling diphtheria.

11. As prophylactic means, are to be considered: *a*, care for cleansing, keeping dry, sufficient ventilation, and lighting of the dwelling; *b*, careful cleansing of the mouth and nose, gargling with weak solutions of common salt and carbonate of soda, thorough brushing of the teeth, extraction of bad teeth, attention to the deeper cavities of the tonsils, and removal of hypertrophied tonsils; *c*, cold douching of the throat in times of diphtheria prevalence.

12. Every case suspected as diphtheria must, when possible, be bacteriologically investigated. The physicians must have easy access to the required materials for carrying on the culture, for example, in the chemists' shops. The investigation has to be carried on by specialists, as in the case or cases of suspected cholera.

13. All cases proved bacteriologically to be true diphtheria, as well as cases suspected as diphtheria which have not been bacteriologically investigated, must be dealt with as under police regulations.

14. Every diphtheria case must be isolated, either in a separate room of the dwelling or in an isolated ward. In order to restrict as much as possible the spread of the bacilli by the sick, a local, anti-baccilar treatment must be employed, with a view to prophylaxis against the early stages of the disease.

15. One of the most effective means against the spread of diphtheria to be cared for is the protective inoculation of susceptible individuals in the neighborhood of the patient, especially of children. In proportion as the inocuousness of Behring's serum cure through preventive injection is established for curing or prophylaxis, it appears worth while to develop further as far as possible the art of inoculating it in families and in school classes in which diphtheria cases have occurred.

16. In every case of diphtheria disinfection is imperative. This is needed for all utensils for the sick, as well as for the sick themselves and the sick room.

17. Convalescents from diphtheria must not mix freely with others (or children go to school) till bacteriologic investigation has proved the removal of the bacilli, and the sick after a warm bath with soap have been thoroughly cleansed and have put on clean clothing.

18. On the outbreak of diphtherial epidemics, notification should be given in the public press.

Dr. P. H. Brice, the efficient secretary of the Board of Health of the Province of Ontario, Canada, residing at Toronto, has

made a number of experiments with reference to the number of micro-organisms found in school buildings in each cubic metre of air. It is not to be presumed that these organisms are all or many of them pathogenic—that is, disease-producing, but it would be equally unfair to infer that many were not. The following gives the results and his conclusions respecting diphtheria:

From the experiments on the air of houses and schools already given I take the figure of the number of micro-organisms in the air of a school of average cleanliness, naturally ventilated, and find it to be one hundred and twenty-five thousand per cubic metre, and in the cleanest of mechanically ventilated schools, taken from twenty-two in all thus ventilated, there were three thousand microbes per cubic metre.

Were there no such enormous number of microbes in school air as compared with outside air, the relative dangers would be proportionately great in the case of the school, from the fact that the same air is breathed again and again, if not by the same person, then by others, the ratio of change even with good ventilation as compared with the slightest breeze being as one to two thousand five hundred.

But I need not multiply by illustrations the dangers to which I have referred. Only one word need be said with regard to the conclusions to be drawn from them, which may be summed up as follows:

1. Diphtheria in houses is an intensely infectious disease.

2. It is a disease capable of a very mild character in some cases, while still retaining for several weeks in such patients the ability to transmit the infection and produce cases of extreme malignity.

3. It is a disease specially influenced as regards its infectiousness, by the character and thoroughness of local treatment, and by the frequency with which the air of the sick room is changed. How this latter is true is shown by the effects on the number of microbes in mechanically ventilated schools.

4. It is a disease peculiarly liable to attack with malignity children under ten years of age, but causes relatively fewer deaths than scarlatina amongst children under three years.

5. It is a disease, the germs of which have, when hidden away in damp spaces, where dead organic matter is present, a capacity for prolonged resistance to destructive influences.

6. It is a disease whose germs are weakened in their virulence by free exposure to sunlight, moisture and free air, and these may be completely destroyed within a few days.

7. It is a disease which does not produce epidemics through the medium of public water supplies.

8. It is a disease which may be introduced into houses from defective sewers and bad plumbing; but epidemics in a series of houses on a street, or in a town or city, are never produced except by direct communication and direct infection, and this method of propagation has fresh scope and produces its most potent influences through the medium of public schools, and by persons and children visiting infected houses, and by persons from infected houses visiting in healthy homes.

9. It is a disease which, during the period of the last census, caused twelve thousand five hundred recorded deaths in Ontario, and probably more than fifty thousand cases of the disease.

10. It is a disease peculiarly frequent and fatal in the latitudes lying between the Ohio river and the northern limits of settlement in Canada.

11. It has no special habitat except that it is peculiarly a house disease and finds its greatest opportunities for spreading in damp and cold climates, where the temperature makes people close their houses to natural ventilation, and where artificial heating is specially resorted to.

HOW DIPHTHERIA SPREADS.

Health Officer Dr. A. O. Strout, at Parkersburg, in reporting cases of diphtheria within his jurisdiction, cites a case which forcibly illustrates how important it is to be extremely careful in adopting measures to prevent the spread of that disease. The doctor says:

There were two girls in this family, aged five and seven years. The oldest came down with diphtheria, and I at once ordered the younger one sent to another house entirely. She remained there some three weeks until the other girl had recovered. I had the house thoroughly disinfected, and I thought I took every precaution before bringing the other girl home. But I forgot a little dog that was the pet of both girls, and in five days after the girl returned she was taken sick and died. Wherever any contagious disease exists, especially diphtheria, we should not forget the dogs and cats when disinfecting, and if they are inclined to stay in the house, shoot them at once.

In Humboldt county a child died from diphtheria. A few hours before its death the father, in violation of the quarantine, went to another town in another county on business, and immediately two children in the family where he stopped were taken with the disease, and the disease spread to several families, with a number of deaths.

Books are a source of danger not often thought of. During convalescence there is a general desire among children for books, often from public libraries. They are read and handled for several days without any disinfection. N. J. Narty, city chemist of Indianapolis, reports the following case:

During the last week of March, 1894, my son, fifteen years old, was stricken with diphtheria. Cultures were immediately made from the throat patches, and the Klebs-Loeffler bacillus was certainly obtained. This, together with the careful examination and diagnosis of the physician, established the existence of diphtheria without a doubt. Close inquiry and questioning of the boy failed to discover any exposure to the contagion. The youth attends the city high school in the forenoon. In the afternoon his study hour is continued until four o'clock, then on his bicycle a ride of

a few miles is taken, and then outdoor exercise is enjoyed. He had no recollection of visiting any unusual places, had not been to any public entertainment for more than two weeks prior to the attack, and the high school had known nothing of diphtheria for two years. We were greatly puzzled concerning the origin of the disease. It was remembered, however, after some days, that he had had a public library book, which was much soiled. This book I quickly secured again. It was much worn and very dirty, and on one of the covers the marks of teeth were plainly visible.

Being constantly employed in chemical and bacteriological work, I was able without delay or uncertainity to make cultures from many parts of the book. The corner having the teeth marks was the only spot that furnished the Klebs-Loeffler bacillus. One of the tubes developed staphyloccus pyogenes aureus, and all, of course furnished grafts. The cultures being unmistakable, I feel positive that my son must have taken the disease from the book in question.

Pack peddlers are frequent disseminators of contagious diseases. Dr. Frederick Becker, member of the State Board, reports a case which came under his observation:

A family of one of my patrons was under quarantine on account of scarlet fever. A pack peddler called and was refused admittance, but he insisted on showing his wares and staying all night. He was repeatedly refused, and told why, but he could not be persuaded to leave, until the husband made his appearance. He would have stayed in this scarlet fever-stricken family and gone out next morning to spread the disease broadcast. I think these peddlers should be declared a nuisance, and stopped from roaming over the State. Could we not do something to stop them?"

Peddlers who, knowing a house is under quarantine for an infectious disease, will insist on entering it, especially against the protests of the inmates, should be arrested and fined heavily, or have a good bulldog turned loose upon them.

This is one of the mysterious ways in which infectious diseases spread in sparsely settled districts, and in farming communities. A peddler's pack has a wonderful attraction for children in many of the country homes. They gather around the peddler and eye with curiosity, and often with open mouth, every piece of merchandise exposed. They stand over it—perhaps handle it. The children here may all be in good health, but away off a mile or two the peddler had exhibited his goods in a family where there was scarlet fever. The child or children may first have been in the desquamative (scaling-off) stage, and the infectious pieces of skin are transferred to the goods, and come in contact with Mr. Jones' children. The peddler packs his goods and betakes himself to other homes. In a few days one, two or three of Mr. Jones' children are stricken down with scarlet fever, perhaps in a malignant and fatal form. The doctor is called, and tries to ascertain the source of the disease. No clue can be given. He remarks: "I had a couple of cases over at Mr. Brown's a couple of weeks ago," and suggests it may have been carried from there. The family is sure it could not, as there was no communication at all. The peddler's visit is forgotten, or if remembered is deemed of no importance, as they had no trace of his itinerary before nor after visiting them. Perhaps months after, when the neighbors

get together and compare their purchases, does the fact dawn that Brown's home had been visited by the peddler but a short time before he called and exhibited his wares at Jones'.

Flies are unquestionably the conveyors of disease germs.

Dr. Sawtschenko, writing in the *Centralblatt fur Bakteriologie*, gives the results of experiments made by him with the view of ascertaining the part played by flies in the transmission of cholera. In these inquiries he employed ordinary house flies, and also a larger variety, which live in the open, and are to be found alike on excrement and on exposed food stuffs (flesh and fruit). The results obtained were as follows: 1. In the bowel contents and excrement of flies fed with pure culture of cholera the specific bacilli could be demonstrated as late as the fourth day after ingestion of the organisms. 2. The same results were obtained when, instead of pure culture of the bacillus, the excrement of cholera patients, or matter from the bowels of a cholera corpse, was supplied as food. 3. Cholera bacilli taken from the bowels of these flies on the third day after ingestion still maintained their virulence, killing guinea pigs about as quickly as the original culture. 4. In certain cases the flies were fed plentifully upon sterilized broth after the bacilli had been supplied to them, and preparations made from these flies showed the organisms in immense quantities, so that it is highly probable they had multiplied in the body of the fly; if so, the fly must be regarded not only as a conveyor of cholera, but also as a focus or source of fresh infection.

The lesson taught in relation to cholera applies with equal force to all infectious and contagious diseases. It is that all excreta from the lungs, mouth, bladder, rectum in such diseases, or from open and discharging sores, of infectious character, should be destroyed or disinfected without the possibility of flies coming in contact with them; that flies themselves should be, so far as possible, kept out of our houses, or when in, destroyed as promptly as possible and burned; and that articles of food and drink should be kept under cover, or at least secure from contact by flies.

TUBERCULOSIS IN MAN.

HOSPITALS FOR TREATMENT*.

The annals of preventive medicine demonstrate a considerable number of attempts in the line of preventing the spread of tuberculosis, but most of these attempts have proved that our knowledge of the disease is not far enough advanced to permit the entertainment of much hope of a successful warfare at present.

We do not, at present, know of a method of treatment of persons suffering from tuberculosis, which shows uniform success. Medical science now advises methods by which the crisis may be retarded, and the rapid progress of the disease delayed. This might be termed a hygienic-dietetic treatment which tends to regulate the nutrition and augment the sum of vital force in the patient.

Common hospitals can not, however, successfully accomplish this. While they can do much good to people from those classes of society whose conception of hygiene is most rudimentary, they can not properly adopt the treatment of tuberculous sick in the so-called first stage of the disease when patients are not totally deprived of their working power or of gaining themselves a livelihood.

In consequence of this, hospitals for the treatment of tuberculosis exclusively have been attempted. In England the National Hospital for Consumption, and in Germany Dr. Brehmer's hospital in Goerbersdorf, and that of Dr. Dettweiler, in Falkenstein, stand as monuments of the correctness of the claim which is now far from being new.

Neither private physicians nor the charity of the public at large can be expected to establish hospitals for consumption. Either the State or the unions which are established for the benefit of the sick must be called upon to relieve the need of consumption hospitals.

*Read by J. C. Bay, Bacteriologist of the State Board at the annual meeting, May 1, 1895.

The great majority of cases of tuberculosis are not properly managed. The public does not comprehend the nature of consumption, and treats it with indifference until great damage begins to make itself felt. Among the poor classes consumption is not and can not be properly treated. Whether the patient is rich or poor humanity has the same claim upon medical aid. Humanity has this claim, that attempts should be made: first, to suppress the disease; second, to restore life and vital power and strengthen the individual's power of gaining a livelihood.

That tuberculosis is curable is proved by the results of a number of post-mortem examinations. Structural alterations have been observed in the lungs and indicate cure of tuberculosis processes. Literature treats of a number of cases, especially of tuberculosis of the larynx, and of the lungs which have resulted in perfect cure.

Since cure does occur frequently, we must assume that in individuals who can not protect themselves against colds, dust, exhaustion and unfavorable hygienic surroundings to the proper extent, perfect, or at least partial, cure would occur at a much greater percentage if they could be better taken care of.

According to Dr. Fielitz, twenty-five to twenty-seven per cent of the cases of consumption treated in the hospital for consumption in Falkenstein resulted in perfect cure, the average extent of treatment being a hundred days. It must be remembered in connection herewith, that the majority of patients neglect to submit to treatment at the proper time, they being mainly coal miners.

In the Falkenstein hospital, forty or fifty per cent of cases showed considerable changes for the better. The average increase of working power was five years.

Considering the classes of people for the benefit of which consumption hospitals should mainly be established, I am thinking especially of the humbler strata of society, coal miners, working men and women, the population of factories, etc., which sort of people are often captured by physicians who profess an ability to cure tuberculosis and like diseases. Were such unfortunate people given an opportunity to enter a hospital where they could be honestly treated, and receive proper care, they would become, if not cured, able to keep up their working faculties for a much longer period than otherwise, and

at a reasonable outlay of money. "The crowded poor," as Dr. N. E. Wordin remarks, "who barely eke out an existence, are a constant and positive source of danger to the community." This is true, especially with regard to tuberculosis.

But many intelligent persons are thrown into these so-called "lower strata," and will take the better course, if educated to know better.

Increased knowledge of consumption, and of the measures necessary to restrict and prevent it, may have been a partial cause of the reduction of mortality from tuberculosis in Massachusetts. In 1886 the average mortality was one hundred and fifty-six per one thousand; in 1887, one hundred and forty-one; in 1888, one hundred and thirty-four; in 1889, one hundred and twenty-four; in 1890, one hundred and thirty; in 1891, one hundred and sixteen; in 1892, one hundred and eleven. A reduction in six years of forty-five per one thousand.

It should be taught and learned that perfect isolation is not necessary for those who know how, and are able, to disinfect all broken down tissue expectorated or otherwise excreted from the body.

No place is safe against tuberculosis. But in high altitudes, in pure air, and at a safe distance from cities and towns, the conditions of infection are very much diminished. Dry soil and sufficient supply of healthy water are also important conditions for the location of consumption hospitals. A grove or wood is desirable, and the location should not be very far away from railroads. The Harz mountains in Germany have proved an excellent location for these establishments. No doubt numerous ideal locations could be found in Iowa, especially in the mining districts. In Colorado such districts have proved to be very favorable.

The size of the establishment depends upon the means available. In Germany none of the hospitals started with less than fifty beds. The ideal principles are to be found in the National Hospital for consumption at Ventnor, Wight, which is divided into blocks, each block accommodating twelve patients. All rooms occupied by the sick face toward the south, and each patient has a separate bedroom of from one thousand five hundred to two thousand cubic feet of space. Every six patients have a parlor of three thousand cubic feet of space and an extra dining room. The bedrooms are separated by thick walls, which is considered important, inasmuch

as the sick are very easily disturbed, in more than one respect, by the coughing of other patients, and as the convalescent are best protected against infection by being perfectly isolated at night.

Numerous plans have been devised for the establishment of such hospitals. They are easily accessible, and my object is not to reconsider such plans, but to advocate special hospitals or homes for the care of such sick, against whose malady no reliable remedy has yet been discovered, but whose lives may be prolonged if judiciously cared for.

TUBERCULOSIS IN CATTLE.

THE TUBERCULIN TEST. *

It is our intention to give in this paper conclusions drawn from tests and experiments made at our own station, at the State Agricultural College, as well as to pressnt in a condensed form some additional and well established facts on the subject of tuberculosis.

The interests involved are so vast, and the adoption of wise and efficient measures is so important, the subject should receive the fullest discussion with all the available facts before us. Personal interest and preconceived notions should not be allowed to influence our judgment. Recent discoveries and the application of new methods growing out of them, have led to the fear on the part of some that great harm is likely to be done the live-stock interest. While much misleading and unprofitable discussion has been going on, science has been patiently observing facts and bringing new discoveries to light.

Some points have been effectually settled, truth has been approximated on others, and yet there remain for settlement many of the practical details in dealing with the subject.

The scientific aspect of the question has made more uniform progress than the practical application of the facts discovered to the eradication of the disease. The scientist has only the difficulties of discovery to encounter. A variety of interests

*By Prof. M Stalker, State Veterinary Surgeon, and member of the State Board of Health, and W. B. Niles, of the State Experiment Station.

may be antagonized by the efforts at suppressing the disease, and consequent opposition developed.

Within the last few years there has been a general awakening to the vital importance of this question all through the scientific world. The laboratories of the Old World, and the experiment stations of the New, are abundantly supplied with devoted students of sanitary science who are bringing every available means to bear on this question. From these diversified opportunities and fields of observation, the problem is being gradually wrought out.

Investigators working independently of one another have arrived at the same conclusions on a number of points. This method is sufficiently conclusive in its results to set at rest discussion among scientists as to the trustworthy nature of the conclusions, and to furnish an intelligent basis for restricting the evil. It may be well to summarize at least a partial list of facts on which experimenters are so well agreed as to leave little doubt as to their accuracy. Much of the ground has been gone over by the agricultural experiment stations of the more progressive States, with remarkable uniformity as to results.

The following may be said to cover a portion of the ground that has been practically cleared from doubt:

1. Tuberculosis of the lower animals is identical with human consumption.
2. It is an infectious disease.
3. The disease may be transmitted from man to the lower animals, and from the lower animals to man.
4. Tuberculosis causes more deaths in the human family than any other disease.
5. That dairy cows are especially susceptible to the disease and are extensively affected by it.
6. Milk from tuberculous cows may convey the disease to the consumer.
7. Milk from tuberculous cows having non-affected udders may convey the disease.
8. The flesh of tuberculous animals may convey the disease.
9. That a large proportion of the cases can not be recognized by clinical examinations.
10. That no other test yet discovered, than that afforded by tuberculin, can detect any considerable proportion of cases in the living subject, and this test is practically infallible.

11. That injections of tuberculin can not produce tuberculosis, nor is the operation harmful to healthy cattle.

Any one of these asseverations can be successfully defended by observations made on the part of experimenters of unquestioned credibility. Most of them have been verified in our own station work.

If is now about a year and a half since the station began the work of applying in a practical way, and on a somewhat extensive scale, the tuberculin test. The purpose has been to satisfy ourselves as to the reliability of the test, the danger, if any, resulting from its use, and by conducting a series of tests in various parts of the State to gather information as to the prevalence of the disease.

MANNER OF APPLYING THE TEST.

For the benefit of those not familiar with the methods of making the test, a word of explanation will be in place.

First. The temperature of every individual in the herd to be tested is carefully taken and recorded at intervals of two hours during the day preceding the test. The average of these readings will give a pretty accurate test of the individual temperature of the several animals, which is recorded as the normal, with which any variations are to be compared.

Second. Before midnight of the day on which the trial temperatures were taken, the injection of lymph is made. This consists in injecting beneath the skin, with an ordinary hypodermic syringe, two cubic centimeters of tuberculin for every thousand pounds live weight of animal.

The result to be expected is a more or less well marked rise in temperature shown by all individuals affected with tuberculosis. If the animal is free from the disease no change of temperature will result. The rise in temperature will usually begin to manifest itself in from twelve to fifteen hours after the injection is made. From four to six hours later the temperature in those showing reaction begins to decline and gradually reaches the normal. It is upon this variation in temperature alone that reliance is placed for determining the presence of the disease. Every possible precaution should be observed, that the conditions may be the same under which the temperature is taken before and after the injection. Varying conditions tend to slight modifications of temperature, hence the necessity for the greatest precaution, that only the change resulting from the action of the tuberculin may be shown.

If a change of one and one-half or two degrees occurs, this is sufficient evidence on which to condemn the animal A rise of four or five degrees is not unfrequently noted. There is no well authenticated evidence that these marked differences in rise of temperature shown correspond to like difference in the severity of attack.

RELIABILITY OF THE TEST.

With this feature of the subject we are especially interested. If the results obtained should not show a fair degree of uniformity under like conditions, then the test may be discarded as useless. If the test proves a means of condemning healthy animals, it is a harmful and dangerous experiment, and should be discarded at once. If diseased animals fail to respond to the test, then it is to be regarded as a means of concealing rather than indicating real dangers, and is worse than useless. With these thoughts before us, the work has been done with such attention to details as would insure a fair and impartial trial.

The conditions under which we have been obliged to work have not always been such as to allow all the privileges we have desired, in order to obtain the fullest results. It has not always been possible to secure for slaughter all the animals showing reaction. As a matter of course, we have not had the opportunity of performing autopsies on any considerable number of those that failed to show any reaction. These are regarded as healthy, and are not usually disposed of so as to afford opportunities for post mortem. Out of eighty post mortems made on animals showing reaction, not a single case failed to give evidence of tuberculosis. In no case where an opportunity was afforded to examine the carcass of one failing to show reaction, was the disease found to exist. In other words, the test has not failed in a single instance in our experience. Occasional failures have been noted by other experimenters. Whether this was due to lack of attention to details in the work, to want of searching methods in examining the cadaver, or to actual failure in the essential features of the test, I am not prepared to say. But it would not be a matter for surprise if there should be some contradictory results reported, owing to the many inexperienced hands into which the test has fallen. Our experience with the test, however, tallies so closely with the results obtained at other United States experiment stations, as well as scientific institutes throughout the world, that there

is practically no disagreement among the workers in this field of investigation, as to the uniformity of results. It cannot be said of any drug in the pharmacopœia that it is infallible in its action; that it was never known to produce other than its generally recognized effects, and that these invariably follow the administration. But this by no means breaks the law of uniformity, or reverses the rule of action.

The New Jersey experiment station, in its Bulletin, after detailing experiments made, summarizes its conclusions by saying: "Every case of undoubted reaction proved to be undoubtedly tuberculous."

The Wisconsin station, where careful tests have been made, publishes the results in bulletin form, and gives expression to the following: "We have then, in this agent, a means of detecting the disease if we desire. The use of this agent is to be recommended."

Dr. Law, in a bulletin issued from the Cornell University station, speaks of tuberculin as possessing "the highest value as a test of tuberculosis in animals." He further says in the same bulletin: "This has now been employed on thousands of cows, and those who have used it most value it the most highly, whereas many who at first reported reactions in non-tuberculous animals are now acknowledging with Nocard that the fault has been mainly their own, for small tubercles were present, but were overlooked through their failure to examine the bones and other organs."

The same observations have been made by workers in the Maine Agricultural College experiment station. In the published reports of that institution we read: "With suitable instruments and professional skill, it is comparatively easy for one man to examine a herd of fifty animals in less than twenty-four hours and detect every case of tuberculosis that may exist there."

The Massachusetts station, after a long and unsatisfactory attempt to rid the college herd of tuberculosis by the weeding-out process, decided to apply the tuberculin test. The bulletin of the station, in speaking of the effort to free the herd from this disease without the application of the test, says: "That in all probability we should never have been able to accomplish this is shown by a study of the records of the tuberculin test."

Both those that reacted and those that did not were slaughtered, and the accuracy of the test was fully demonstrated.

The North Dakota Experiment Station, through its bulletin, says: "We have taken pains to hold post mortem on all animals which have been tested up to date which yielded to the test, and in every one we have been able to demonstrate the presence of tuberculosis."

The conclusions of the Bureau of Animal industry are thus summarized: "The number of instances in which the conditions indicated by the results of the injection do not conform to the conclusions founded on post mortem examination is so many times less the number of errors from all other methods used to diagnose tuberculosis, and there are so many cases of tuberculosis which could not possibly be detected by any other method, that even they who are least inclined to favor the use of tuberculin cannot fail to recognize its importance."

Our own station has had similar experience in dealing with the disease at home. No other means employed ever enabled us to free the college dairy herd from the disease. In every instance where post mortem proofs have been added to the findings of the tuberculin test they have coincided.

It is not necessary to multiply at length quotations from independent experimenters. They are to one and the same effect. But we have thought it best to present a very little of the mountain of evidence in support of this test, to offset the reiterations of the objector. We have cited the most unbiased and trustworthy evidence. The observations of men employed by the government, who have no occasion to become swift witnesses in support of any theory or any practice; investigations carried on by the station authorities of Minnesota, Virginia and Arizona, and by the Sanitary Board of the Dominion of Canada, and by many other government stations and scientific bodies throughout the world, might be drawn upon for added evidence to the proofs already furnished.

EFFECT OF TUBERCULIN ON THE HEALTH OF THE ANIMAL.

The statement has so frequently appeared in print that the use of tuberculin is harmful; that it induces tuberculosis, etc., the results of our experience seem worthy of mention.

During the Fall of 1894, ten cows that had previously reacted to tuberculin, received the second and third injection. These animals were situated on different farms, and received the same treatment as the balance of the herd. No bad results followed in any way, and in no case was the process of the disease apparently hastened.

During the Spring and Summer of 1895, three cows have been receiving regular injections of tuberculin. At this writing no unfavorable results have been shown.

Dr. Pearson, of the Pennsylvania experiment station, says in discussing the probable danger from the use of tuberculin: "The experience of the State Agricultural College Experiment Station herd is also against this theory, because its members have now been tested with tuberculin three times, each time being injected in practically the same spot, and not the slighest evil result has manifested itself, although the period of observation now extends over two and one-half years."

A bulletin issued by the experiment station of Cornell University, after detailing a series of experiments on this subject says: "So far as there is evidence before us, everything points to the harmlessness of a single test done on a sound animal system."

The experience of the Minnesota station furnishes conclusive proof of the same nature.

THE UNCERTAINITY OF OTHER TESTS—THE MILK TEST.

It has not been alone the purpose of the station to prove or disprove the reliability of the tuberculin test, but to compare its value as a diagnostic agent, with other means of recognizing the disease. To this end a large number of tests have been applied to cows from which samples of milk had been subjected to examination.

Much has been said through the public press in favor of this method of detecting the disease and determining the dangerous quality of the milk. Samples of milk taken from cows in charge of the experiment station, which are known to be tuberculous were submitted to microscopic examination. These samples were declared to be free from the bacilli. This being the microscopic test of contamination there could be nothing done but to pronounce such samples free from danger so far as this test applies. However, as before stated, these cows have been proven tuberculous beyond question.

Again, in ten herds where from five per cent to more than fifty per cent had been pronounced tuberculous by the microscopic examination of the milk, not a single case of tuberculosis could be found by the most searching and painstaking tuberculin test. Conversely, eight cows in one herd were proven by the tuberlin test to be affected. They were slaughtered and all gave the

unquestioned proof of being tuberculous. These had passed the ordeal of microscopic test of milk with a clean bill of health, though two of them were found on post mortem examination to have miliary deposits throughout the udders.

These experiments have convinced us that the plan of microscopic examination of milk is altogether untrustworthy as a means of detecting the disease.

PHYSICAL EXAMINATION.

In cases where the herds were being subjected to the tuberculin test, careful physical examination of suspected and non-suspected cows have been made. These tests have proven to us that it is impossible to detect any considerable proportion of the cases in an affected herd, by the most careful examinations of this nature. Cases that have presented no evidence to the senses on which to condemn, or even to suspect the presence of disease, have reacted to the test, and post mortem examination has in many cases revealed extensive tuberculous lesions. These have been found in all parts of the body, including extensive diseased conditions of the mammary glands.

EXPERIMENTS IN FEEDING THE MILK OF TUBERCULOUS COWS.

The use of milk on experiment animals for the purpose of artificially inducing the disease in otherwise healthy individuals is a practical way of putting to the test some of the theories as to sources of danger. If the milk from tuberculous cows, either taken in the ordinary way, or injected directly into the circulation, can induce tuberculosis, the fact becomes one of no ordinary moment. The significance of the experiment has a two-fold importance.

First. It enables us to account for many cases of the disease in young cattle. It has been shown by repeated observations that congenital infection is rare. But calves a few months old are frequently found to be infected.

Second. If milk from tuberculous cows possesses infectious properties, the health and safety of the human family becomes the important part of the question. If feeding the milk to lower animals under ordinary conditions will induce the disease, there is no avoiding the conclusion that it can be induced in the human family under the same conditions. This experiment has been repeated with sufficient frequency, and under conditions to prove the certainty of results beyond question. If

milk is contaminated with the bacilli of tuberculosis, it will convey the disease. But under what conditions the milk will be so contaminated, is a question for separate solution. It has been vehemently claimed that only milk from cows with udders in which the disease was localized, was to be regarded as in any sense dangerous.

An exhaustive series of experiments was undertaken by the trustees of the Massachusetts Society for the Promotion of Agriculture, with a view to gaining light on this question. One of the experiments consisted in feeding twenty-one healthy calves on milk from tuberculous cows. At the conclusion of their experiment they report: "Of these twenty-one animals, eight, or over thirty-three per cent, were shown to be tuberculous. That the cows from which the milk for these feeding experiments was derived were free from tuberculosis of the udder is shown by their history, and by the results of the post mortem examination." They drew the following conclusions:

"The possibility of milk from tuberculous udders containing the infectious elements, is undeniable."

"With the evidence here presented, it is equally undeniable that milk from diseased cows with no appreciable lesion of the udders may, and not unfrequently does, contain the bacilli of the disease."

Dr. McKenzie reports that in cases where there were no lesions of the udder, but where tubercular deposits were found in other parts of the body, the milk in forty per cent of the cases proved infectious.

This is in accord with the best evidence on this subject, and especially does the extensive scientific work of Bong of Copenhagen coincide with these results.

Our station made experiments on these calves from tuberculous mothers. Two were allowed to take the milk from the mothers. These cows were but slightly affected, the udders to all appearances being free from disease, and no bacilli were detected in the milk when examined under the microscope. Both of these calves developed tuberculosis. Like conditions would produce like results in a human being. A third calf from a tuberculous mother was not allowed to take the mother's milk, but was taken as soon as born and kept on the milk of a cow that had been tested and found to be healthy. The calf showed no reaction when tested with tuberculin. It was slaughtered at the age of three months, and thorough examination failed to detect any sign of disease.

This experiment tends to show that calves from tuberculous mothers are not necessarily tuberculous at birth, but that infection takes place through the milk, and that infection will take place when the udders are healthy, and when there is no external evidence of the disease.

ORIGIN OF THE DISEASE IN IOWA.

It is quite impossible to trace accurately the appearance of the disease in our State. We have known of its existence among our cattle for twenty-five years, and undoubtedly it traces back to a very early period in the history of our cattle industry. We first became acquainted with it in herds of well bred cattle, especially those that were represented by the imported individuals. Comparatively little was known at that time of the history and real danger from the disease, and nothing of the modern methods of detection. But long before there were any laws on our statute books making provision for control of contagious diseases, we assisted many of our breeders in their endeavors to get rid of tuberculosis by selecting and destroying the affected individuals. The introduction of imported animals was doubtless an important factor in the introduction of the disease.

TO WHAT EXTENT DOES THE DISEASE PREVAIL IN IOWA?

The work done through this department during the last eighteen months; the occasional discovery of a seriously affected herd, and more frequently less severe outbreaks have led to the frequent repetition of this question.

While a considerable number of tests have been made, and these in various parts of the State, we are not yet in possession of a sufficient amount of evidence on this point to furnish more than an approximation to a definite answer. The evidence of the existence of tuberculosis has been demonstrated over and over, but to attempt to deal with percentages would be to enter the field of conjecture. It must be kept in mind that tests have been made where some form of disease was known to exist or was believed to be present. The unsuspected herd has not, as a rule, been tested. Under these circumstances, the number of cases found to be diseased, in proportion to the whole number tested, will greatly exceed the general average of cases in the State to the entire number of cattle. Again, the proportion of affected individuals in a diseased herd varies greatly. The

time during which the disease has existed, the condition under which the animals have been kept, whether closely confined or in the open fields—these and many other conditions will have a marked influence on the degree to which the herd has been invaded. We append the figures, taken at random from tested herds, which will show the extent to which the disease prevailed in these instances.

About fifty herds have been tested in the counties of Black Hawk, Kossuth, Story, Boone, Page, Harrison, Sac, Wapello and Floyd. Taking eight hundred and seventy-three animals as they occur in these herds that were subjected to the test, one hundred and twenty-two reacted and were pronounced tuberculous. These facts give some suggestions as to the distribution of the disease and the per cent that may be reasonably expected to react in herds that are reported for examination.

HOW THE INFECTION IS EXTENDED.

A living vegetable organism, the *Bacillus tuberculosis* is the reproductive agent which gives rise to the disease. When this germ finds lodgment in suitable tissues and is uninterrupted by any antiseptic agent or opposing force, it tends to multiply with a certain degree of rapidity, and the result in the affected tissue is the deposit of tubercle. Any organ of the body may be assailed through lymphatic and other glandular tissue. The lungs, liver and spleen are parts particularly prone to be the seat of disease. Any animal affected with the disease becomes a center of infection from which the disease may spread. Its distribution is never rapid, but a single case in a herd is certain to be followed by others in the course of time if unrestricted cohabitation is allowed. The bacilli are coughed up, or expelled from the body through other channels. These may be conveyed at once to the body of a susceptible animal, or they may lie in a dry and dormant condition for months and be revived into activity when implanted in a suitable soil. Every individual going out from an affected herd becomes a menace to animals with which it is brought in contact. Doubtless the sale of breeding stock has had more to do with the general distribution of the disease than any other one agency. A general indictment can not be entered against the breeding stock of the State, but many of our breeders can testify to the trouble they have experienced in their endeavors to free their herds from the scourge.

INFLUENCE OF MANAGEMENT ON EXTENDING INFECTION.

The fact is admitted by investigators generally, that the character of the buildings exerts a certain influence either for or against the dissemination of the disease. It is a universally admitted fact that cattle kept in ill ventilated, underground barns, with inadequate air space, furnish favorable conditions for increased contamination. This has been our own observation in conducting examinations on herds so situated. This fact has been emphasized to the extent that some have come to the conclusion that this cause alone furnishes practically all the explanation that is necessary to account for the disease in our herds. Not so. Bad sanitary conditions can no more originate the specific poison of tuberculosis than the virus of small pox can be developed by the same methods. Both diseases may be aggravated, and the cases multiplied by such exposure, but neither disease can be so generated. It is by no means true that extensive invasion of any given herd is to be found only when the animals are kept under such conditions. Some of the very worst outbreaks we have investigated were confined to animals that had never been kept in barns. In one herd of forty-one animals six died during the latter half of the Summer and ten more were found diseased by the tuberculin test. These were all slaughtered and the tubercular condition verified by post mortem examination. This herd was at pasture and had never been kept indoors. From another herd of twenty-eight animals five died in the course of three months. The tuberculin test found nine additional cases. These had never been kept in any better quarters than in an open plank barn. Here were two herds that led practically an out-door life, yet they were both rapidly dying out. This station has made abundant observations of a similar nature in other instances. If an infected individual is brought into a herd of perfectly healthy animals it becomes a menace to the health of that herd, no matter what the conditions are under which the cattle are kept, so long as they cohabit in an unrestricted way. Let no man flatter himself that his herd is safe in the presence of a single case of tuberculosis, no matter what the extent of acres over which they may range. True, these favorable conditions will lessen the chances of infection, but they can not remove them. Several instances have come under our observation where badly infected animals came from the best kept breeding herds in the State.

Cases that are fairly established may be hastened rather than retarded by out-door conditions when these mean exposure to all the inclemency of the unfavorable season. The protection of a comfortable barn, though not in the very best sanitary condition, may prolong life beyond the period that would be reached were the creature forced to fight for existence against storms and sudden changes of temperature.

SYMPTOMS OF THE DISEASE.

"What are the symptoms of the disease?" is one of the questions most frequently asked by the farmer. It is a difficult question to answer, because of the extent of detail involved in making a full statement of the case. From what has been previously said herein, it will be understood that almost any organ of the body may be the seat of disease. The symptoms will be correspondingly various. The pulmonary type, or that form of the disease in which the lungs are extensively affected, may be said to be the typical form. In nearly all cases where the disease is allowed to run its course, the evidence of lung affection will soon become apparent before death relieves the animal. This form of the disease is attended with difficult respiration, high temperature, frequent and feeble pulse, painful cough, failure of milk, emaciation, diarrhœa and finally death. Occasionally the first symptom may be severe lameness from tubercular deposits in the articulations. Swelling and abscesses about the throat and udders of cows, are not unfrequent manifestations.

When non-vital organs are the first seat of the disease the animal may continue in a fair state of general health for months and even years. Doubtless there are occasional cases of final permanent recovery. The disease in nearly all cases assumes a chronic type, which is misleading to the owner. But it must be accepted at once and for all, that it is impossible to detect any considerable proportion of the cases at any given time, by the most searching physical examination of the expert. If it is the fixed purpose of the owner to find the real extent of the infection in a diseased herd, he must have recourse to slaughter or apply the tuberculin test.

RELATION OF MEAT AND MILK SUPPLY TO PUBLIC HEALTH.

That the mortality in the human family from tuberculosis exceeds the death roll from all other infectious diseases put together, is a generally admitted fact. Statisticians place the death-rate from this cause as high as fourteen per cent. At some of our Indian agencies where the habit of eating uncooked meat is general, the mortality statistics show that as high as fifty per cent of the deaths is due to tuberculosis. It is a very difficult matter to determine approximately how much of the mortality from human consumption is to be attributed directly to infection from the lower animals. The causes in most of the cases are so hidden in obscurity that a definite explanation is impossible. But there is abundance of positive proof, and still more collateral evidence, to show that the food supply derived from the animal kingdom is no small factor in the distribution of the disease.

There are few experimenters who have been close observers of these phenomena who can not cite cases that point at least in the direction of these conclusions.

One case came under our observation, where five young people between the ages of twenty and thirty years, died of consumption from one family during a period of two years. Not a trace of the disease had ever been known in the family of either the father or mother of the victims. On the farm where these deaths occurred we found some seventeen cases of tuberculosis in the herd of cattle, and others had died before the investigation was made.

Another fact of history in connection with a diseased herd that was under test, is worthy of mention. A mother and child died; the mother from undoubted consumption, the child from intestinal trouble highly suggestive of the same disease. The cow that had supplied milk to the mother and child was tested and found to be tuberculous. Post mortem examination on this cow revealed a badly tuberculous condition of the udder. Similar observations on the part of other station workers and practicing physicians have been made so frequently that the conclusion is unavoidable that in some extent to our meat supply, and in a much larger way to our milk supply, can be traced many of the cases of tuberculosis in the human family.

TUBERCULOSIS IN RELATION TO ANIMAL INDUSTRY AND PUBLIC HEALTH.

ITS PREVALENCE AND RELATIVE IMPORTANCE.*

Tuberculosis is so extensively prevalent and proves such a veritable scourge throughout the civilized world that no disease is so deserving of close and accurate study, or of the enforcement of effective measures for its suppression. Cholera, yellow fever and small pox, which occasionally invade our territory, creating universal terror and dismay, claim but few victims as compared with this ever-present, universally devastating plague. These other plagues are quick, severe and fatal, it is true, but for this very reason they can be promptly recognized and checked and even stamped out, whereas tuberculosis is equivocal and underhand in its methods, slow and uncertain in its progress, and on this account escapes recognition and proves by far the most deadly of any single disease attacking the human family. The average ratio of deaths from tuberculosis to the total mortality is fourteen per cent, or one death in every eight, while under special conditions it rises to one in three, as in the Marquesas islands, or even one in two, as in some of our Indian reservations. Tuberculosis may be classed with "the pestilence that walketh in darkness," while the three other diseases named are like "the destruction that wasteth at noonday." But the deaths from tuberculosis being constant and uniform, people accept them as inevitable and fold their idle hands with true Mohammedan fatalism instead of boldly exposing the hidden deathtrap and cutting short its destructive work.

If the five thousand four hundred and ninety deaths from tuberculosis which occur every year in the city of New York could be brought together in an epidemic lasting but one week, no small pox, cholera nor yellow fever scare would approach

*By James Law, Veterinary Division, Cornell (N. Y.) University Agricultural Experiment Station.

the panic which would thus be created; for when did all three diseases together create such mortality in this city? Nay, if we take the whole civilized world and compare with the tuberculosis mortality, all the accumulated deaths from war, famine, plague, cholera, yellow fever and small pox we find that the latter are comparatively very insignificant. Yet tuberculosis, like every germ disease, is absolutely preventable, and is allowed to continue its career of death only because of reprehensible ignorance and criminal indifference.

ITS PREVALENCE IN THE LOWER ANIMALS.

Few if any diseases maintain a sway over a more numerous genera of animals than tuberculosis. Among the domesticated animals, cattle are perhaps the most susceptible, but chickens, guinea pigs, rabbits, swine and goats become victims almost if not quite as easily. Some have thought that dogs, cats, sheep and horses are exempt, but when inoculated with tuberculous material these all contract the affection readily enough. The fact that they do not contract it in such numbers in the usual way is probably due in part to the greater amount of out-door life which they enjoy; also to the fact that they have more exercise which secures for them a better developed and higher conditioned muscular system, and full stock of constitutional vigor. After making all these allowances, however, it must be granted that these four classes of animals enjoy a native intolerance to this disease to which the first six classes mentioned are comparative strangers.

Among the less domesticated animals which contract tuberculosis may be named caged apes, lions, kangaroos, deer, elk, gazelle, antelope, birds, and, in addition, the rats, mice and other vermin in our houses and barns. All must, therefore, be considered as possible bearers and disseminators of the infection, and no such animal (indeed, scarcely any animal) can be left out of account in any systematic attempt to root out the disease. Some, however, are justly held to contribute more than others to the maintenance of the affection, and in this sense, in addition to man himself, we must consider as preeminently bearers of this disease, cattle, fowls and pigs.

Accurate statistics are wanting to give the rates of tuberculous animals in our herds, as we have no systematic professional inspection of live animals and of those killed for human food. Even in the large cities of Europe, where such inspections are

obligatory in the case of carcasses, the data given are so variable as to suggest the acceptance of different standards in the various cities and countries. Thus tuberculous cattle are said to number: In Bavaria, 0.$\frac{5}{100}$ per cent (Goring); in Augsburg, 0.$\frac{5}{10}$ per cent (Adam); in Baden, 0.$\frac{5}{1}$ per cent (Lydtin); in France, 0.$\frac{5}{1}$ per cent (Arloing); in Belgium, 0.$\frac{5}{1}$ per cent (Van Hertsen); in Paris, six per cent (Friedburger and Fröhner); in Holland twenty per cent (Schmidt); in Pommerania and Bomberg, fifty per cent (Schanz, Albrecht); at Hildsheim, Hanover, sixty to seventy per cent (Haarstick); in Leipsic, twenty per cent (Rieck); in Edinburgh, twenty-six per cent (Cope, McFadyean). American figures given by the Bureau of Animal Industry are for Baltimore (mostly cows), 2.$\frac{5}{1}$ to 3.$\frac{5}{1}$ per cent, and for the packing centers (among two million two hundred and seventy-three thousand five hundred and forty-seven, mostly steers), 0.$\frac{5}{1}$ per cent. It must be noted that the data from Baltimore are somewhat too favorable for city cows, as the cows were largely from infected dairies, where the more rapidly fatal lung plague carried off many before time had been allowed for the development of tuberculosis, and, as the vacancies were speedily filled by fresh cows from country districts, the results give the ratio for country herds, rather than the normal proportion for the city. The splendid showing for the steers must also be qualified by the remark that the fat and apparently healthy are alone sent to the large distant market, while the unthrifty are held back lest they should spoil the sale.

Steers further largely escape on account of their out-door life with less opportunity for infection, and because they are, as a rule, killed at three years old and under, and tuberculosis becomes more and more prevalent with the advancing age of the stock. In a large aggregate number of German abattoirs, cows suffered in ratio of 6.$\frac{5}{1}$ per cent; oxen, 3.$\frac{5}{1}$ per cent; bulls, 2.$\frac{5}{1}$ per cent; and calves and yearlings, one per cent. In Leipsic, tuberculous cows were twenty-six per cent; oxen, 19.$\frac{5}{10}$ per cent; bulls, 15.$\frac{5}{1}$ per cent; and calves, 9.$\frac{5}{1}$ per cent.

In infected breeding and dairy herds in New York, consisting largely of mature cows I have found a maximum of ninety-eight per cent, and a minimum of five per cent. Again, in healthy country districts, I have found hundreds of cows in adjoining herds without a trace of tuberculosis among them.

TUBERCULOSIS CONTAGIOUS.

In the middle ages tuberculosis in animals was recognized as contagious and laws were made against the use of the affected carcasses as human food, which remain in force in Italy and Spain to the present day. In the sixteenth century the disease was confounded with syphilis and at the end of the eighteenth century with glanders, blunders which, however untenable, show the strong conviction that the malady was contagious. The propagation by contagion in herd was recorded in Germany by Ruhling (1774), and Crunitz (1787), and more recently by Spinola, Zannger and others. In France the same is claimed by Fromage, Huzard, Lafosse, Dupont and Cruzel.

It must be allowed, however, that in the first half of the present century, the manifest tendency of the disease to run in families, and to develop under special unwholesome conditions of life, served to weaken the belief in contagion, and in central and western Europe such belief had become practically extinct among medical men, when their attention was recalled to the subject by the successful inoculation of tuberculosis on rabbits and guinea pigs, by Villemin, in 1865. The subject was taken up on all sides by incredulous experimenters and for a time a keen polemic warfare raged, but slowly the stern logic of constantly accumulating and unanswerable facts compelled all candid observers to accept the doctrine of contagion.

THE GERM—BACILLUS TUBERCULOSIS.

An even fuller demonstration came in 1882, when Robert Koch, of Berlin, demonstrated the existence of the tubercle bacillus, and showed that the disease could be produced with equal certainty by inoculating with the substance of a tubercle from the ox's lung, or with a pure culture of the germ grown on peptonized gelatine, apart from the living body. Before publishing his discovery Koch demonstrated the presence of the bacillus in the expectoration or tubercle of over one hundred cases of consumption, and had successfully inoculated four hundred and seventy-two subjects—guinea pigs, rabbits, mice, rats and cats, besides dogs, pigeons and chickens. The following are some of the characteristics of the germ:

Form.—A delicate rod with rounded ends, 1.$\frac{5}{1}$ to 3.$\frac{5}{1}$ micromillimeter in length (about $\frac{1}{12500}$ of an inch). They occur singly or in pairs or chains of three or four connected end to end. When cultivated on blood-serum the groups tend to form elongated, rope-like colonies, having a waving or serpentine outline.

Staining.—It is characteristic of this bacillus that it absorbs coloring matters very slowly and once stained retains its color with great tenacity. This enables the microscopist to distinguish this amid a mass of other microbes. The opaque particles in sputum or a section of the tubercle is stained by prolonged exposure to a warm alkaline solution of an aniline pigment; it is then bleached by a solution of nitric acid (1:3); it is then washed and slightly stained with a color which will contrast with the first; finally it is washed, mounted and examined under the microscope. The rod-like bacillus tuberculosis appears stained with the first color while the other bacteria, if any, are stained with the second.

Biology, Life-history.—The bacillus tuberculosis lives mainly as a parasite in the animal body, but may be cultivated on the ordinary culture media containing five per cent of glycerine and makes the best growth at 100° to 102° Fah. A temperature of 158° Fah. for ten minutes is fatal to it (Yersin). Unlike many bacilli this shows no spontaneous movement at any stage of its growth. Its development is slow in any medium, the earliest signs of growth being visible only after ten to fourteen days.

Vitality.—As it has great power of resistence to the entrance of coloring fluids, so this germ can hold its own for a length of time against destructive agencies. It retains its vitality and infecting power for nine to ten months in dried expectoration (Koch, Schill, Fischer, De Thoma). In tuberculous cow's lung, dried and pulverized, it infected Guinea pigs after one hundred and two days. In putrid matter it infected after forty-three days (Schill, Fischer) or one hundred and two days (Cadeac, Malet). It is not destroyed by gastric juice (Baumgarten, Fischer, Falk).

In sputum it perishes in twenty hours in a three per cent solution of carbolic acid, in a saturated aqueous solution of salicylic acid or in saturated aniline water (Schill, Fischer); in five minutes by iodoform ether; in ten minutes in sulphuric ether or mercuric chloride (1:1,000); in three hours in thymol. It dies in a few hours in direct sunlight, and in five to seven days in diffuse daylight (Koch). In an ordinary room it gradually weakens but remains virulent for at least two and one-half months (Sawiskey).

INDESTRUCTIBILITY OF THE GERM.

Drying and Heating.—The substance of a tubercle, like expectoration, may be dried up and reduced to powder without lowering its virulence, provided too much heat has not been employed in the drying. Although an absolute heat of 158° Fah. for fifteen minutes is fatal to the germ, yet in virulent masses, as in meat, it is difficult to determine the actual temperature at all points, and tests are, therefore, often misleading. Thus Toussaint found that broiled steak, the interior of which, by his tests, had reached 163° to 176° Fah., was still infecting. Martin heated tuberculous matter in sealed tubes to 212° Fah., and found that even then some germs would exceptionally escape. Chauveau and Arloing found that nothing survived half an hour of the boiling temperature, and Galtier found that 162° Fah., which coagulates albumen, sterilizes completely if kept up for a sufficient length of time. If, in cooking meat, the blood (albumen) is not coagulated, but oozes out as a red fluid, the temperature has not been enough to insure the death of the bacillus. Where there is a risk of tuberculosis, therefore, *rare* steaks must be refused.

In milk, as in meat, heat is effective, but at 162° Fah. the continued albumen is coagulated, the liquid acquires the boiled flavor, a tendency to constipate, and a diminution of its digestibility and nutritive qualities. In sterilizing this liquid, therefore, for infants and invalids, it is better to keep the temperature at 158° Fah. for a longer period, say half to one hour continuously.

Drying of the tuberculous matter indoors or in the shade, and apart from the above temperature, and its inhalation as fine dust, is one of the most common causes of tuberculosis. In one store, with a tuberculous clerk, the dust raised in sweeping out the store infected clerk after clerk, and a similar rising of the virus in dust is a cause of infection in dwelling houses, stores, barns, barnyards, stockyards and railroad cars. It is now allowed that the infecting matter dried on the handkerchief and shaken out in the air is one of the most prolific sources of infection. So, in animals, a manger smeared with the discharge of a diseased animal retains the virus in an infecting state, and infects the next susceptible animal fed from it. Hence, long before the days of Koch and his discovery of the bacillus, the infection of animal after animal which occupied

the same stall in succession had convinced observant stock owners and veterinarians of the contagion of the tubercle.

Survival in Water and Moist Earth.—Galtier found that the *Bacillus tuberculosis* was preserved indefinitely in springs, ponds and wells at all ordinary temperatures. Hence the danger of common drinking-troughs, of streams that have run past infected herds, or the places where their manure has been put, and of soil that has received the manure or carcasses of the deceased. The danger from soils is less from dust blown from the surface and which has been presumably devitalized by prolonged sunlight, than from the earth that is pulled up attached to the roots of the turnips, beets and carrots, or to tubers like potatoes. Grain crops may, therefore, be grown with greater safety on infected soils, than can root crops.

Freezing.—The germ survives a freezing temperature. Galtier kept tuberculous matter at different times in a frozen state for four and five days respectively and found it still infecting. Neither the Winter's frost, therefore, nor the usual alterations of temperature in the soil can be trusted to speedily disinfect it.

Putrefaction is not fatal to the germ (Cornil, Babes, Mallassez, Vignal, Galtier, etc.)

Heavy salting of the meats has been thought to be fatal to the germ in one month. After fifteen days in salt the germ failed to kill rabbits, but still killed the guinea pig, whereas after thirty days it killed neither (Galtier). In salting, however, the meat is impregnated unequally in different parts of the same mass, and therefore, as in the case of a temporary heating, this can not be relied on as a safe measure of disinfection.

The comparative indestructibility of the germ under any of these conditions show that the slow absorption of pigments by the bacillus is significant of an equally tardy penetration by other hurtful agents, and of a corresponding power of resistance to ordinary disinfectant agents.

ACCESSORY CAUSES OF TUBERCULOSIS.

While all must today recognize that the one essential cause of tuberculosis is the bacillus, yet it is wrong to ignore the fact that many conditions of the animal system and its surroundings contribute to the propagation of the disease, or retard its progress. While none of such accessory causes can generate tuberculosis in the absence of the bacillus, yet when that diseased seed is present, these conditions often serve to sway the balance toward its advancement and diffusion, or its restriction and suppression. A suitable soil and favorable climate is no less essential for the vigorous growth of the microscopic vegetable microbe, than for the Florida moss or the palm.

Among the most efficient accessory causes may be named:

a. Hereditary Predisposition.

Consumption runs in families and it has long been supposed that this was essentially a family—that is, a hereditary disease. But as a matter of fact it is extremely rare to find the offspring tuberculous at birth or before. In many thousands of pregnant tuberculous cows killed in the slaughter-houses of Europe not more than ten tuberculous calves have been found. To the same effect is the fact that in calves under a year old, born of cows, six per cent and upward of which prove tuberculous, the ratio of tuberculosis is often below one per thousand. In Saxony, with the ratio of tuberculous cattle 16⅞ per cent, that of tuberculous calves was only two per thousand. At Lyons, out of four hundred thousand calves slaughtered only five were found tuberculous, and at Munich, out of four hundred thousand but two tuberculous. Again, in such calves the tubercle is found in a very large proportion of cases in the bowels and adjacent glands, suggesting infection after birth through the milk, rather than in the liver and lungs, which would have been its natural seat if conveyed before birth through the blood. Not a few of the obstinate and fatal bowel diseases of sucking children and calves are in reality tuberculosis of the bowels induced by the infected milk.

What runs in a family, then, is rarely hereditary disease:—it is in the great majority of cases only a hereditary susceptibility to the disease, tuberculosis. But it is none the less a fearful legacy, being often so potent that the disease attacks certain families as a matter of course, while other families can count on a practical immunity. In the human family this is notorious. In cattle it is no less remarkable. In the Burden herd of Jerseys, in 1877, I made examinations, and condemned eleven animals, verifying my diagnoses by examinations after death, and found to my surprise that I had taken every representative of a given family, and left the pure bred members of the second family untouched. Both families had mingled freely in the pastures and yards, yet the second family furnished no tuberculous cases and remained sound from that time onward.

b. Close Buildings, Lack of Ventilation.

Air rendered impure by repeated breathing is so favorable to the propagation of tuberculosis that it has been looked upon as the sole cause (Macormac). Though now certain that this can not produce tuberculosis at all in the absence of the germ, yet it is such a potent accessory cause when the bacillus also is present, that its importance can not be too highly appreciated.

For the mild cases of tuberculosis in man life in the open air day and night, in a genial climate with pure air affords one of the best grounds of hope of recovery or mitigation In the Burden herd above referred to, animals condemned in the Spring spent the Summer at pasture, with a general appearance of perfect health, yet when returned to the barns in the Fall, they fell off so that soon some of them had to be helped to rise in the stall. All the world over city dairy cows are notorious for tuberculosis. In Europe where the country cattle are affected in a ratio of one to two per cent, those in the city dairies suffer to the extent of six to twenty per cent and upward. Of our plains and prairie steers the government inspectors, at the abattoirs, condemned as tuberculous but 0.$_{\frac{1}{10}}$ per cent, whereas of the city dairy cows, mostly recently from the country, they condemned $_{\frac{33}{100}}$ per cent. The ratio is one steer to sixty cows, a most striking showing in favor of an open air life.

c. Dark Stables.

Dark stables are usually dirty and ill-ventilated, and as such lower the general health of the inmates and strongly predispose them to tuberculosis. The darkness, however, acts indirectly in depriving the tissues of the body of their due supply of air. The formation of green pigment (chlorophyll) in plants and that of red pigment in the blood globules are alike due to the action of light. In darkness both disappear. But the red globules of the blood are the bearers of oxygen to all parts of the body, and if these globules are deficient the whole body is denied its due aëration. The final result is as if the air contained little oxygen, in other words, as in the case of a close building without any means of renewing the air.

d. Insufficient or Unwholesome Food. Overtaxing.

Lack of food, and indigestible or innutritious food, agree in producing practical starvation and weakness with increased susceptibility to tuberculosis. Hence, this disease is the scourge of the half-starved poor, and no less of the rich who abuse their digestive organs and court chronic dyspepsia. So, too, in our dairy herds the stimulating ration-for-milk, the warm drinking water, and warm atmosphere, together with the enforced rest in the stalls for months at a time, and the clean, careful milking soliciting the gland to act to its extreme capacity, all tend to a lowering of the general health and an increased susceptibility. This sufficiently illustrates how the cow which has been made a milking machine, and which to this end must produce a calf every year, becomes dangerously susceptible to any tubercle bacillus to which it may be exposed. We have developed most valuable qualities at the expense of hardihood, and we must take the consequence. The argument is not that we should part with acquired powers which give the animal its high value, but that we should recognize the attendant dangers and rigorously exclude the tubercle germ.

e. Breeding too Young.

Breeding of immature animals is a most fruitful accessory cause of tuberculosis, as the demands made upon the system for further growth, for the nourishment of the unborn offspring, and later for the nursing of the calf, or for the dairy yield, undermine the strength and vigor. In different families of that marvelous dairy cow, the Jersey, this has been carried to such an extent that discredit has been thrown upon the whole breed as one especially prone to tuberculosis

f. Inbreeding. High-breeding.

Inbred families of cattle are proverbially subject to tuberculosis. This is due partly to resulting constitutional weakness, which often shows itself in an increasing indisposition to breed to near relatives, though still fertile with strangers. More frequently it depends on the intensifying and fixing of personal and family characters. The susceptibility to the germ being equally strong in both parents, becomes intensified in their common offspring, just as the beef or dairy characteristics are improved. Indeed, the qualities which make an animal valuable for the butcher or milkman are exactly such as favor tuberculosis. The germ of this disease lives by preference in the lymphatic system, either in the lymphatic glands or in the loose connective tissue forming the lymphatic networks leading to these glands. Now the breeds which are preëminent for

early maturity and rapid fattening, or for a high yield of milk, are remarkable for their excess of connective tissue, as shown by the delicate, mellow skin, and in the case of the Channel Island cattle by the unusually large lymphatic glands. This helps to explain why certain families of beef-making cattle have been virtually ruined by tuberculosis. Yet it would be equally wrong to abandon the improvement of our beef and our milking breeds. The improvement already attained is essential to successful competition in the market, and prospective improvement will be no less essential in the future. The true and only real remedy is the extinction and exclusion of the bacillus of tubercle.

g. Ill Health.

All acute and chronic diseases leave the system weak, and with less power of resistance to other diseases. Above all, we must fear long standing diseases which produce emaciation and weakness, fevers which interfere permanently with the blood-forming processes, diseases of the digestive organs, which hinder the requisite preparation and absorption of nutritive elements, and diseases of the lungs which form a raw or weakened surface on which the bacillus can grow without hindrance. Again, the germ lives best in a slightly alkaline or neutral medium, and is weakened in the acid contents of the stomach during vigorous digestion. But in indigestion the contents may be too much lacking in acidity to prove hurtful to the germ, and the imperfectly digested morsels, enclosing the bacillus, may be passed on unchanged into the alkaline intestine, a field especially favorable to the development of tuberculosis. Again, in the intervals between meals, when the acid secretion is arrested, the bacillus in drinking water may easily pass through the sentinel stomach to develop in the intestines.

h. Chemical Poisons in the Tuberculous Body.

The soluble chemical poisons in meat and milk of consumptives will be noticed later as a potent cause alike of susceptibility to tuberculosis and of its more rapid progress when already in the system.

LESIONS AND SYMPTOMS OF TUBERCULOSIS.

Tuberculosis appears under two great types: the acute and the chronic, the first of which may run a fatal course of four to six weeks, while the second may last for many years. At the outset in the acute form, and for a great length of time in the chronic, the disease-process may be confined to one organ or to one region of the body and therefore the symptoms may vary exceedingly according to the particular organ attacked. In many chronic cases, with the tubercles confined to one organ or locality (lymphatic glands, liver, spleen, pancreas, etc.) the victim may be in good condition and no sign of disease may be recognized by the owner or even the veterinarian. In acute cases, on the other hand, and when the tubercles are generally diffused through the body, there is usually fever, wasting and emaciation in addition to the characteristic symptoms of disease in particular organs.

The lesions being caused by the colonization and local multiplication of the bacillus they tend to assume a rounded or nodular form, from which has been derived the name of tubercle. Such nodules may, however, be absent, the diseased product, being a diffuse infiltration and thickening of the affected part. The early nodule may vary in size from a millet seed up to a pea or more. It is at first red, congested and firm; soon it may become gray in the center, though still red outside. With the grayish discoloration comes a gradually extending death of the mass (coagulation necrosis) and disintegration into a more or less soft cheesy looking material (caseation). In cattle and chickens this cheesy nodule tends to remain firm and it may even become gritty through impregnation with earthy salts (calcification). Exceptionally it will soften into a semi-liquid whitish debris, resembling an abscess, and this excessive softening is the usual course of tubercle in swine. In some cases, however, the tubercle does not break down into a dead cheesy mass but develops into firm fibrous rounded nodules hanging in clusters from the lungs, inside of the ribs, or skin, and known as pearl disease (perl-knoten), grapes, etc. This form is particularly common in cattle. In man may be found nearly all forms of the disease, the primary hard red congested nodule, the same with its grayish disintegrating center, the firm caseated mass, the same further softened into a white or yellowish semi-liquid pus-like mass, and in addition an open unhealthy sore caused by the breaking down of the tuberculous growth on the skin (lupus), or intestine, etc. Similar tuberculous sores are found on the skin of mucous membrane (bowels, throat) of cattle and other animals. In all the many forms and seats of the disease the bacillus may be found in the affected

parts, and the morbid discharges from the lungs, skin, open pores, etc.

SYMPTOMS IN CATTLE.

a. Tuberculosis of the lungs.—In the chronic cases which are by far the most common this may last for months and years unperceived; in acute cases it may prove fatal in a month.

In recent, slight, chronic cases there may be no other ground of suspicion than an occasional cough when the animal leaves the hot stable for the cold outer air, when it is suddenly raised in the stall, when it is run for a short distance, when it drinks cold water or eats dusty food. The cough is usually small, dry, wheezing and may be repeated several times. When run or driven rapidly the animal proves short winded. Yet it may show as good spirits, as clear, full an eye, as smooth glossy a coat, as supple and mellow a skin, as good an appetite, as rich and abundant a flow of milk, and as much propensity to fatten as its healthy fellows. An accomplished diagnostician may detect altered sounds on percussion and anscultation of the chest, but from the difficulty introduced by the heavy muscular shoulder, the frequent variations in the size of the heart, the rumbling and crepitating sounds from stomach and bowels, which, according as they are full or empty, press forward and diminish the size of the lungs, and greatly mask or modify the results, even the able practitioner can not be trusted to detect these, and the case fails to be recognized. There may be a flow from the nose in which bacilli should be detected by the microscope, but cattle have a habit of cleaning the nose with the point of tongue, so that the virulent particles are difficult to secure, and when secured they prove to contain few bacilli so that a failure to find these would not be so reassuring as it would be in man. As a large proportion of cases of chronic tuberculosis of the lungs are of this kind the tuberculin test, to be noted below becomes practically indispensable.

When the lungs become more extensively involved, symptoms are more distinct and reliable, and the animal usually falls off in condition, yet in many cases cattle in good condition are killed for beef and the lungs and ribs are found to be literally covered with clusters of fibrous tubercles (grapes). Usually in advanced cases the hair is dry, lustreless, and erect in patches, especially along the back. The skin is dry, powdery and rigid, without its customary mellow touch or mobility on the parts

beneath. The eye is less prominent and brilliant, the breathing is more easily accelerated, the cough, more frequent and easily roused, is often gurgling or rattling, and may cause a discharge from the nose of a whitish, flocculent, sometimes gritty material. In the flocculi bacilli may sometimes be found. The breath is heavy and mawkish. Pinching of the back at the shoulders or loins may cause wincing, groaning or cough, as may also pinching above the breastbone or striking the ribs with the fingers or fist. Percussion over the ribs reveals spots where there is a lack of resonance, apart from the solid masses of the heart, liver, spleen and stomach contents, and listening over these spots will detect that variety of morbid sounds familiar to the physician, the most prominent being rubbing, wheezing, creaking or fine crepetation, mucous rattling and various blowing sounds. A remarkable feature of tuberculosis, distinguishing it from many other forms of lung consolidation attended by unnatural sounds, is the occurrence of such changes in patches with intervening spaces of sound lung. Ordinary inflammations more commonly attack one portion and spread from that as a center extending the solidification in one or all directions. Arrived at this stage, the animal usually fails to make flesh satisfactorily on the best feeding, and milk is not only lessened but becomes poor, blue and watery.

The tubercles tend also to form more in other organs, notably the lymphatic glands and bowels, and digestion and assimilation being thus seriously interfered with, emaciation advances more rapidly. This advance may be largely accounted for by the fact that the infecting expectorations brought up with the cough are largely swallowed to affect stomach and bowels. The animal has now diminished, and capricious appetite, irregular, infrequent, slow rumination and slight bloating after meals. The body temperature is more variable and more frequently high than in the slighter forms.

In the advance stages of lung tuberculosis everyone can recognize the consumptive animal. It is miserably poor and wastes visibly day by day, the dry coat of hair stands erect, the harsh, scurfy skin clings tightly to the bones, the pale eyes are sunken in the sockets, tears run down the cheeks, a yellowish, granular, fœtid and often gritty discharge flows from the nose, the breathing is hurried and catching, the breath fœtid. The cough is weak, painful and easily roused by pinching the back or breast or striking the ribs. Tapping the ribs

with fingers or fist and applying the ear detect far more extensive changes, including in many cases evidences of blowing into empty cavities (vomicæ) and loud gurgling. Temperature may vary from below normal to 107° Fahr.

In all such cases there is extension of the disease to distant organs and symptoms as given below, complicate those of lung disease. To give means of diagnosis of tuberculosis from some diseases of the lungs which most resemble it in symptoms (lung worms, hydatids, actino-mycosis, lymphadenitis, etc.) would unduly extend this article without corresponding advantage to my present class of readers.

Tuberculosis of stomach, bowels and mesenteric glands.—In young animals living on milk, tuberculosis of the bowels and glands gives rise to indigestion, fœtid diarrhœas, bloating, and finally enlargement of the superficial lymphatic glands and the affection of the lungs if the animal should survive long enough. In older cattle there are impaired regular appetite and rumination, slight bloating after meals, a tendency to scour when liberally grain fed, costiveness alternating with scouring, colics, and usually a more pronounced wasting than with the lung disease. The oiled hand introduced into the last gut may detect the enlarged mesenteric glands which must be carefully distinguished from hardened fæces in the bowels from the ovaries, from masses of fat, etc. The temperature is raised in proportion to the activity of the tubercular process.

Tuberculosis of womb and ovaries.—These and their supporting membranes or ligaments are often implicated in the bowel disease giving rise to undue generative excitement. They may also become primarily infected through coition. The affected cow is usually sterile, sooner or later parting with any ovum that may have been impregnated. Later her *heats* may become more intense and last longer, and never lead to impregnation. The cow spends most of her time wandering around, bellowing for the bull, and neglects to eat or ruminate and wastes away rapidly. There is often a whitish discharge from the vulva. The temperature is elevated and general tuberculosis sets in sooner or later.

Tuberculosis of the liver, spleen or pancreas.—The liver is one of the first organs to suffer in infection through the stomach and bowels, and it may be exclusively affected in calves and even in mature animals. Tuberculosis of the liver may be accompanied by impaired appetite and digestion, bloating after meals and, in exceptional cases, by jaundice, but often an indefinite ill-health is all that can be detected. Pancreatic and splenic tubercle are marked by a similar obscurity of symptoms. It is usually only when the disease begins to be generalized that distinct, objective symptoms are available.

Tuberculosis of the kidneys and bladder may be attended by extra sensitiveness of the loins to pinching and by frequent passage of urine, more or less discolored by blood or mixed with purulent matter. Examination of the microscopic blood casts in the urine after having stained them may reveal bacilli.

Tuberculosis of the throat. Pharyngeal glands.—This is one of the most common types in cattle. Attention is usually first drawn by a wheezing breathing, the sound manifestly coming from the throat, and the glands around that part are felt to be enlarged, unequal on the right and left sides, or shrunken and of a gristly hardness, or softened and even fluctuating on pressure. The formations above the throat and beneath the first bone of the neck are particularly liable to undergo this special softening. There is usually a loose gurgling cough, some difficulty in swallowing, and a slimy discharge from the mouth. Small tubercular growths may exist on the lining mucous membrane, and this sometimes extends into the air passages causing *tuberculosis of the larynx* with a persistent paroxysmal cough and a harsh, altered voice.

Tuberculosis of the udder.—A portion of a single quarter is usually first affected, causing a circumscribed swelling, harder than the rest of the gland, but not hot nor painful, and this gradually extends to the whole udder. With this extension the gland becomes harder, and the milk lessened, more watery, and clotted, and the lymphatic glands in front of the udder and behind are enlarged and hardened. The gradual advance of the disease serves to disarm the milker of any suspicion and the milk is commonly utilized until its watery or grumous appearance draws special attention to the gland. The case may be tested by inoculating with the milk, or less satisfactorily by a microscopic search for the bacillus, or the tuberculin test may be applied.

Tuberculosis of the lymphatic glands.—In cattle the lymphatic glands are often found to be tuberculous to the exclusion of internal organs, and as this form of the disease tends to become chronic it is likely to be overlooked for a length of time. Wherever a group of these glands exists, there may be tuberculosis. In addition to those already cited may be here named:

a. The submaxillary glands situated on the inner side of the lower jaw at the point where the pulse is felt. These which are almost imperceptible in their natural condition may swell up to any size, soften, burst, and discharge a cheesy matter. They are most liable to be confounded with actinomycosis of the same region, but do not show the almost microscopic hard yellow clusters of the actinomyces. They yield in place the specific bacillus.

b. The glands at the root of the ear.—These swell in front or behind the ear, soften and like the submaxillary glands they may or may not burst and discharge.

c. Glands inside the chest, mediastinal, bronchial, etc.—The mediastinal and bronchial glands lying between the lungs in the center of the chest are often affected independently of the lungs and give no easily available symptom. A persistent, nervous cough and some unthriftiness, though on good, liberal rations, may arouse suspicion, but can not lead to diagnosis. If the *glands on the walls of the gullet* (*œsophagean*) are implicated the vagus nerve and stomach may be involved and digestion, rumination and the eructation of gas may be interfered with so that chronic bloating may be added to the suggestive, though by no means diagnostic, symptoms. Equally obscure are the indications of the *glands beneath the back bone and those above the breast bone.* Of the more superficial glands of the trunk the following are the most easily examined:

d. Glands in front of the shoulder blade.—This group is in front of the middle of the shoulder blade, and may easily be seized in the hands in thin cattle. If enlarged unequally on the two sides, or if very hard and nodular though small, suspicion may well attach to them. It is only on rare occasions that they burst and discharge.

e. Glands above the stifle.—These, placed on the side of the flank in front of the stifle, can also be grasped and examined. Indeed, in certain animals, notably in the Channel island breeds, they can be seen by the eye. Swelling, inequality, hardness, nodularity are the usual suspicious features. Often smaller pea-like or hazelnut-like masses are found scattered over the latteral walls of the belly from the last rib to the hip bones, and even in the interval between the two last ribs.

f. External inguinal glands.—In the male the glands on the sides of the scrotum, and in the female those on the sides of the udder may be felt to be enlarged when affected with tuberculosis.

g. The posterior cervical glands, situated in the lower end of the furrow that lodges the jugular vein, may be similarly implicated and recognized.

The deeper seated groups of lymphatic glands need not be individually referred to, for, though subject to tuberculosis, they rarely show as external swellings. Tubercles, however, may appear in any part of the skin. I have found a caseated mass like a hickory nut on the point of the shoulder, and fibrous, watery-like growths on the skin, and open unhealthy sores with hard fibrous surroundings may be fibroid tubercle.

It must be borne in mind that the lymphatic glands are liable to become congested and inflamed from other sources of irritation in themselves and in their vicinity so that the mere fact of disease of these glands is no sufficient evidence of tuberculosis. It is, however, ground for grave suspicion, and further exculpatory evidence is demanded.

Tuberculosis of bones and joints.—This is especially seen in young growing animals, being common in calves in badly infected herds. William Mueller has produced it experimentally by injecting the nutrient artery of the bone in a three-months goat. The bones most commonly attacked are those entering into the formation of the elbow and knee, the stifle and hock, and as the disease usually extends from the gristly, growing substance in the bones of the joint surface, the trouble is recognized as disease of the joints. In some instances, however, the disease begins in the lining membrane (synovial) of the joints and forms fungous growths extending into the bone. In the open (cancellated) tissue on the end of the bone it is at first red and congested, later it is partly fatty, and caseated. Usually the disease becomes general, but if it remains circumscribed, it is enveloped in a layer of dense, hard bone. The animal is very lame, perhaps even unable to rise, the joints swollen and tense, and the ends of the bones enlarged and tender. The disintegrated bone may even crumble and the sharp spiculæ protrude through the skin.

Further Indications of Tuberculosis.

The above outline of symptoms seen in cattle is rendered necessary by the invariable question: "How can I recognize it?" The intelligent reader will realize from the partial sketch above that it is no simple matter to diagnose tuberculosis. It is to be hoped that he will also have apprehended so much of

the subject as will save him from being victimized by the man who boasts loudly, but really knows little.

In the multitude of equivocal and occult cases further tests must be applied. These may be named as (1) microscopic search for the bacillus, (2) inoculation, and (3) injection of tuberculin.

Inoculation.—The first named test having been already incidentally referred to, inoculation may be noticed. This consists in the introduction into the peritoneum or other part, of a guinea pig or other animal or some of the suspected product (discharge from the nose, milk, juice from an enlarged gland, etc.). General abdominal tuberculosis should be present in the guinea pig in thirty days. Beside the delay, this has the drawbacks that the guinea pig may have been already infected before the inoculation, the portion of the suspected product may have been devoid of bacilli, though these were abundant enough in the animal from which it was taken, or the guinea pig may have become infected after the inoculation from being kept in an infected place, or from infected food, water, attendants, etc. We must first secure for the guinea pig the very guarantee we are seeking for the larger animal. Is it not then better to secure this for the larger animal first, and avoid all the subsequent sources of fallacy attendant on an inoculation experiment?

The tuberculin test gives prompt results and is less open to fallacy.

Tuberculin.

Tuberculin or *Koch's lymph*, consists in the concentrated, sterilized liquids in which the *Bacillus tuberculosis* has been grown. It contains no living bacillus; all germs have been killed by heating, but it does contain the chief poisons which are produced in the tuberculous body, and which bring about all the diseased processes in such body. A possible exception may be made of any such poisons as are destroyed by heat, if any such there be, in tuberculous products.

It must be distinctly understood that in every contagious disease there is, first, the germ which grows and multiplies in the susceptible animal system, but is not in itself and by its mere presence, necessarily injurious, and second, the products of the life of that germ which may or may not be poisonous. The many germs, which continually enter the animal body, have products that are not appreciably poisonous and, therefore,

produce no disease, whereas the few that do manufacture poisonous products cause our different contagious diseases. We find a counterpart in the yeast germ which in itself is virtually harmless to man, whilst the alcohol which it manufactures from sugar under certain conditions, is a poison more or less hurtful according to the susceptibility of the person taking it.

Tuberculin consists of chemical poisons which the bacillus secretes or manufactures, and on which the force and all the manifestations of tubercle in the tissues are chargeable. Having no living germ it can not increase its own substance, nor can it cause tuberculosis in a healthy system as it is soon thrown out of the body through the kidneys and other channels and its power for evil is at an end, yet none the less is it the immediate agent through which all the destructive work of tuberculosis is carried on. Where the bacillus tuberculosis lives and multiplies in the animal body these chemical poisons are being constantly formed, and thus its pernicious action is continuous, not only in the seat of the tubercle but through the whole system.

Tuberculin as a Test.

The tuberculin test is based on the fact shown by Koch that it increases the activity of the disease process in tubercle, and affects the whole animal body, producing a reaction or rise of temperature in a marked degree. On the ordinary tubercle as seen on the surface, the frequent use of tuberculin produced a more active process of cell growth leading to degeneration and death, so that there was a more speedy transition from the red congested nodule, through the grayish degeneration into the dead cheesy mass, cut off from all blood circulation. If this dead mass were sloughed off, leaving sound tissues to heal, that particular tubercle might be cured. But deeper tubercles usually exist and these are similarly stimulated and their degeneration hastened by the tuberculin; it is impossible for them to be cast off; the increasing masses of bacilli which have been produced under the rapid growth, are shut up in the solid tissues around to furnish new seed for a fresh extension of the disease. As such deep-seated tubercles usually do exist with superficial ones, they render tuberculin almost useless as a curative agent, since to eradicate the disease the deep caseated tubercles must be afterward removed by surgical means, a resort which might have been had at the beginning and without the use of tuberculin.

But this action, which renders tuberculin so objectionable as a curative agent, makes it of the highest value as a test of tuberculosis in animals. The minute dose, which has no effect on a healthy cow, horse or pig, when employed on the slightly tuberculous one produces an acceleration of the disease process and in eight to fifteen hours a material rise of temperature. This has been now employed on thousands of cows, and those who have used it most value it the most highly, whereas many who at first reported reactions in non-tuberculous animals are now acknowledging, with Nocard, that the fault has been mainly their own, for small tubercles were present but were overlooked through their failure to examine the bones and other organs.

The explanation of the reaction under tuberculin may be very simply stated. The dose is made so small that it will not affect a healthy cow under ordinary conditions. In the slightly diseased cow the system contains a certain amount of tuberculin produced by the bacillus in the tubercles, but to this the system has become accustomed and it causes no very appreciable fever. But when in addition to this we introduce into the body of this cow the small amount of tuberculin used for the test, the increased dose acts on tubercle and nervous centers alike and a fever is produced. So evenly balanced has been the tolerance acquired, and the amount of poison tolerated with impunity, that four drops of tuberculin will as a rule produce this elevation of temperature in the moderately tuberculous cow.

Objection to tuberculin as a test.—1. The temperature sometimes rises in a non-tuberculous cow after the use of the tuberculin.

This is true. So does the temperature sometimes rise in a non-tuberculous cow when no tuberculin has been employed. Every animal is liable to suffer from inflammation and fever, and if such inflammation and fever set in after the use of the tuberculin test they are liable to be charged to it as their cause. This is a valid argument against the reckless popular use of the tuberculin, but surely not against its use in skilled hands. The person who uses the tuberculin on cattle must be a trained veterinarian, acquainted with the different diseases of cattle, and on his guard against confounding any one of these with the temporary fever caused by tuberculin in the consumptive. If it is claimed that every rise of the body temperature after the use of tuberculin must necessarily demonstrate the existence of

tuberculosis, then truly tuberculin will be discredited. But if it is held rather that a rise of temperature after tuberculin, in a cow that furnishes to the most careful and skillful comparative pathologist no evidence of other disease, implies the existence of tuberculosis, the claim is substantially correct. To secure the valuable testimony of tuberculin, the practitioner must be highly skilled in the diseases of the animal operated on. If he is not he will be occasionally misled.

Again *heat* or *bulling* may come upon a cow after the use of the tuberculin and the temperature will rise two or three degrees. To call such a cow tuberculous would be inexcusable carelessness. Yet the condition demanded the rise of temperature after the use of tuberculin is present.

Again a cow that is closely approaching calving has the temperature raised. If tuberculin has been used it is often raised higher than it would be otherwise. It is, therefore, improper to use this agent on a cow at this period.

Active exertion, exposure in the hot sun, confinement in a close building, the privation of water at the customary time and other conditions will cause rise of temperature. But such a rise would not imply tuberculosis, even after tuberculin.

Apart from these and other such causes of error in unskilled hands, the rise of temperature under this test should be taken not as a condemnation of tuberculin, but as a stimulus to search for small occult tubercles. A thorough search will rarely prove fruitless.

2. The temperature sometimes fails to rise under the tuberculin test, though the animals be in the last stages of tuberculosis.

This also is true. Here the body seems to be already so saturated with tuberculin, that the small addition made in the test makes no impression, and if we trusted to the reaction alone, we would pronounce the cow free from the disease. But such cases are easily diagnosed without tuberculin. Even the unskilled more than suspect them, and a physical examination by the skilled practitioner leaves him in no doubt as to their condition. To use tuberculin on such cows is to waste an expensive agent and to run the risk of being misled. Objection based on blunders of this kind is valid enough as an argument against the use of tuberculin by the ignorant and thoughtless, but not against its use by an able practitioner.

3. Tuberculin causes reaction in even the slighest cases of tuberculosis, in which the victims would survive for years and might recover.

This charge is also true, and it is because of its truth that tuberculin is invaluable and indispensable as a diagnostic agent, in all attempts to put an end to the disease. An eminent German professor (Eggeling) in objecting to the use of tuberculin as a general test records the following experience. In a herd of thirty-seven reaction after tuberculin occurred in thirty-one, while six gave no reaction. When killed the six proved sound and the thirty-one without exception tuberculous. But of the thirty-one only one had general tuberculosis and was condemned as unfit for food, and one was sold as second-class meat. The twenty-nine brought first-class prices as meat, and having been only slightly affected would probably have lived for years without infecting others.

Now it is submitted that the German standard, as thus given, is not radical enough to secure safety for man or beast, nor to give hope of an early extinction of tuberculosis. The meat of an animal with two or three tubercles in one organ is generally, but by no means always, free from the germ. When the disease does extend from such isolated tubercles, as often happens, the germ is carried not only in the lymph, but in the blood, and, with tubercle in the body, no one can tell when the bacillus has passed into the circulation and reached the different organs. Tubercles usually form slowly, and the bacilli must have been in the blood for some time before they show as fresh tubercles in tissues and organs distant from the old ones. The meat of a tuberculous animal can never, therefore, be fully guaranteed as safe to eat. But again, while a cow with one or two tubercles only in lymphatic glands, may not be liable to transmit the disease to others, yet whenever an extension takes place the germs being carried by the blood and therefore throughout the whole system, there must always be danger of their escape from the natural surfaces (lungs, udder, liver, bowels, etc.) to infect other animals. And let it be borne in mind, this diffusion through the blood takes place before its occurrence is revealed by the formation of tubercles in new situations. So long, therefore, as a single victim of even slight tuberculosis is left in a herd it can only be looked upon as an invitation to a renewed extension of the disease. It also may become at any moment a source of infection for man

through the use of the meat or milk. It is only in degree that the contagion of tuberculosis differs, as to its sanitary aspect, from that of any one of the more contagious diseases; and, in all alike so soon as we attach more importance to the preservation of an infected animal that will probably recover than we do to the radical extinction of the disease, we undermine and destroy the effectiveness of our sanitary work. Practically all cases of foot and mouth disease recover; yet the frequently recurring epizootics of this disease each cost from five dollars to ten dollars per head over the entire bovine population. Of the victims of rinderpest and lung plague that do not speedily die, practically all recover. Are the slighter cases, therefore, to be kept alive to perpetuate indefinitely those disastrous visitations that sweep away values of hundreds of millions? Is the remorseless scourge of tuberculosis to be perpetuated, not only in herds but in our homes as well, to save for a few months or years some tuberculous cows? No country has ever dealt successfully with any of these animal plagues on the basis of preserving the mild cases for recovery. Always and everywhere it has been by the radical and thorough extinction of the disease germ, wherever found, that success has been achieved. While this can not be done for man, it must be done for our flocks and herds if we would ever cut off this prolific animal source of tuberculosis from the human race. Even as regards the herds themselves, the stock owner who would consult his own future interests would at any cost exclude from his barns and fields every possible source of future tuberculosis.

As will be shown below, the meat and milk of tuberculous animals contain tuberculin (even when they do not contain the bacilli), and serve to aggravate any existing or latent tuberculosis in man.

4. A fourth objection to the tuberculin test is its alleged liability to produce tuberculosis in healthy animals, or to aggravate it in the tuberculous ones.

Now tuberculin, properly prepared, is absolutely sterilized, so that it can plant no living germ nor start the growth of any tubercle in a healthy animal. The further claim that it aggravates tuberculosis which is already in existence is too true, and is the sound basis of its value as a test. As a means of testing the existence of tuberculosis in man, it can not be too strongly condemned, since no man has a right to seal the fate of his fellow for the sake of finding out if he has tuberculosis. The same

condemnation must be passed on the use of tuberculin as an alleged curative agent, except in those few cases in which the tubercle is confined altogether to the surface of the body, whence it can easily be sloughed off. The existence, or possible existence, of an internal or deep-seated tubercle in man should forbid the use of tuoerculin for diagnosis or for curative purposes.

The same remark would apply to animals if we adopt the German view that it is impolitic to destroy those that are only slightly affected. If tubercle exists, to however limited extent, tuberculin tends to aggravate it, and the owner who wishes to preserve his mild cases can not desire to have them made worse, which means to have the disease extended and possibly generalized.

So in government sanitary work. Unless the government is prepared to slaughter and pay for every animal affected with tuberculosis in however slight a degree, it has no right to use a tuberculin test. It is only when the State means to make thorough work in eradicating tuberculosis from the herds that the tuberculin test is at all admissible. But when the State aims at the thorough extinction of the disease in our herds this test can not be omitted, as it is absolutely essential to success. The temporary aggravation of the disease is no possible harm, when the animal is to be promptly killed and paid for.

To sum up: The tuberculin test aggravates existing tuberculosis and is, therefore, unwarrantable for use on man or on cattle that are to be kept alive; it is, however, the only known means of detecting many occult cases of tuberculosis and is, therefore, indispensable in any systematic effort to *stamp out* the disease by the purchase and slaughter of every tuberculous animal.

MEAT AND MILK OF TUBERCULOUS ANIMALS UNFIT FOR FOOD.

In this connection we must consider two questions essentially distinct from each other and equally important in a sanitary sense. The first is the question of *infection* by the use of such food products, and has been very fully investigated by pathologists and sanitarians. The second question—is that of *poisoning* by the pernicious products of the germ, and has hitherto been entirely ignored by sanitary writers and administrators. It will be convenient to consider these questions separately.

I. INFECTION BY BACILLI IN MEAT AND MILK.

First, however, it will be instructive to compare the geographic distribution of cattle and that of tuberculosis, not with the view of showing that the most of the tuberculous infection of man comes from cattle, for it probably comes mainly from his fellowman, but to demonstrate rather that in some way the intimate relation of cattle to man is a potent agent in the extension and maintenance of consumption in the human family. To the student of this subject it is plain that where cattle are few or absent consumption is relatively less prevalent in man. In northern Norway, Sweden, Lapland and Finland, where reindeer constitute the chief farm stock, about Hudson bay and in the islands of the Pacific, where no cattle exist, and in the Scottish Hebrides, Iceland and Newfoundland, where cattle are few, tuberculosis is far less prevalent in man. In Algiers (a resort of consumptives) the cattle are few and live in the open air apart from the cities and tuberculosis does not increase among the natives. In Italy (another resort of consumptives), where cattle are housed, tuberculosis has become the scourge of man and beast (Perroncito). In Austria (a great resort for the English consumptive) the disease, formerly unknown, has become exceedingly prevalent, and the same is becoming true of our own Minnesota, formerly so lauded as favorable to weak lungs.

In the temperate regions of Europe and the United States at least every eighth death is due to consumption. Dr. Biggs tells us that in New York City every fifth death is from tuberculosis of the lungs. He adds that in the charity hospital of the city thirty per cent of all deaths show old lesions of tuberculosis now become stationary. He quotes a Vienna hospital pathologist to the effect that he finds similar old stationary lesions in eighty-five per cent of all post mortem examinations. This leaves but fifteen per cent who have not suffered from tuberculosis.

But our Northwest Indians furnish the most striking illustration of infection derived from cattle and fostered in man by unhygienic surroundings. Dr. Treon in the *American Practitioner*, describes the poor emaciated diseased animals furnished to the tribes, how the Indians eat the liver, tallow and entrails raw and fresh, and how the carcass is dried, pounded and packed in the skins to be eaten later without cooking. The meat is eaten even though the animal may have died of disease. Dr. Holder in the *Medical Record* (August 13, 1892) gives the

Indian mortality from consumption fifty per cent of all the deaths at Green Bay, Wis., Tulalip, W. T., and Western Shoshone, Nev. He says that at Lower Brulé, Dak., scrofula is present in sixty per cent of the Sioux under twenty-one years, and that at Crow Creek, Dak., fifty out of a total Indian population of twelve hundred die yearly of consumption and scrofula. Taken along with half as many deaths from other causes this would kill the whole twelve hundred in sixteen years.

These are extreme examples it is true, in which the transmission and fostering of the disease by cattle, is extended and aggravated by overcrowding and every imaginable unhygienic condition, among the human consumers.

Experimental Tuberculosis by Feeding.

This experimental transmission of tuberculosis by feeding tuberculous products was demonstrated by Villemin, Günther and Harms, Zurn, Gerlach, Johne, Kolb, Toussaint, Chauvean, Peuch, Leisering, Bollinger and a host of others, the animals infected in this way including guinea pigs, rabbits, fowls, swine, sheep, goats, dogs, cats and birds. Infection was by no means so constant as when inoculation was performed, yet in three hundred and twenty-two experiments recorded by Johne thirteen per cent became tuberculous. The varying results depend on a variety of causes, among which may be named:

1. The relative susceptibility of the various animals experimented on. As we know this varies greatly with the genus, species, family and even the individual.

2. The condition of the digestive organs at the time of feeding. The bacillus tuberculosis lives in an alkaline or neutral medium and suffers weakening or even death in an acid liquid like the contents of the stomach during active digestion. If, therefore, the subject of experiment has a strong digestion, and if infecting matter is taken only during active digestion, infection is usually promoted. If on the other hand the infecting material passes through the stomach in water or otherwise in the intervals between digestion when the stomach is neutral, if there is indigestion so that the contents are only mildly acid, and infecting morsels pass into the bowels without having been digested or thoroughly impregnated with acid, or if the stomach is overloaded so that part of its food passes on undigested, then manifestly infection is possible or probable. Again if there are raw sores on the mouth, throat or gullet, or if the

germ happens to lodge in the recesses of the bowels or pass down into the lungs infection may start from any such point as a center.

3. The germ is more or less virulent according to the animal from which it is derived. Thus the virus from the ox which proves certainly fatal to the guinea pig on inoculation, can not be sucessfully inoculated under the skin of the guinea pig after it has passed through several generations in as many birds, but if inoculated from the bird in the abdomen of the guinea pig and continued for several generations in this rodent it reacquires all its former potency (Nocard; etc.). So to a less extent with cattle; from one cow the inoculation invariably produces the disease; from another only occasionally. The same must hold in feeding.

4. The degree of infection of the material fed has much influence. Tuberculous glands and tubercles, whether recent or caseated, are, of course, the most certainly infecting. The blood and red flesh (in the ox) may be said to be the least frequently infecting, while the infecting power of milk will vary according as the udder is or is not the seat of the tubercle. Toussaint, who seems to have met with especially virulent cases, inoculated successfully with the blood, nasal discharge, bile, urine, tears, flesh juice, dung, etc., of a tuberculous cow. Others, like Nocard and McFadyean, have failed with blood and flesh juice. The danger may be estimated by taking a middle position. It may be well to consider the blood, flesh and milk separately.

Dangers from Blood.

It can not be denied that blood is inimical to this bacillus as to most other microbes. Even if the virus is injected into the veins in such quantity as to produce general tuberculosis, the germs become largely arrested in different organs or robbed of their virulence so that in a few days the blood is comparatively little infecting. This does not, however, do away with the fact that the injected bacilli live long enough in the blood to produce tubercles in many different organs, and the same is true when the disease extends from single primary tubercles to a general tuberculosis; in most cases the bacilli can only have traveled through the blood. Bang found that of twenty cows in advanced tuberculosis, the blood of only two (or ten per cent) proved infecting when inoculated. Nocard has never succeeded in producing the disease by injecting the blood of a tuberculous

ox into the abdominal cavity, yet he recognizes that as the disease extends by means of bacilli conveyed by the blood, this liquid must be infecting wherever these bacilli are contained in it. As the migrating bacilli must be present in the blood before these secondary tubercles can be formed by them in organs distant from the tubercles that gave them birth, it follows that this infecting condition of the blood must precede the formation of the secondary tubercle, or general tuberculosis. While, therefore, it is quite true that the probabilities of infecting blood are greatly increased when the tubercles are numerous and generally diffused, it is an error to assume that the restriction of the tubercles to one organ is a guarantee that the blood is non-infecting. And when we can not give a guarantee for the blood we can give none for any part or organ in which blood circulates.

Danger from Flesh.

It would seem as if the muscle or red flesh in cattle were antagonistic to the bacillus tuberculosis. Certain it is that tubercles are rare in the substance of the muscle. They are, however, very common in the lymphatic glands lying between the muscles, and in swine they are common in the substance even of the red flesh. The flesh of tuberculous pigs is therefore far more dangerous than that of consumptive cattle. Even in tuberculous cattle, however, the beef is not always free from bacilli, as shown especially by the crucial test of inoculating its juice. Arloing tested ten tuberculous cattle in this way by inoculating guinea pigs, and found that the muscle from two of the cows only (twenty per cent) proved infecting, and that only three of the ten guinea pigs inoculated by the muscle juice of these two cows became tuberculous. Galtier fed two calves and two young pigs with the raw flesh of a tuberculous cow, but failed to infect them. This failure was, however, not necessarily due to the absence of bacilli, since two rabbits inoculated with juice from the same flesh contracted tuberculosis. Nocard fed several litters of young kittens on the flesh of cattle condemned as tuberculous, at the abattoirs of La Vilette and Grenelle, but none of them contracted tuberculosis.* Perroncito fed eighteen young pigs from three to five months on the flesh of cattle condemned as tuberculous in the Naples abattoirs, yet none became tuberculous.

* By inoculation with the muscle juice of tuberculous cattle, Nocard infected five per cent of the subjects of experiment.

Two things are shown by the above: (a) that the red muscle is less frequently infecting than other parts, yet unquestionably so in some cases; and (b) that the acid stomach juices during vigorous digestion are in some measure protective. It is equally plain that no sufficient guarantee can be given as to the safety of the raw flesh in any particular case. Then again, the intermuscular lymphatic glands, which are favorite seats of infection, were carefully avoided in the above experiments with flesh juice, yet they always go with the dressed carcass and are eaten with its steaks and roasts. In pigs, as already noted, the muscle itself is often tuberculous.

Danger from Milk.

Milk is more to be dreaded than meat because the udder is often the seat of tuberculosis, and the milk is usually taken uncooked. The danger is enhanced by the fact that this is often the necessary and only food of the infant and invalid, in which the germ is especially liable, through weak and imperfect digestion, to escape into the susceptible bowel.

In milk, as in the case of meat, a strong, vigorous digestion does, in some measure, protect the consumer. Peuch fed a two-months' old pig in five days four and one-half quarts of milk drawn from a tuberculous udder, and, killed in fifty-six days, it proved quite sound. He inoculated four rabbits with the milk and all four became tuberculous. Again, in the absence of tuberculosis in the udder the milk may be little, if at all infecting. Gerlach, who produced tuberculosis in calves, pigs and rabbits by feeding the milk found no result from certain tuberculous cows, while others infected a large proportion. Nocard and McFadyean have been unable to infect rabbits, etc., with milk from an apparently sound udder of a tuberculous cow. The same has been my experience with milk from one cow in the last stages of chronic tuberculosis, and another having acute tuberculosis. Bollinger, Nocard and McFadyean claim that in the absence of tubercle in the udder the milk is not infecting. Whether true or not as an ultimate fact this can not be made a rule of action, as the following will show:

Hirschberger inoculated rabbits in the abdominal cavity with the milk of twenty-nine tuberculous cows, of which the udders were or appeared sound, and produced tuberculosis fourteen times.

Bang inoculated from sixty-three tuberculous cows selected for their sound udders, and found the milk of nine of them infecting. A careful microscopic examination revealed tuberculosis in the udders of three of the cows, leaving six giving infecting milk in which even after death, and with all scientific appliances no tubercle could be found in the udder. This is 9⅓ per cent as tested by the microscope after death; it was 14⅔ per cent as tested by the able veterinary professor during the life of the cows.

Ernst found ten cows in thirty-five with infecting milk though the udders were sound. In one hundred and three animals inoculated seventeen contracted tuberculosis, and of twelve calves sucking the cows five became tuberculous.

Drs. Smith and Kilborne (Bureau of Animal Industry, Bulletin No. 3) found the milk infecting in three cows out of six with apparently sound udders. One infecting cow, and one non-infecting one had each tubercle in the lymphatic gland behind the udder. Forty-four per cent of the inoculated guinea pigs contracted tuberculosis; one in five from one cow, eight in ten from another and six in six from the third.

In my own experience three calves from healthy parents, sucking the apparently sound udders of three cows with general tuberculosis all contracted the disease.

It must be allowed that calves sucking the cows run extra risk of infection through their nurses licking them and through feeding from a common trough, but there is the same danger for the ordinary milk consumer, since the cow in licking her udder is liable to leave bacilli to fall into the pail at the next milking,

Again the concentration of the bacillus in the undiluted milk of an infecting cow, renders this much more dangerous than the milk of the same cow diluted, with that of twenty, fifty or one hundred others. Bollinger and Gebhardt found that milk which infected all animals which took it pure, was apparently harmless when diluted with fifty or one hundred times its volume of the milk of sound cows. As the bacillus can live in milk this apparent loss of virulence must be largely due to the reduction of the number of bacilli in a given measure of milk, and to their tendency to removal by adhering to the sides of the vessel during the mixing.

Tuberculous expectoration which is incomparably richer in bacilli may be diluted in one hundred thousand times its volume

of water and yet remain infecting. But again the glutinous saliva forms a protecting coating which strongly resists dilution.

Infection of man through the milk.—Instances of accidental tuberculosis of the human being through drinking the unsterilized milk are no longer wanting.

In the practice of Dr. Stang of Amorback, a well developed five-year-old boy, from sound parents, whose ancestors on both male and female sides were free from hereditary taint, succumbed after a few weeks' illness with acute milliary tuberculosis of the lungs and enormously enlarged mesenteric glands. A short time before the parents had their family cow killed, and found her the victim of advanced pulmonary tuberlosis. (Lydtin).

Dr. Demme records the case of four infants in the Childs' Hospital at Berne, the issue of sound parents, without any tuberculous ancestry, that died of intestinal and mesenteric tuberculosis, as the result of feeding on the unsterilized milk of tuberculous cows. These were the only cases in which he was able to exclude the possibility of other causes for the disease, but in these he was satisfied that the milk was alone to blame.

After a lecture of the author's at Providence, R. I., a gentleman of North Hadley, Mass., a graduate of the Massachusetts Agricultural College, publicly stated that his only child, a strong, vigorous boy of one and one-half years, went to an uncle's for one week and drank the milk of a cow which was shortly after condemned and killed in a state of generalized tuberculosis. In six weeks the child was noticeably falling off, and in three months he died, a mere skeleton, with tuberculosis of the abdomen. The father could trace no tuberculosis among his near ancestors, but the mother's father and uncle had both died of it. She remains in excellent health.

Dr. E. O. Shakespeare (*Med. News*, March 26,-1892), attributes one-fifth of all deaths in infants and young children feeding on milk to tuberculosis, usually commencing in some part of the digestive organs.

Identity of tuberculosis in cattle and man.—This is abundantly proved in the above instances of the infection of man through the milk, and in the hundreds of cases in which the tubercle of man has been successfully inoculated on the lower animals. As evidence of direct transference of the disease from cattle to man by inoculation, the following two cases are quoted:

Tscherming of Copenhagen attended a veterinarian who had cut his finger in making a post mortem examination on a tuberculous cow; the wound healed, but there remained a swelling which soon ulcerated and refused to heal, so that the whole tumerfied mass had to be cut out. The microscope revealed the distinct tubercular process and the presence of the characteristically staining bacilli.

Pfeiffer attended a Weimar veterinarian of the name of Moses, thirty-four years old, of a good constitution, and without hereditary predisposition, who, in 1885, cut his right thumb deeply in making a post mortem examination of a tuberculous cow. The wound healed, but six months later the cicatrix still remained swollen, and in the Autumn of 1886 the man had pulmonary tuberculosis, with bacilli in his sputa, and death occurred in two and a half years after the wound. Post mortem examination revealed tuberculosis in the joint of the wounded thumb, and in the lungs extensive tubercles and vomicæ.

To Tscherming's may be added the case of a young veterinary friend of the writer, who was inoculated in the hand in opening a tuberculous cow, and suffered from a tumefaction of the resulting cicatrix, with distinct tubercle bacilli. The surgical removal of the tumefaction manifestly saved the subject from a generalized tuberculosis.

II. POISONING BY PTOMAINES AND TOXINS, IN MEAT AND MILK OF TUBERCULOUS ANIMALS.

By an unaccountable oversight medical and veterinary sanitarians alike have never, up to the present hour, looked beyond infection by the tubercle bacillus in estimating the dangers to man of tuberculosis in our flocks and herds. We find accordingly that the question kept continually before the public is that of the presence or absence of the tubercle bacillus in any food product—meat, milk, butter or cheese—furnished by the diseased or suspected animal. The question of the presence or absence of ptomaines or other toxic elements which are calculated to prove hurtful, or even fatal, to certain members of the human race is not for a moment considered.

Hence we are met by the most elaborate arguments that tubercle is rare in the muscular system of cattle, and that muscle juice is inimical to the bacillus and that therefore the muscular tissue which forms the great mass of the dressed carcass

may, as a rule, be safely eaten, though the internal organs may have been affected by tubercle. In Germany and other European countries the flesh of animals in which the tubercles are found in only one organ or in two related ones, is passed as wholesome. It is only when the tubercles are found in the bones or muscles, or in the lymphatic glands among these, or finally, when the tubercles are so generally distributed in different parts of the body that it is evident that the bacilli must have been carried by the blood, that the meat is rejected as unfit for human food. So with milk and other dairy products; many claim, with Nocard and McFadyean, that the milk is harmless so long as the udder is quite free from tubercle, and that it is only when tubercle is unmistakably present in that gland that this secretion is to be feared. Apart altogether from these discussions as to the wholesomeness of uncooked flesh and milk it is safe to say that up to the present, every writer on the subject holds that even the infecting tuberculous meat and milk are rendered absolutely harmless by cooking. The consensus of professional opinion on this subject is tersely given by Salmon and Smith in their article on tuberculosis in the work on the "Diseases of Cattle," published by the Bureau of Animal Industry—"Fortunately tubercle bacilli are readily destroyed by the temperature of boiling water, and hence both meat and milk are made entirely safe, the former by the various processes of cooking, the latter by boiling for a few minutes.

But this is altogether too narrow a view to take of the subject, and it is liable to lead to most serious and fatal results if put into every day practice. The professional mind in concentrating its attention on *tubercular infection*, has practically entirely overlooked the no less real, and in many cases, no less dangerous fact of *tubercular poisoning*.

To elucidate this matter let us consider that much of the poisonous matter produced by the growth of the tubercle bacillus is retained in Koch's "tuberculin," which has been absolutely sterilized. What, then, is the action of "tuberculin" on the animal system? It produces a constitutional disorder with elevation of the body temperature, commonly known as fever, and an impairment of most of the bodily functions, notably those of assimilation and secretion.

This is abundantly manifest in the wasting and fever of the victim of acute tuberculosis in which these poisonous principles are being constantly produced in large quantities. As the dose

is reduced a point is finally reached at which no fever or appreciable systematic derangement is produced, and thus in many slight and indolent cases of tuberculosis the animal appears well, and thus, also, the usual test dose of tuberculin has no recognizable disturbing effect on the healthy animal system. With a dose less than this it may even be questioned whether it may not be actually beneficial in conferring on the healthy system a small measure of tolerance and power of resistance to the bacillus and its poisons.

This, however, is of little account, seeing that no real immunity from tuberculosis is ever acquired. In many systems, both human and brute, the disease continues its slow progress for many years, and the slight tolerance that results, while it may suppress the disease so that it assumes an indolent and chronic form does not fully arrest it.

Very different is the effect of even a minimum dose of tuberculin on a subject which is already attacked with tuberculosis. In such a case the products of the existing tubercle, circulating in the blood and tissues, are often so small in amount, and the system has acquired such a tolerance of them that there is no manifest disturbance of health, and the animal may even be in excellent condition. But add to this minimum amount of poison already in the system a small quantity of tuberculin and in ten or fifteen hours the temperature of the patient's body will rise two or more degrees above the normal, and the destructive process going on in the seats of the tubercles will be accelerated. In cattle this is now used as a most valuable test of the presence or absence of occult tubercle.

In horses and other animals, the subjects of tuberculosis, "tuberculin" causes the same rise of temperature, and this rise may be accepted as a rule applicable to all classes of animals. In the tuberculous man this action of "tuberculin" is a well established fact, and was made the basis of Koch's employment of this material as a curative agent. The daily use of tuberculin in cases of lupus or other superficial forms of tuberculosis led to a more active congestion and an earlier molecular death of the tissues of the local tubercle, until these were separated from the living healthy parts and the progress of tuberculosis in that part was arrested. If there were then no deeper unseen tubercles left in the system, a real cure might be effected in this way. But the cure in such a case was only secured by a temporary aggravation of the disease in its primary focus.

If other tubercles existed in internal organs, they, too, had the morbid process aggravated and extended and the death of tissue increased by the fresh introduction of tuberculin from without. In such a case the increased mass of tubercle—dead and living—remained confined in the midst of the surrounding tissues, and as the infecting materials could not be cast off and separated from the body, they continued their ravages with an increasing force in proportion to their recent artificial extension.

It is this extension of the tuberculosis under the influence of the toxic products of the bacillus which raises the most important question in connection with the consumption by man of the flesh and dairy products of tuberculous animals, and yet this question has been overlooked by sanitarians in the most unaccountable way. It has seemed enough for them that the living tubercle bacillus did not exist in the juices of the muscles nor in the milk. It seems never to have occurred to them that all the soluble poisonous products of this bacillus were constantly circulating in the blood which passes through the muscles, and that they equally traversed the blood vessels of the mammary glands and escaped into the milk. No pathologist can for a moment doubt this general diffusion of these products in the tuberculous subject.

Accepting, then, as undeniable the presence of the soluble chemical poisons in blood, flesh and milk, it follows that those who eat this flesh or milk are continually taking in small doses of tuberculin, and that in case they are already the victims of tuberculosis, in however slight or indolent a form, this continuous accession of the poison will rouse the morbid process into greater activity and secure a dangerous extension.

If we now consider the frightful prevalence of tuberculosis in the human race, that here in New York every eighth person dies of tuberculosis, that in cities like Vienna eighty-five per cent of the people suffer from it, and that in our own cities thirty to fifty per cent contract it at some period of life, we see what a fearful risk is being run by the utilization of the meat and milk of animals so affected, even if it could be shown that such meat and milk were in themselves free from the living bacillus. Such reckless consumption of the products of tuberculous animals can only be looked on as a direct means of sealing the fate of that large proportion of the community which are already slightly affected with tuberculosis.

The claim that the canning of tuberculous carcasses and the boiling or Pasteurizing of milk does away with every element of danger can no longer be entertained. Sterilization is not a restoration to a non-poisonous condition; it does away with the possibility of infection, it is true, but it does not render the product innocuous.

As a matter of fact, Koch's tuberculin has been sterilized by heat, but this has not by any means rendered it safe and harmless. On the contrary, it invariably intensifies any existing tuberculous process and develops fever and general constitutional disorder. When tuberculin, therefore, is present in meat and milk it can only cause these to operate in the same way on subjects that have been already infected. In my experience with tuberculous cows, cases have come to my knowledge in which invalids drinking the milk of such animals have suffered very obviously and have improved after such milk was withheld. So, too, in the case of calves sucking phthisical cows; they have done badly and proved unthrifty though they took the whole of the milk furnished by their respective nurses, and they have thriven better when weaned and put upon solid food alone. I have followed some such calves until they grew up and were slaughtered, and have made post mortem examinations and found them bearing old calcified tubercles pointing back to the time when they sucked the infected and poisonous milk.

It is idle to say that such milk was merely lacking in nutritive principles;—the calves in question had access to other food, while following their nurses, and would not have been harmed by taking the same amount of pure water as they took of milk. Apart from the bacilli, which operated slowly, and which allowed these animals to live for years and even thrive after they had ceased taking the milk, there was unquestionably in this secretion a definite poison which undermined the health and stimulated the progress of the tuberculous process. Accessions of bacilli are not denied, but at the worst these acted tardily, and apart from the soluble poisons their action must have been cumulative up to the cessation of the milk feeding, so that immediately after the withdrawal of the milk the morbid action should have been greater than at any time before this, whereas in the cases in question improvement dated from the change to dry, coarse food.

K. Yamagiva in his experiments on guinea pigs obtained corresponding results. After inoculation with tubercle, the administration of tuberculin greatly hastened the onset of general tuberculosis, so that after a week tuberculous centers were found in lymphatic glands, spleen, liver and lungs.

If this is the result in guinea pigs, which, though very subject to tuberculosis, are not easily poisoned by tuberculin, how much more so in man who is many thousand times more susceptible to tuberculin? The healthy guinea pig is almost unaffected by two grammes of tuberculin, while man, weighing eighty times as much, is seriously affected by $\frac{1}{10}$ gramme. In the tuberculous condition, the guinea pig reacts violently under $\frac{1}{4}$ gramme, while man is seriously affected by $\frac{1}{1500}$ gramme. Weight for weight being considered, it follows that the consumptive man is twenty thousand times more susceptible to the tuberculin poisons than is the guinea pig. From this may be inferred the danger to the tuberculous man of meat or milk containing the poisons of tuberculin.

It may be safely held as proved, by analogy, observation and experiment, that the soluble poisons of tuberculosis invariably operate by exaggerating any existing tuberculous process, and that blood and all animal fluids becoming charged with such poisons uniformly tend to still further endanger the health or even the life of any person who may consume them while suffering from tuberculosis.

We may freely allow that the transmission of the bacillus from man to man is far more common than from beast to man. But though the implanted seed may have been in many cases derived from a fellow man, its subsequent destructive progress may be due far more to the constant accessions of the soluble poisonous products conveyed in the meat and milk of tuberculous animals. Without these constant doses of soluble poisons of tubercle, the implanted germ would in many cases have proved comparatively harmless. Although it could be proved in regard to many cases that the cow had not contributed the seed of the diseases, she is left little less responsible for the destructive progress and fatal result. The germ, which might have remained comparatively dormant and harmless in the absence of the poisoned meat and milk, is by these stimulated to a more deadly energy.

HOW TO MEET THE DANGER.

This hitherto unchallenged factor in the progress of tuberculosis opens up new and uncultivated fields for sanitary work. The great evil ventilated in this paper cannot be effectually met without the eradication of tuberculosis in every herd kept for the supply of food products for the public. Nothing short of this can be trusted to act satisfactorily in putting a check upon the present fearful mortality from this disease. No inspection of dressed carcasses, nor of milk, butter and cheese will furnish a guarantee. We must go to the herds and subject them, animal by animal, to a critical test, and only accept the products as safe when there is no longer a shadow of suspicion remaining. A professional examination of the most searching kind must be supplemented by the "tuberculin" test before a clean bill of health can be furnished. In my own experience on cattle two-thirds of the cases of tuberculosis sometimes escaped under the most critical professional examination and were detected later by the "tuberculin" test. Often, when cattle were condemned by the "tuberculin" test, have the owners pronounced them the most thrifty and the least suspected in the herd, and it was only after slaughter, when the bodies were opened and the caseated tubercle exposed, that they were satisfied that no mistake had been made. Recently in a herd kept for the supply of high-priced milk of guaranteed soundness, the stock having been subjected to weekly examinations by a veterinarian, the "tuberculin" test was applied and fifty per cent of the herd demonstrated to be tuberculous. Without the "tuberculin" test, there is no guarantee possible for the products of the dairy, and the sanitary officers who will affect to deal with this disease in herds without the aid of "tuberculin" are at best but pruning the tips of the branches of the evil tree. Public money ought not to be thrown away on such fruitless and ineffective work. The purification of a herd must be followed in every case by a thorough disinfection of contaminated buildings and places, and by a careful seclusion of the herd from new sources of infection. It is evident, therefore, that the non-tuberculous herd must be secured against the addition of fresh animals from any herd that has not been similarly attested sound, and that any necessary addition from another source must be tested by "tuberculin" before it is added to the herd. Equally important is it to test all farm animals, of whatever species, which live on the place and cohabit with the herd, and to see to it that no

human being suffering from tuberculosis is allowed to attend to the animals or to prepare their food. It is difficult to see how anything short of such a system can afford a guarantee of the absence of the soluble tubercle poisons from our milk, butter and cheese.

In the case of butchers' meats a professional examination when slaughtered, covering all of the viscera as well as the carcass, will be essential, and the current doctrine of sound meat with localized tuberculosis must be abandoned. Every municipality must have its own public abattoir in which alone its meat supplies should be butchered and where every carcass should be systematically examined as it is opened. Private slaughter houses controlled by individual owners afford endless opportunities for the evasion of sanitary statutes, and ought to be abandoned as relics of an age when modern sanitary science was unknown.

The question of dressed, canned and salted meats is one that must be carefully considered. It is quite evident that such products must come to us with a sufficient guarantee if allowed to compete with our home meats which have passed the municipal inspection. It is equally evident that no inspector paid by the packer or canner can furnish a certificate which will command public confidence. The inspector must be a government official who is entirely independent of the packers, and who is in no way dependent on their good will.

Then, again, the existing method of furnishing government inspectors at our great packing centers only, and thus giving a monopoly to the large operators, can not be long maintained in a country of equal rights and privileges. The most obvious cure for this evil is to make all packing establishments government institutions, where the small packer shall have equal privileges with the large, and where all carcasses shall be subjected to the same scrutiny and all shall go out with the same guarantee.

Such a proposition will doubtless be severely criticised both from the medical and economic standpoint.

On the medical side it will be argued that if the soluble poisons in the meat and milk were as injurious as represented, we would see the evil results on every side and that medical men would be universally cognizant of them. And yet do we not see clearly to-day much that was never suspected twenty, thirty or fifty years ago? How recent is the acceptance by the

profession of the doctrine of contagion in tuberculosis, in tetanus, in pneumonia, in influenza, in glanders, etc. Are we to suppose that our forefathers were surrounded by fewer evidences of contagion, at a time when no precautions were taken to prevent it, than we are with all the antiseptic and antizymotic provisions of the present day? The facts of contagion were doubtless more abundant in their days than in these, but their attention had never been drawn to them. So now let the attention of physicians and sanitarians be given to the morbid action of soluble poisons of tubercle and evidences of their evil results will accumulate on all sides. It is the scrutiny and not the facts that are wanting.

The economist will object to drastic measures for the suppression of tuberculosis on the ground of expense. Who is to pay for the municipal abattoirs, the inspectorships, the disinfections and the indemnities for slaughtered animals? In return let me ask, who now pays for the constant losses of live stock which the proposed system would put a stop to; for the frequent infection of sound herds by unfortunate purchases of animals that prove to be tuberculous; for the losses to the nation, to the community and family of the tuberculous one-eighth of all deaths; for the loss of work—literary, scientific, manufacturing, commercial, domestic and manual of the great host of consumptives waiting all over the land to fill the places of this fatal eighth in coming mortality statistics; for the losses represented by the many migrations and exiles in search of health and of the costly consumption hospitals and sanitaria? And who is to pay in the future for the needless harvest of similar fruits, which the seeds now sown through our supineness, must inevitably produce in the coming generations?

Is it not a truer economy to destroy the seed before it has germinated, or even before it has been sown, than to wait for the multitudinous evils that must attend on its growth and fructification?

PREVENTIVE MEASURES FOR ADOPTION BY THE STOCKOWNER.

If he will the stock owner can extirpate this disease from his herd and thereafter keep the herd pure from such contamination. The following are the main precautions necessary to this end:

1. Board up the partitions of the stalls at the front so that no two cows can feed from the same manger, nor lick each other.

2. Keep each animal strictly by its own stall and manger.

3. When any animal is suspected don't let it use a drinking-trough nor bucket in common with other animals.

4. Avoid old milch cows and unthrifty ones, or keep them secluded from the rest of the herd.

5. The following conformation usually indicates a weakness of constitution and a susceptibility to tuberculosis: Head narrow between the horns, sunken eyes, depth of cavity (temporal) back of the eyes, thin, narrow ewe neck, chest small, lacking in both breadth and depth, hollow flank, and tendency to pot belly; a general lack of muscle so that the limbs seem loosely attached to the body; in breeds that show a variety of colors; animals of the lighter shades of brown and yellow. If, however, such animals are of high value for dairy, and can be kept free from infection they need not be rejected. The finest conformation of Shorthorns, Devons, Holsteins, black or red polled furnish no protection in the presence of the germ.

6. Don't purchase from a herd in which tuberculosis has appeared, or in which cattle have died or been killed within a year or two. Resort first to the tuberculin test.

7. Don't take a cow with a husky or rattling cough, wheezing, hurried breathing, discharge from the nose, fœtid breath, hard bunches under the skin, diseased udder, swollen bones or joints, unthriftiness, or a tendency to scour or bloat.

8. Don't purchase from city, suburban, nor swill stables.

9. Don't add newly purchased cattle to your herd until you have tested them with tuberculin, especially if they have been the product of inbreeding.

10. Don't admit strange cattle to house, field, nor yard with your own; keep them apart until tested with tuberculin.

11. In case of disease or unthriftiness in your herd put the animal apart and have it examined by a skillful veterinarian.

12. If after this there remains any doubt as to the real nature of the disease, have the animal tested with the tuberculin, in the hands of a practitioner thoroughly acquainted with cattle and their diseases. If the result is not yet quite clear keep the animal by itself and repeat the test in four weeks.

13. In case one animal in a herd shows tuberculosis test the whole herd with tuberculin.

14. Test in the same manner all animals on the farm (swine, goats, sheep, horses, rabbits, cats, dogs, fowls) that cohabit with the cattle.

15. Kill all tuberculous animals, and boil, burn, dissolve in acid, or bury them deeply in a place to which no animals have access.

16. Disinfect premises thoroughly, also all products of the diseased animals, and all articles used about them.

17. Let no consumptive person attend on cattle or other live stock, nor prepare their food.

18. Vermin (rats, mice, sparrows) in a building where tuberculous animals have been should be exterminated.

STATE MEASURES FOR THE PREVENTION AND EXTINCTION OF TUBERCULOSIS IN FARM ANIMALS.

The best, most effective, and economical measures for the suppression of tuberculosis are those which naturally devolved on the State. It does not follow, however, that State interference will exonerate the stock owner from his personal duty in taking the precautions laid down for him above. It is the duty of the State to see that all such precautions are enforced, together with others that transcend the power of the individual stockowner, and which must be undertaken by the governing power for the public good. Among these may be named the following:

1. The providing of municipal slaughter houses in which alone farm animals designed for human food can be slaughtered.

2. Exclusion from the home market of all dressed, salted and canned meats that have not passed a crucial examination at the time of slaughter by an accomplished government veterinary inspector.

3. Government stamping and labelling of all canned meats that have passed the municipal inspection and can be guaranteed as from non-tubercular animals.

4. Forbid the use for pigs, fowls or other animals of all milk furnished by tuberculous animals, and of all offal or other products of slaughter houses until they shall have been boiled for one hour.

5. Provide for the systematic inspection by skilled and reliable veterinary practitioners of all dairy herds, and primarily of such as furnish milk for immediate use as sweet milk.

6. If tuberculous cattle or other animals are found in a herd, have the remainder tested with tuberculin and have all affected cattle appraised, killed, and, without delay or further expense, paid for by the State.

7. Appraisers may be chosen, one for the State and one for the owner, or better, to secure a more even-handed justice, all alike should be valued by two State appraisers chosen for their knowledge of animals and their values, and for their integrity.

8. Indemnities should be paid without delay on presentation of the affidavits of the stock owner, the inspector and the State appraisers.

9. The precautions prescribed for private owners under the headings 9 to 15, and 18 should be carried out under the supervision of State officers.

10. Disinfection of all contaminated premises and objects should be done at State expense and by a special disinfecting corps under a trained, careful and thorough foreman.

11. Attendants on cattle or other meat producing animals, who show any chronic disease of the air passages, lungs or bowels, should be examined for tuberculosis by the municipal or town health officer, and their expectoration should be tested bacteriologically. If found to be tuberculous they must be forbidden to continue this occupation.

12. Though herds have been tested and guaranteed sound, such guarantee must lapse as soon as new animals are introduced into them from public markets or untested herds. The guarantee may be preserved by having all such additions tested by tuberculin before they are added to the herd.

13. In making tests with tuberculin the inspector will, as a rule, omit cases that are suffering acutely from other diseases, or from advanced general tuberculosis, or that are approaching *orstrum* or parturition; such cases must be secluded and tested later when there is no such source of fallacy.

14. All deaths in inspected and attested herds should be promptly reported to the government veterinary inspector of the district, who should make a careful post mortem examination, and if he finds tuberculosis in even a latent form, the whole herd should be again tested with tuberculin.

EFFICIENT DISINFECTION.

The extreme measure of killing the infecting or diseased animal entails the imperative duty of thoroughly disinfecting the place where such animal has been. Without this the killing is a comparatively futile procedure. In the hands of an inexperienced farmer the attempt at disinfection is far more likely to

be insufficient than complete, and if imperfect all or much of the trouble and expense has been thrown away. In all veterinary sanitary work looking toward the extinction of a contagion, the work must be of a very radical nature, and if it fails in this it may be looked on as practically a failure. Restriction of the disease there may be without this, but extinction, never. With mere restriction outlay for prevention must go on forever; with extinction it will be brought to a final end.

To be effective, disinfection should be made the work of trained State officials. There is no more reason why this should be charged on the stock owner than that he should bear alone the money loss of his animals. Both are means of the extinction of the contagion with the one object of the public good.

PROVISION FOR SYSTEMATIC WORK.

The existing law fails to provide means for dealing with tuberculosis in all parts of the State, or to enjoin that the limited means provided shall be applied in a systematic manner upon any given area. Attention is therefore given to the herds whose owners make special application for inspection and those that are reported by others, and thus the inspectors are to-day in Westchester county, to-morrow in Erie, and the next in Tioga or Oswego. Single reported herds are dealt with, and the great bulk of stock in the same district are passed over unnoticed. Is it to be wondered that complaints of partiality are heard? With the utterly inadequate appropriation this condition of things is perhaps inevitable, but it is certainly not the way to suppress the disease. A system that wipes out the disease on one farm, and at once leaves it to be reinfected from a diseased herd on the next place perhaps, is anything but commendable. If the means can be afforded to deal with the disease over the entire State, let this be done; but if not, then let the appropriation be applied to a given geographical district, and let this be purified as a whole and held so, while the good work is extended to other regions.

INSUFFICIENT INDEMNITY A FALSE ECONOMY.

In conclusion, it is right to emphasize the importance of a due consideration of property rights. Sanitary laws which in any way ignore or disregard the rights of property have within themselves the seeds of defeat. If within our municipal abattoir the butcher can not conduct his business as well and

economically as in his own establishment, he or his competitors will evade the law in some way. If the stock owner is not fairly reimbursed for his animals slaughtered, and for other losses sustained for the protection of the public health, and of the country's herds, unscrupulous men will find ample means of trading off the as yet incipient and occult cases of tuberculosis, and thereby planting the infection widely in new herds. Compensation must stop short of making the sanitary bureau a profitable customer for tuberculous animals at sound prices, but it must be so liberal as to enlist the ready coöperation of the stock owner in having every infected beast safely disposed of. Cases of advanced generalized tuberculosis may in all justice be listed at a low rate, as they are in every sense unfit to live, and are an expense, a danger and a nuisance, even when dead. Cases too, that have just been imported from another State or country, and which are either manifestly diseased or taken from a tuberculous herd, may fairly be excluded from indemnity, and above all from a liberal indemnity. But in nearly every herd the majority of the stock condemned are to all outward appearances sound animals, and the owner has had no suspicion concerning them until this has been betrayed by the tuberculin test. But for that, he would have gone on utilizing the animals in perfect good faith, and his customers would have received the dairy products in all confidence as to their wholesomeness. Had he wished to sell these animals for the dairy or for beef, he would have found plenty of purchasers at sound market rates. If the stock were thoroughbred and their progeny of a high prospective value, he could have continued to breed from them for years, since calves are rarely born tuberculous—not once in many thousand births even from tuberculous parents—and thus he might have largely profited by raising them on the milk of healthy cows. Then again, in country districts the owner must bear the cost of disposing of the carcass by burning or burial in some place to which other animals do not have access. Further, the essential work of disinfecting the premises is at present put on the shoulders of the stock owner. Once more, if the stock owner is a dairyman, his trade is injured by the condemnation of animals in his herd. Customers will suddenly change to other dairies, creameries will be closed against his milk, and health officers are likely to quarantine the product, at least between the condemnation and slaughter. Apart from this, his home supply of milk is

lessened, and, to keep his customers, he must go into the market and buy milk from others.

It is quite evident that in many cases of dairy herds and of valuable thoroughbred animals, an idemnity amounting to even the sound market value of the animals killed comes far short of reimbursing the owner for his actual losses.

These considerations should be taken fully into account, before adopting any proposal to fix a maximum sum or rigid rule for estimating values. The wording of the present law "the actual value" is perhaps as good as any, only provision should be made to have able and incorruptible appraisers, and a restricting clause might be introduced to prohibit or minimize awards for animals recently introduced into the State.

Disinfection should as a rule be done by State employes, thus relieving the stock owner of the expense and securing effective results. The disposal of carcasses may also in many cases be justly charged on the State. This can not be an entering wedge for corruption, as excessive indemnity would be, and yet it would relieve the stock owners of an outlay that should be met by the public at large.

The disposal of infected manure and other products must be under the direction of the inspector, but must evidently be undertaken by the stock owner himself.

Points like the above can not be too strongly insisted on, as they determine success or failure. In the extinction of cattle lung plague in the United States the strict attention to such acessories proved the main factors in the speedy success. In Cook county, Ill., I took charge of the work on behalf of the United States Government in April, 1887, and in July we had done away with the last acute case of the disease. But the whole city was systematically purged, stable by stable, no communication between sick and healthy was possible, condemned cattle were quickly disposed of, and in two weeks each owner received from Washington a check for the amount of his indemnity; thorough disinfection was affected by a government corps so that no stable ever needed to be disinfected a second time, and effective measures were taken to prevent the introduction of any new cattle from infected localities.

No State was ever so speedily cleared of this disease, and the result must be altogether attributed to the carefulness of the methods and their thorough application, and not least to fair indemnities and the promptitude of their payment. Great

Britain has been struggling with the same disease for fifty years, and though she slaughters the sick, yet for lack of other efficient measures she can not yet show a clean bill of health.

ACTINOMYCOSIS.

Actinomycosis is a vegetable parasitic disease. It is due to the introduction into the animal of a ray-shaped fungus through an abrasion or wound of the mouth, tongue or cheeks, or along

FIG. 2. A TYPICAL CASE OF ACTINOMYCOSIS (LUMPY JAW) AFFECTING LOWER JAW.

a shedding or diseased tooth. It multiplies and grows somewhat similar to plants outside of the animal economy. As

FIG. 3. ACTINOMYCOSIS OF THE JAW.

The lower jaw is sawn through transversely from right to left; *a*, within the mouth showing the papillæ on the mucous membrane of the cheek; *b*, front view of a molar tooth; *c*, the skin covering the lower surface of the jaw bone; *d*, the jaw bone hollowed out and enlarged by the formation of cavities within it, which are filled with the soft growth of the actinomycotic tumor; *e*, a portion of the tumor which has broken through the bone and the skin and appears as a tumor on the cheek. The small roundish masses represent the granulomata (minute tumors) in which the fungus vegetates.

these filaments grow, the tissues in which the implantation occurred give way to them. Tumors and abscesses form and

finally rupture. The abscess frequently discharges into the mouth, throat or nasal cavities, and consequently the discharge may be swallowed, or inhaled into the lungs, and fresh tumors and abscesses develop in the lungs and stomach.

The preferred seat of the disease is on the bones of the upper and lower jaw; in the parotid salivary gland in the angle of the jaw; and in the region of the throat. It may appear in different parts of the body under the skin.

The actinomyces are imbedded in the soft tissue composing the tumor, or in the pus of the abscess, and are perceptible to the naked eye as very minute grains of from a pale yellow to sulphur yellow color. With a needle they are easily lifted out from the tissue, when they appear as roundish masses about $\frac{1}{20}$ of an inch in diameter. The outer surface is made up of club-shaped bodies all radiating from the center, somewhat like a rosette. The interior is made up of bundles of fine filaments apparently continuous into the club-shaped bodies. The inflammatory growth increases as the fungus continues to multiply until they reach enormous proportions if the affected animal is permitted to live long enough.

Fig. 4. Bacillus of Actinomycosis.

The effect of the disease upon the health of the animal depends upon the location. So long as the tumor or abscess does not interfere with mastication, the use of the tongue, or breathing, the animal will grow and fatten, and the general health is not affected until internal organs, such as the lungs, become involved.

An animal affected with this disease should not be allowed to run with other cattle. From one infected animal it will spread through an entire herd.

The important relation of this disease to the public health is, that the

Fig. 5 A Typical Case of Actinomycosis.

disease is infectious and communicable to man. Of this fact, several hundred cases are of record, and one case is on record where the disease was communicated from one man to another man. Human beings are liable to infection through an abrasion of the skin, by handling diseased animals, or articles soiled by the pus from them, or by eating meat that contains the parasite.

Fig. 6. A Case Far Advanced.

As to whether or not the flesh of lumpy-jaw cattle is fit for human food, the question was heard on its merits in a trial in Chicago, wherein it was sought, without success, to restrain the Illinois Board of Live Stock Commissioners from seizing lumpy-jaw cattle at the Stock Yards and sending them to the rendering houses to prevent their sale to butchers. The cuts illustrating this article are from photographs of cattle exhibited at the trial. Dr. James Law, Professor of Veterinary Science at Cornell University, testified:

Fig. 7. A Very Bad Case.

The flesh of an animal affected with actinomycosis is not fit for human consumption, unless it has been first heated for a length of time to above 112° Fahrenheit—(evidently a type error, meant for 212°, boiling point)—so as to destroy all organic life. The disease, once started in any part of the body, being liable to be extended to other organs through the cells, being carried by the blood as well as by swallowing or inhalation, it follows that no part of the body can be considered quite safe when any part has become the seat of actinomycosis. It must be understood that when one or more cells are starting to grow in a new tissue, there is at first no reason to suspect their presence.

Dr. A. Liautard, Fellow of the Royal College of Veterinary Surgeons of England, and editor of the "American Veterinary Review," said:

I believe the meat of actinomycoses animals is entirely unfit for general use, as the introduction of the parasite and its possible growth is all that is desired to give rise to the disease. I think the fact of possible difficulty of discovering the same in all the tissues, and yet found in some parts of the body, ought to be sufficient reason to consider the whole as unfit for eating.

Dr. Paul Paquin, of Missouri, the eminent veterinary surgeon and investigator, said:

The flesh of animals affected with actinomycosis is unfit for human food, because first, of the presence of parasites that may be lodged where the naked eye can not detect them. Second, because slightly diseased organs may often be sold to consumers through ignorance or greed. Third, because it takes more heat to kill the parasites than is often produced by the ordinary cooking of many people. Fourth, because it is possible that this parasite produces a poison of the character of Ptomaines, or some such principle. Fifth, because diseased meat is obnoxious to man, and does not contain the amount and quality of nutritive substances necessary for nutrition, and which the consumer expects and should have when he pays for meat.

Dr. Knowles, of Indiana, said:

The flesh of an animal with this disease is not fit for human consumption because of liability of transmitting the disease.

Dr. Horne, of Wisconsin, said:

In my opinion the flesh of the whole animal is so contaminated as to render it unfit for food, for I have seen a family of seven all poisoned by eating the flesh of the forequarter of a cow with this disease.

Dr. J. B. Murphy, of Chicago, president of the American Association of Railway Surgeons, and who has treated nearly a score of persons affected with the disease, testified:

The flesh of an animal affected with this disease is unfit for human food.

Dr. Ochsner, of Chicago, said:

In my opinion the flesh of an animal with this disease is unfit for human food, because of the danger of transmitting the disease to those eating the flesh. The actinomyces have been found in every organ of the body.

Dr. Chas. Hewitt, secretary of the Minnesota State Board of Health, testified:

I consider the meat of animals affected with actinomycosis decidedly unfit for human food, because of the liability of infection from the disease; and, in addition, as long as there was a doubt upon the subject, or a suspicion of the possibility of such infection in any meat, it should be condemned.

These witnesses were confirmed by a large number of eminent physicians and veterinary surgeons.

Fig. 8.

A case of actinomycosis in man was reported by Dr. Ochsner, as one coming under his observation and treatment (see illustration from the photograph) in 1889.

Dr. J. B. Murphy reported a case of actinomycosis in the abdomen of a man treated by him at the Alexian Brothers' hospital, Chicago, in 1891, in which the entire abdomen was involved, and which terminated fatally in thirty days. (See illustration.)

This patient was in excellent health, when on the night of August 9th he was attacked with severe pains in the abdomen, and frequent vomiting. He was placed in the hospital August 14th, and died September 14th.

Prof. J. M. Byron, M. D., director of the bacteriological laboratory of the University of New York, who has treated the disease in human beings says:

> It is fatal when the internal organs are invaded, and it is not so rare as once supposed. Inasmuch as the true character of the disease is of recent discovery we can not know how many thousands of persons have found untimely graves by eating the flesh from lumpy-jaw cattle.

In March, 1895, William Thompson, a young man living near Jefferson, Greene county, while assisting in operating upon lumpy-jaw cattle became infected, the disease appearing in the neck and throat, and several severe surgical operations were necessary to a removal of the actinomyces.

Under the regulations now in force in Chicago, a rigid inspection of lumpy-jaw cattle is had by the State Veterinary Surgeon, and those which are condemned are immediately sent to the rendering tank with a loss to the owner of all except the hide, and the value of the material into which the carcass is converted. The result of this inspection is that lumpy-jaw

FIG. 9.

cattle are not shipped to Chicago, but are sold to local butchers and thus get into the markets of cities and towns throughout the State, against which there is no provision of law in Iowa, and no protection to the people except in the honor and integrity of the butcher. It is pertinent here to say that consumers of meat furnished by the Chicago packing houses have the benefit of rigid inspection whatever else may be said of the traffic.

ANTHRAX.

Anthrax prevails in every clime and country the world over; in high as well as low latitudes. Its history goes back to the days of Moses. It afflicts all the domesticated animals, even birds and fishes, most frequently cattle and sheep; less in the horse, hogs and poultry, and rarely in the dog. It appears at all seasons, but principally in hot weather. Predisposition to it is not modified by age or sex, though some observers claim that pregnant and young animals are most frequently attacked. It is most frequent and fatal in localities where the soil contains much organic matter undergoing decomposition; when the land is retentive of moisture; in marshy districts, or where the soil is frequently overflowed and the water can not easily recede. Evaporation under high temperature and the soil itself furnish in the air they breathe, the water they drink, and the food they eat; the germ of the disease, which, when it gets access to the blood, causes death quickly. Frequently infected animals are feeding apparently in good health, and drop as quickly as if struck by lightning; animals feeding heartily in the stall at night are found dead in the morning. Sixty to seventy per cent of cases are fatal in from twenty-four to forty hours. Treatment is of but little avail. It is a terribly infectious disease, and is transmissible to man by handling carcasses and skins of animals that have died from the disease, wool, and rags. The infection usually takes place through some abrasion of the skin, into which the bacillus find its way. There first appears a dark point or patch resembling the sting of an insect, which in a few hours changes to a yellowish pimple, and later to red or bluish color with intense burning sensation. Later it

enlarges, becomes dry and gangrenous at the center, the surrounding parts elevated and yellowish or bluish in color and doughy to the touch. As these swellings may infect the whole body with fatal results, surgical aid should be secured at once. The disease may also be contracted by eating the flesh of diseased animals which has not been thoroughly cooked, and in this form it is more fatal than when infection is had through the skin.

Numerous instances are reported where the disease has been communicated to human beings by flies which had fed on the bodies of diseased animals. This method is probably more general than suspected.

On the appearance of the disease, whatever be the form, vigorous and prompt suppressive measures should be adopted. Healthy animals should be isolated from the diseased and attended by those who do not come in contact or near the diseased animals. Those who attend diseased animals should exercise extreme caution and not allow blood, saliva or any matter from tumors, swelling or other part of the affected animal to remain on their skin, and persons who have sores, abrasions of the skin or eruptions on the hands should not be permitted to have the care of diseased animals. In handling the carcass of dead animals gloves should be worn on the hands and the gloves then burned. Pigs, dogs, cats and fowls should be rigidly excluded from pastures and stables where are diseased animals. The pasture whereon diseased animals have been kept should be abandoned for a season. The carcasses of animals which have died from the disease should be buried in some remote place and so deep that they will not be reached by dogs and wild animals. The litter and manure should be burned. Stables or buildings in which they have been kept should be thoroughly cleansed, thoroughly disinfected and then ventilated for several weeks. All woodwork of stables and fences of yards should be thoroughly whitewashed, and articles of little or no value used, burned. Iron articles should be heated by fire. The flesh of diseased animals should not be used for food, and milk from diseased cows should be inhibited. It is only by the most thorough and vigilant suppressive measures that the disease can be eradicated.

It should be borne in mind that the virus of the disease retains its vitality a long time, even for years, in the soil on which diseased animals have grazed and died.

Hartmann cites an instance in which a cowhide had hung for twelve months drying, was then steeped twenty-four hours in water, after which it was made into a harness for two horses. The horses became infected after wearing the harness four days and died in forty-eight hours.

Gilbert reports he saw nine hogs die from merely smelling the track where a cow had been dragged to be buried.

Roche-Lubin tied two sheep forty paces from the grave where nineteen anthrax cattle were buried three feet deep, and well covered with brushes and stones to keep off dogs and wolves. The wind blew over the grass and on the sheep eight hours. Seven days after the sheep succumbed to anthrax.

Two cows died in a farmer's stable, which was then cleansed, washed, disinfected and ventilated thirty days, when thirty sheep were placed in it for a few hours. In forty-eight hours fourteen sheep were dead.

As to the vitality of the virus or *Bacillus anthracis* Dr. Klein, the eminent bacteriologist, says:

> I have tried to ascertain whether the spores of *Bacillus anthracis* become killed by freezing or boiling. Boiling for two minutes does not destroy their life. After freezing at a temperature of twenty-seven degrees below zero for one hour a guinea pig inoculated with the spore was dead from typical anthrax the third day. Therefore spores of the bacillus formed in the earth from the bacillus of anthrax that happen to be growing there are practically indestructible, as the temperature rarely reaches so low a point even in the coldest Winter.

As to the preservation of the activity of the *Bacillus anthracis* within the body of the dead, Dr. Klein gives the result of numerous observations and practical tests, to-wit:

"Numerous observations have taught me that the bacilli, however numerous they are in an organ of an animal at the point of death, go on after death to degenerate till they have entirely disappeared; and consequently the organs are perfectly harmless when this degeneration has become complete. I have studied this process of degeneration, and I have found that, beginning with death, invariably the number of degenerating and degenerated bacilli rapidly increases. I have made a great many observations with reference to this point from its obvious great practical importance, and I have no doubt about the fact that the blood and organs kept in an animal dead of anthrax gradually lose their power to communicate the disease by inoculation.

"Of course, excepted from this are the evacuations of such animals, like urine, the discharges of the throat and nose, for these spread on the ground and exposed to the air, give an excellent opportunity for the *Bacillus anthracis* contained in them in large numbers, to form spores, and thus permanently retain its infective power. In the case of buried animals these spores are brought to the surface by earthworms, and thereby fields where such burial is had become permanent localities of infection, and animals grazing thereon are liable to be infected with anthrax."

To illustrate the virulence of this disease, there was a recent outbreak of it on the farm of Mr. Warren, at Arvesby, England. He and sixteen men were all sick with the disease at one time. All kinds of animals and birds were infected and died. A woman, while passing the spot, was stung by a fly and died from typical anthrax.

RABIES.

There *is* a disease known as rabies which is as distinct from mental influence as any other recognized disease. It is also called hydrophobia, which is a misnomer, for the word signifies dread of water.

As rabies is of frequent occurrence throughout the State, and its appearance is at all times attended with great danger to human life, it is important that the public, who seem to have very erroneous ideas regarding it, should be informed as to its nature and to this end the newspapers in every county in the State should give it some concise form.

It is an infectious disease communicable only by inoculation from animals or man suffering from the disease, therefore intelligent, vigilant, continued effort, extended over the entire country would secure its removal. This involves attention to worthless dogs and cats. Stray and vagabond dogs and cats without responsible owners should be killed. Necessary and valuable animals should be properly tagged for identification. A high dog tax would help to rid the country of a worthless surplus. A dog not worth the tax has no right to existence.

SYMPTOMS.

Briefly, it may be said, the first symptom of the disease in a dog or other animal is to roam, to get away from home. In the second and third stages of the disease the symptoms vary in different animals.

Every stray dog is a suspicious animal, and especially if he keeps continually in motion with head and tail down. He should be watched, and if he has not bitten any animal or person and no owner can be found, he should be put to death. If he has bitten any animal or person, he should not be killed. Capture him at once, and confine him with strong chains or in a close pen. If he has rabies he will show it soon, so there will be no mistake about it, and he will be dead within ten days. If he is killed the only means of knowing certainly whether or not he was rabid has been destroyed, thereby intensifying and increasing the anxiety and uncertainty of those who have been bitten.

Two things should be born in mind: 1. A rabid dog does not shun water; on the contrary his thirst is intense and he will drink it; and even swim in it if accessible. A rabid man can not drink because of severe spasms of the throat. It is to avoid these paroxysms, and not a dread of the water which induces avoidance of water. A current of air, a loud voice or sharp noise, or the wave of a fan will cause the spasms. The man would drink if he could. A rabid animal seldom has these laryngeal spasms, and he drinks.

2. Rabid dogs do not have fits. There may be slight convulsive tremors, but not "fits," as generally understood.

The second symptom of rabies is a tendency to eat strange things; tear up clothing and wood; to hide away; there is a change of voice and a peculiar, hoarse bark or howl, and extreme restlessness and irritability. This is followed by a furious stage, when he will rush at a person or imaginary objects, and the presence of a dog increases the fury; there will be short periods of abstraction, when he will gaze into vacancy, then suddenly become furious, even tearing himself. This is followed by the third or paralytic stage, which first appears in the hind legs and the lower jaw. He lies down; can not rise; a stupor follows, broken only by tetanic muscular action, until comes the certain death.

The entire period of the disease is an average of eight days; it may run its course in as many hours.

The poison may be conveyed by a lacerated bite, by a simple punctured bite, by licking with the tongue or by the saliva coming in contact with an abrasion of the skin, a crack or sore, or the mucous membrane of the mouth.

The incubation period in dogs is usually thirty to fifty days. It may be three days, or as long as two hundred and forty days. During the incubation period, that is from the time the dog was inoculated or bitten until the disease is developed, the animal may communicate the disease by its saliva. This is a fact not generally known and should be borne in mind. In man this period is six to eight weeks. It may be as short as twelve days; it has been as long as two years. In children when bitten about the face and neck it is usually short.

WHEN BITTEN—WHAT TO DO.

The recommendations of Pasteur, who is now acknowledged authority on rabies, are, when a person is bitten by a suspected rabid animal; suck the wound instantly and thoroughly; if on an extremity, bind a handkerchief or band as quickly as possible, tightly around the limb between the wound and the heart, so as to encourage free bleeding. Cleanse the wound thoroughly with hot water, or a saturated solution in hot water of boracic acid, which will also aid bleeding. Also, dress frequently with the same or with a saturated solution of boracic acid in glycerine, or with a solution of carbolic acid, five parts to one hundred of water, or by corrosive sublimate solution, one part to five hundred of water. The use of strong caustics, and red-hot irons is of no benefit, but an injury.

When the wound is thoroughly cleansed, it should be allowed to heal.

When a person has been bitten by an animal known to be rabid, resort should be had at once to the Pasteur treatment, for which there is an institution in Chicago.

To enable a person who had been bitten by a dog suspected of rabies to ascertain whether or not the animal was rabid, the *Universal Magazine*, of London, in 1753 published the following, accredited to "The Memoirs of the Royal Academie of Sciences, at Paris:"

"When a person hath been bitten by a dog that is apprehended to be mad, it commonly happens that the dog is killed before one is assured of his condition, and the person bitten continues an uncertainty. Dr. Petit, the surgeon, hath an expedient

for putting an end to this uneasiness. He rubs the throat, the teeth and the gums of the dead dog with a piece of meat that hath been dressed, taking care that there be no blood to stain it, and then offers it to a living dog. If he refuses it with howling and crying the dead dog was certainly mad; but if well received and eaten, there is nothing to fear."

Whether or not Dr. Petit's rule still holds good is problematical, but it is true, as observed, that a healthy dog will shun a rabid dog, and is seized with terror on the near approach of one.

QUARANTINE.

Perhaps the greatest obstruction and hindrance to the practical work of local boards of health is the fear of quarantine. Infectious diseases are not reported in a great many cases because of this fear. Even reputable physicians have been known to compromise their reputation as diagnosticians and their professional honor by catering to this prejudice against quarantine, and have called typical cases of infectious diseases —such as scarlet fever, diphtheria, etc., by names that would not render the subjects—their patrons—quarantinable.

There must be some reason for this prejudice—indeed, there are several. In the first place a great many people regard an infectious disease as a *disgrace*, rather than a misfortune, and they do not wish the disgrace to be advertised by quarantine. If they have to submit to quarantine they are solicitous to have the placard proclaiming it placed on the back door, on the barn or anywhere except where the people will see it.

There could hardly be a more unreasonable objection. Diphtheria and scarlet fever, though a terrible misfortune, are only a disgrace to those through whose negligence the disease was carried into another's home. Perhaps the presence of small pox in a home is a disgrace, like itch, since the means of its prevention are so simple, sure and economical, compared with its care, cure, and burial in case of death, that there is no reasonable excuse for its presence.

Diphtheria and scarlet fever are not filth diseases. They enter the palace and the hovel alike and with equal malignancy.

They enter these homes because the germs of these diseases by some means come in contact with some of the inmates thereof through exposure to places or persons or things infected by the disease. So the question of disgrace should never be harbored for a moment.

Another source of opposition to quarantine arises from the inconvenience of being shut up for several weeks, since it interferes with business, shuts out the children from school, breaks up social intercourse, requires disinfection afterward and, in case of death, deprives the inmates of the home from many loving offices of friends, and the dead of a respectable funeral. A serious consideration, however, of these objections shows that in the light of the "Golden Rule," they have no force whatever. Interference with business, temporary suspension from school, the deprivation of social advantages and even the absence of sympathizing friends in case of death, and a night funeral weigh but little against the great wrong that would be wrought by placing up no danger signal and using no efforts to restrict the spread of the disease. Hence, all judicial tribunals are extremely liberal in the construction and application of health law especially in the enforcement of quarantine.

If a household, unfortunate enough to lose one or two of its members because of an infectious disease, felt that the invasion of the home was because of a lack of quarantine, or in violation of quarantine, they would not only be justly indignant but they could never rid themselves of the feeling that their loved ones had been murdered. A physician or a household assumes a fearful responsibility, and perpetrates a monstrous crime when either, for any cause, conceals knowingly a case of infectious disease that is dangerous in character.

Pertinent to this subject is the following from the May (1890) Health Bulletin, the official organ of the State Board of Health:

> There is scarcely anything that more forcibly illustrates the selfishness of human nature than quarantine. Let us illustrate. We know of an intelligent Christian lady who was mortally and commendably afraid her little boy might contract diphtheria or scarlet fever through the carelessness of persons who were, or should have been, quarantined, or by taking him to some house or place not properly disinfected after having had an infectious disease. Nothing to her seemed so criminal or at least so heartless as for persons who had infectious diseases in their homes to be on the streets, or in public conveyances, or in public places where children might be unwittingly exposed to the contagion.

It so happened that the little boy did take scarlet fever, and, greatly to her discomfiture, quarantine was established. Now quarantine assumed an entirely different visage—it was a monster of hideous mien, and she remarked to a neighbor—"If Dr. ——— had been home I wouldn't have been quarantined." This is quite likely!

A week or two after quarantine was established in this and some other cases we received the following letter from an intelligent, very well known and successful business man:

J. F. Kennedy, M. D., City:

MY DEAR SIR—I write you because I presume you are the proper party to see to some matters that are sorely neglected. Why is it that ———, ——— and others who have scarlet fever in their families go out on the streets, mingle with old and young, and no action taken to prevent it. I have come in contact with two of these men unavoidably, and even before I knew I was endangering the lives of myself and family. Such things should be prevented, and the man or woman who will thus expose others is, in my opinion, worse than the assassin who takes the life of your dear ones, for he takes his chances, while he who carries death to dear children, and thus robs us, does so feeling secure and thinking, "Well, no one can trace it to me, and even if they do it will only be called an unavoidable accident." I personally know of a home that was robbed of a lovely child, and an only one, by pure carelessness that we think is criminal. We know a woman whose children had scarlet fever and who went out every day on the street cars, and in all kinds of gatherings, without change of clothing and was the direct carrier of other cases that were known, and perhaps many not known. It seems some people think they should not heed any law, or the lives or good of others. I don't care to have my name quoted, but you can verify these statements and I hope have power to stay the spread of this pestilence.

Yours truly,

P. S. These parties are all personal friends of mine and esteemed by me, only for this action, which, in my mind, is a crime greater than they seem to comprehend.

We believe the sentiments expressed by this gentleman so vigorously are justified, and will be endorsed by most of our readers—at least until they themselves become the subjects of quarantine.

Not all, however, who are quarantined believe it an unmitigated evil. Looked at properly all should regard it as a blessing—as an opportunity for quiet, for rest; for exemption from the too often oppressive cares of social life; a relief from "calling" and "being called upon;" an opportunity for the wife and husband and children to get better acquainted with each other; a refuge from the persistent collector and the irrepressible "agent." We verily believe that many a family with great benefit to their health and comfort could at least once a year be quarantined for small pox or some other dreaded infectious disease.

Instead of quarantine being regarded as a punishment and a disgrace it should be considered, and could be made, a blessing.

Harper's Bazaar some time since contained an article giving the experience of a woman while enduring the hardships (?) of quarantine. Her remarks are so sensible and so different from

the expressions usually heard from those quarantined that they are reproduced here. They are as follows:

"My boys and I have been shut up together for six weeks," said a little woman the other day, her bright face dimpling with sunny smiles, showing how sweet and fresh is the quality of youthfulness which makes the matron as captivating in her meridian as the girl must have been in the morning. "Quarantined," she added, "and we've had a siege of it; but the dear lads were never really ill, notwithstanding the dreadful character of the disease which had them in its clutches. Of course we were terribly anxious, and the doctor kept warning that we could not be too careful; and I had such a horror of any infection wafting itself from our doors into the home of some body else where there were children, that I could not sufficiently multiply precautions; but when all was said, and all the privations and disappointments borne, there were compensations. The boys and I grew so well acquainted! We read several splendid books through, from the first chapter to finish; we studied the New Testament; played games. They told me everything, just as when they were my babies toddling over the floor and coming to mamma with their questions and troubles, and now that it is over I shall always look back with a certain gratitude and pleasure of memory on our six weeks in quarantine."

Quarantine though so beneficent in design may become a great *hardship* and inhumane through the ignorance or wilful neglect of health officers. The mayor of an incorporated town or city, or the clerk of the district township are the only persons legally authorized to institute, maintain and release quarantine. This authority and duty to establish and maintain quarantine carries with it the duty to see that the quarantined not only properly respect quarantine, but that they are furnished with proper medical attendance, food, raiment, fuel, nurses and other needed help as well as proper sepulture in case of death, and proper disinfection of the premises and persons of the exposed or infected whatever the result of the sickness.

There have been some instances of the maintenance of quarantine in Iowa in a manner highly discreditable to any civilized community; when rigid quarantine was established and when for weeks no one visited the premises to look after the personal wants of those shut up, and the only method of supplying the wants of the family was by the stealthy visits of the father and husband to the nearest village. Happily these occurrences are very infrequent and are growing less frequent.

There is a good deal of confusion as to the *quarantinable diseases*—the Board not deeming it necessary to quarantine all infectious diseases.

Quarantine is required in small pox, yellow fever, cholera, typhus fever, diphtheria (membranous croup), scarlet fever (scarlatina, scarlet rash), and measles. The Board issues, and distributes free upon call, circulars relating to most of these diseases—giving the cause, and best means of preventing and restricting their spread.

Children from the homes where these diseases exist must be kept from the public school—the sick themselves being isolated in the home so far as possible; all the inmates kept within, and the public and everybody kept without, except the medical attendant and nurses.

There are circumstances when the local board may find that the head of the family may be allowed to attend to his duties as the bread-earner. This can only be done when there is positive evidence that the party desiring release does not come in contact with the sick, and when the occupation of the person does not throw him or her among children. It would not apply to school teachers, nor to canvassers, nor to any person going into homes or into public assemblies.

There are other infectious diseases that are not fatal in character, and others that are, that the Board has not yet required to be quarantined.

In addition to the above named diseases, "Rule 3," of the Rules and Regulations, relating to the "Prevention and Restriction of Contagious Diseases," declares that persons sick with whooping-cough and mumps must be excluded from the public schools "until by authority of the mayor or township clerk, as the case may be, approved by the health officer, permission for their admission is granted; and all persons from families where such diseases exist shall also be excluded." Still the Board does not quarantine against whooping-cough or mumps, nor against typhoid fever and rothein (or German measles).

Children from homes where typhoid fever is present should be excluded from the public schools. It is well known that this disease is wholly communicated by food or drink. There are many ways in which the lunch furnished children for the noon hour might be infected by the germ producing typhoid fever. Children at such times are often generous, sharing their fruit and food with their associates and thus spreading the disease. Typhoid fever is not spread by personal contact, unless by such contact some of the disease germs are transferred from the sick to the well. Hence the Board has thought there was no necessity to quarantine this infectious and fearful disease.

The following from the October (1893) number of the monthly Bulletin illustrates the disposition of the courts in the application of statutes and rules and regulations founded thereon relating to the public health. With cholera menacing the State on the West and a constant possibility of an invasion by small pox or cholera it is well to consider what backing would be given the State Board of Health and local boards in vigorous efforts to protect the people.

When cholera visited New York in 1892 an emergency meeting was called, and this Board determined, if the invasion of Iowa by cholera or small pox become imminent, that sanitary inspectors would be placed on duty at all points of entry to the State with authority to challenge all persons entering the State, detain and quarantine all persons from infected ports or vessels, and to disinfect their baggage. There were not a few who doubted the legality of such measures and who felt that the railways and other common carriers would not and could not be required to submit to such detention and interruption with their traffic.

Dr. Baker, Secretary of the Michigan State Board of Health, refused to recognize a passport issued to an immigrant from Quebec and insisted on the inspection, detention and disinfection of immigrants to Michigan. The agent of the Milwaukee, St. Paul & Sault Ste. Marie railroad notified Dr. Baker that if the Michigan Board of Health attempted any interference or detention of their passengers and baggage he would sue for damages. Dr. Baker in reply said the rules of the Board would be enforced—that whatever the costs he was going to do his best to protect his State from infection. This emphatic reply brought matters to a crisis. The railroad authorities applied to the United States Circuit Court, Western District, Michigan, for a preliminary injunction to restrain the Board of Health from enforcing its rules. The case came before Judges Severens and Sage and the decision handed down July 29, 1893.

We hope all health officers and local boards, and also those who questioned the legality of our Board to attempt to enforce the rules above referred to, will all read the decision of these learned judges carefully.

The motion for injunction was overruled, as set forth in the following decision:

1. In Brown vs Maryland, 12 Wharton, 419-433 vs. Chief Justice Marshall, recognized that the removal or destruction of infectious or unsound articles was undoubtedly an exercise of the police power of the State, and

an exception to the prohibition resulting from the exclusive power to regulate the operation of foreign and interstate commerce, and he says that laws of the United States expressly sanction the health laws of the State.

In the license cases, 5 Howard, 504, 576, Chief Justice Taney declares that "It must be remembered that disease, pestilence and pauperism are subjects of commerce, although sometimes among the attendant evils. They are not things to be regulated or trafficked in, but to be prevented as far as human foresight or human means can guard against them." In Creatcher vs. Kentucky, 141 A. 547, Justice Bradley refers to these cases with approval, and states with great clearness and force the distinction between the exercise of its police power by State and an attempt to legislate upon matters of interstate or foreign commerce, which are exclusively in the power of the Federal government. These authorities render it unnecessary to refer particularly to the cases cited for the complainant. It is sufficient to say that they all relate to State enactments concerning articles of commerce, and hence we are not applicable here. Moreover the quarantine act of Congress approved February 15, 1893, expressly recognized the validity of State laws, and in section 3 requires the Supervising Surgeon General of the Marine Hospital Service to cooperate with and aid State and Municipal Boards of Health in the execution and enforcement of their rules and regulations.

2. We find nothing in any existing treaty with Norway and Sweden which conflicts with the institution or enforcement by any one or more of the States of this Union of quarantine regulation.

3. We do not deem it necessary to express an opinion whether the provision of the Michigan Statute making it a misdemeanor to violate the rules of the State Board of Health, adopted in pursuance of the act, is constitutional or valid, for we should not, even if we were of the opinion that it is unconstitutional, undertake to issue an injunction against criminal prosecution by the State. That the legislature might authorize the Board to adopt rules, is, we think, beyond question. Such rules are essential to the proper enforcement of the law.

4. To the objection that passengers from non-infected countries and localities are detained, the answer is that such detentions are in the nature of the case, to a certain extent unavoidable; and passengers from such countries and localities may have become subject to detention by reason of having mingled with others who could communicate pestilence or disease to which they themselves had been exposed or subjected. An opportunity for separation is indispensable also.

5. The objection that passengers who had certificates from United States Inspectors, were detained is not tenable. The States may exercise their police power according to their own discretion and by means of their own officials and methods. The inconvenience resulting to emigrants and travellers from being halted and subjected to examination and detention at State lines is of trifling importance, at a time when every effort is required and is being put forth to prevent the introduction and spread of pestilential and communicable diseases.

The costs and charges which are incurred in such quarantine inspection may lawfully be imposed on the railway company, as being incident to the business in which they are engaged. The cost of the motion will be taxed to the complainant.

H. F. SEVERENS.
GEORGE R. SAGE.

It will be noticed that this decision not only sustains the Michigan Board in its rules and regulations, which are very similar to those of the Iowa Board of Health, but declares that the expenses incurred in the inspection and quarantine may be charged to the railroad as an incident to their business.

RATIONAL QUARANTINE.*

Health is a relative condition which all beings gifted with intelligence aim to possess. Its complete possession only means enjoyment of life and happiness of existence.

Its opposite—disease—in whatever degree or form it may exist, means suffering, misery and unhappiness.

Sanitation, the science of sanitary conditions, aims at the discovery and recognition of disease causation, the prevention of disease and suffering, the prolongation of life, and the enjoyment of happiness.

Sanitation, then, must include a knowledge of the causation of disease, and with it a knowledge of the means and methods of its prevention, or the prevention of its spread when it appears.

Of the many forms of disease now known, outside of the accidental, three distinct varieties are recognized: The non-contagious, the contagious and the infectious. The latter are again subdivided into the malignant, such as small pox, scarlet fever, diphtheria, cholera, yellow fever, typhus fever, puerperal fever, etc.; and the non-malignant, such as measles, roseola, chicken pox, erysipelas, enteric fever, mumps, whooping cough, etc., etc.

The first order, the non-contagious or infectious diseases, do not endanger the health or life of others, whereas the contagious and infectious ones do, the former by simple contact with the individual thus diseased or his environments, the latter by having introduced into the healthy organism the disease product causing it.

To prevent the multiplication and spread of these classes of diseases isolation of the individual thus diseased and disinfection of the disease-products have been found to be the best and only means now known, and are recommended by all sanitarians and ordered by all boards of health, both State and local.

QUARANTINE.

In its narrowest sense the word means "a period of forty days." In its earlier history its meaning was applied to ships having on board contagious disease, and which were prevented from entering or leaving port while the disease lasted.

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*By Frederick Bocker, M. D., Clermont, member of the State Board of Health.

In its wider sense it means isolation on account of contagious disease of any person infected or sick with such disease, sufficiently long to cover the period of incubation, or the entire duration of the disease, together with time for complete disinfection of the apartments and apparel occupied and used by an individual while sick.

If from no other than an economic standpoint, quarantine would not only be justified but demanded to save to the home, to the State and Nation valuable lives and productive powers, not to mention the prevention of suffering, and often death, with its heartache, which is sure to follow in the path of widespread and fatal contagious diseases. More than that. The broken ties of family life caused by a single preventable death carry with it pangs of conscience often too great to endure, especially if the realization accompanies it that carelessness or ignorance has been its cause.

Let us look back a moment to the recent epidemic of cholera in Asia and Europe, which caused thousands of deaths in those countries, and which was prevented from taking a foothold on this continent by the strict quarantine measures employed by our government.

We refer further to the recent outbreak of small pox in different parts of the United States, which no doubt would have become a widespread epidemic had not State and local boards of health acted promptly in isolating and quarantining the cases that did occur.

There is no longer a doubt as to the utility of quarantine measures in the prevention of contagious and infectious diseases. The question is, How to make it effective and popular in all cases and in all localities?

GRADATION IN QUARANTINE.

As there is a recognized gradation in the malignant and dangerous character of contagious and infectious diseases, so there must also be a gradation in quarantine regulations and their enforcement. The reason for this is apparent. Every measure which restricts the freedom of a people, or an individual must, in order to be observed, be popular. And further, in order to be popular it must be reasonable, that is, must be warranted by circumstances, and not interfere with the welfare of those placed under restrictions. It must also be administered with impartiality to all alike under the same circumstances—the rich as well as the poor.

The question of the proper gradation of quarantine is a fine art and requires the best of judgment on part of health boards. It will only be possible to give a general outline here, leaving the finer shades to the good judgment of those whose duty it is to administer it. The strictest quarantine measures should only be employed in the most malignant and fatal of the contagious and infectious diseases, such as small pox, scarlet fever, diphtheria, cholera, yellow fever, typhus, etc., wherein as nearly as possible (except necessary attendants and nurses) complete quarantine of the infected premises and isolation of the sick should be maintained for the full duration of the disease, and wherein release from quarantine should be granted only after thorough disinfection of the premises and apparel of the sick has been had. From this rule there should be no exception made in any of the above named diseases, no matter whether the cases are mild or the most malignant, for, as a rule, it is the mild case from which the disease is spread more often than the malignant.

These suggestions can not be emphasized too strongly, for it is a fact well known to every sanitarian that "walking cases" of contagious diseases of this type are the ones especially that spread disease and cause thousands of deaths annually.

The modified or milder quarantine, which consists in the prevention of intercommunication with the well, and placarding of the infected premises, is admittable in the less malignant and fatal contagious diseases, such as measles, roseola, chicken-pox, mumps, whooping cough, enteric fever, erysipelas, etc.

A third class of diseases, which have thus far not been brought under quarantine regulations of any kind and class, which, however, are contagious and infectious in a high degree, are the tuberculous and the syphilitic, for which quarantine measures of some kind should be, and undoubtedly will be, provided in the near future.

Now, let us return to the question: How to make quarantine popular and effective?

If the golden rule, "Love Thine Neighbor as Thyself," is applicable anytime in human life, it certainly has an especial significance in connection with quarantine regulations. When seclusion must be added to suffering; when an individual or a family is deprived of intercommunication with friends and relatives; when many of the privileges they commonly enjoy are denied them; when they are to be confined to their own

premises for a period of forty days and often more; when death enters the home and robs it of some loved one; when they are deprived even of the assistance of friends in the burial of their dead, and are obliged to lay them away in their last resting place—then is the time when those, in whose keeping is placed the responsibility of enforcing quarantine regulations, need wisdom and need love to temper down the objectionable features of quarantine.

It is not enough to place the danger signal upon the door of those afflicted with contagious disease to warn the public against entering the infected premises; it is not enough to simply show the authority of the law and of the individual who administers it; all these things, it is true, must be done, and strictly done, as well as punctually and effectively; but it should be done tenderly and sympathetically; should be done in such a manner as to let the afflicted feel that he that administers the law is their friend and will be their provider. With the very act of placing a family under quarantine should go the assurance that the health board will carefully guard their most sacred interests, supply their every need and want. This alone will make quarantine popular.

DUTIES OF ATTENDING PHYSICIANS.

To make it effective requires the cordial coöperation of the attending physician and local health boards. Much depends upon the early recognition of any case of contagious and infectious disease, and the prompt reporting of all such cases to the proper health officer. Every physician to whom has been granted by the statute of the State of Iowa, or any other State, a certificate to practice medicine within the State, has with it been granted a great privilege, one that presumes a profound education in medicine and allied sciences, and a proper training in the diagnosing of diseases. It presumes further that the recipients of such certificates are not only men of scientific attainments, but that they are gentlemen of honor; honest in character and upright in conduct; men that stand above deception and fraud, especially when the lives and welfare of individuals or a community are at stake. To practice favoritism or fraud with the possibility of it being the cause of suffering and often death of the innocent is criminal in the extreme and should be sufficient cause for the revocation of such certificates.

We are proud to say that but few such physicians could be found and that nearly all holding such certificates are men of honor, who would not knowingly neglect a duty sacredly placed upon them by a State authority.

DUTIES OF HEALTH PHYSICIANS.

The association of a health physician with all local health boards is a wise provision of our statute. He is the counsellor of the Board in all questions pertaining to sanitation and public health. He is also the authority before whom are brought all questions of doubt or dispute in the diagnosis of contagious and infectious diseases. His position is an utmost responsible as well as a very delicate one. Of him is required profound knowledge in the recognition of disease, as well as masterly tact in the settling of disputes. He needs to exercise the greatest of caution if called upon to either corroborate or correct diagnosis, and should always be courteous to the physician who has such cases in charge. Questions of creed in medicine should never form a barrier to duty, neither should it be the cause of discourteous conduct. It is always proper when called upon to visit patients of other physicians to do so in company with him who has the patients in charge. Many complaints are annually brought against health physicians for breach of courtesy, which should not be.

The health physician should be well informed in the value of different methods of disinfection, for he is the judge whether it is well or poorly done. In great measure is the public health depending upon proper disinfection after an invasion of contagious disease, and neglect of this duty may be the cause of its spread.

DUTIES OF HEALTH BOARDS.

One of the wisest provisions of our health laws is the section creating local health boards in every township, town and city throughout the State. By this means alone it is possible to stem the tide of widespread contagious and infectious diseases.

So soon as an outbreak occurs in any part of the State the local board is at hand to meet it and to prevent its spread. Its duties are many fold and exacting, for upon its prompt action much is depending in the preservation of the public health and the prevention of epidemic diseases. Its labors, although of the greatest importance to all, are not often duly appreciated, especially when it becomes their duty to restrain individuals,

families or corporations in their freedom of action and oblige them to be obedient to the dictates of law.

One of the most unpleasant duties of local boards certainly consists in the establishing and maintaining of quarantine during outbreaks of contagious and infectious diseases, when it becomes their duty to confine individuals or families to their premises for a longer period of time, and hinder communication with their neighbors and friends. And still, duty must be done, regardless of person, even under the most trying circumstances.

But, as has been suggested before, such duty should be done with sympathy and freely seasoned with love; then much of the hardship of suffering and isolation will be tempered down, as oil poured upon the turbulent waters soothes down the roaring billows and makes smooth sailing for the mariner.

Placing the placard upon infected premises does not constitute the fulfillment of all the duties of local boards toward the quarantined; it is simply the first and most unpleasant act. With it begins the real labor of love for the afflicted. The placard serves as a warning to the public not to enter the premises and is generally all that is needed to keep people at a distance. The providing of those quarantined should not be left to the good Samaritan who, perchance, happens to be passing that way, but should be regularly and punctually attended to by the local boards, in order that want may not be added to disease. The delegating of such duties to some one else is sure to be a sad failure and will always result in disappointment to the afflicted, and in the breaking up of quarantine.

For the guidance of local boards the State Board of Health has published a number of circulars in which it calls their attention to the fact that "Whenever quarantine has been established against any individual or family, it becomes the duty of said board to provide in every way necessary for those quarantined in the furnishing of the necessities of life and in providing medical and other attendants, and nurses, if needed, for the proper care of the sick." And further, "Where well persons are quarantined with the sick (as there always are) they, also, must be furnished with food and other necessary supplies."

These instructions are earnestly meant, for the State Board does not intend a quarantine that savors of ancient barbarism, wherein the sick and dying are left alone and to their fate. It intends a quarantine that will be a credit to this nineteenth century, wherein no additional suffering is inflicted upon the

sick and the well by neglect and want. The providing of the necessities of life to the quarantined becomes the first and most important duty of local boards after the establishment of quarantine, a duty that should never be neglected nor forgotten.

EXEMPTIONS FROM QUARANTINE.

There are often times and circumstances under which it becomes necessary for local boards to allow exemption from quarantine, especially to the providers of the family afflicted. It will hardly be necessary to say that this should always be done only under the greatest of sanitary precautions, to be prescribed by the Board in consultation with the health physician, and should be carefully regulated in each individual case. It is better, however, for a community, or town, to provide for the afflicted at public expense, than to endanger the health and the lives of the well.

BURIAL OF THOSE DEAD FROM CONTAGIOUS AND INFECTIOUS DISEASES.

Never, under any circumstances, should a corpse be taken into a place of public gathering, or public worship, prior to its interment in mother earth. This old habit of superstitious times should have been abandoned long ago by all civilized peoples. This assertion is founded in the fact that any corpse, no matter how lovely the person may have been during life, has become a mass of decomposing matter after life is extinct, emitting a mass of deadly gases, injurious to the well. Especially is this the case after death, from the malignant contagious diseases, where, during the latter hours of life, decomposition begins. Sentimentality should cut no figure here; reason should rule supreme. The ruling of the State Board of Health that bodies dead from any of the contagious and infectious diseases, shall be enwrapped in a sheet saturated in a solution of bichloride of mercury, is a precaution only during the transportation of the corpse from the home to its place of interment. Never should such a corpse be taken into a church or other place of public gathering, but should be transported to the nearest place of burial by the shortest, most direct and least frequented route possible. It is not generally known that such corpses are more prone to the spread of the disease after death than the individual could while living. Such, however, is the case. It is for this reason, too, that such

corpses are prohibited from being transported by railway trains and other public conveyances.

All these precautions are adopted, not as a menace to the afflicted, but as a safeguard to the well, and are intended for the preservation of the public health, the prolongation of life and the increase of human happiness.

DISINFECTION.

A great deal of the sickness and mortality that have befallen the human family from remote ages until the present time has been produced by infectious and contagious diseases—diseases that if unchecked are liable to become epidemic in character and frightful in mortality.

When a person dies with a non-communicable affection the malady dies with him, and the result, so far as the public is concerned, is comparatively trifling. If, however, a person be sick with an infectious or contagious disease, his sickness is a public calamity, since during his entire indisposition, including convalescence, he is a center of infection or contagion—his breath, perspiration, excretions, skin, clothing, every thing coming from him, or being in contact with or near him being more or less permeated with the specific poison. As a focus, therefore, the disease may spread from him, if unchecked, until numberless others, covering great areas of country, may be involved in its fatal influences.

Hence, for several years men of science and legislators have been planning, experimenting and legislating with the hope of discovering the best method of preventing or restricting the spread of these infectious diseases. As a result of these patient and prolonged investigations two simple means have been determined upon which, if faithfully carried out, would soon rid the world of these dreadful maladies. These "means" are QUARANTINE, or isolation of the sick and their nurses, and thorough DISINFECTION—"the former meant to let the matured disease die out, and the latter to kill the new germs before they can develop fresh mischief." To these means should be added,

in the case of small pox and perhaps some other of the communicable diseases, vaccination or inoculation.

The object of this circular is to designate, so far as the Iowa State Board of Health can, the best disinfectants and their most practical and successful methods of application.

It is important, first, to know what parts of the body are the favorite breeding places of the germs or micro-organisms that are the cause of infectious diseases and what parts give them off most freely.

As a result of observation and experimentation it has been found that—

In cholera they are most numerous in the discharge from the bowels.

Consumption, in the expectoration from the lungs.

Diphtheria (membranous croup), in discharges from mouth, throat and nose.

Measles, in the air passages and skin.

Puerperal fever, in the discharges of the reproductive organs.

Scarlet fever, in the discharges from mouth, throat and nose, and particles from the skin.

Small pox and varioloid, in the pustules of the body.

Typhoid fever, in the discharges from the bowels.

Whooping cough, in the air passages.

From these sources they get into our bodies by means of the food we eat, the water we drink, the air we breathe, or through broken surfaces of the skin and mucous membranes. Many of these germs are very tenacious of life, and under favoring conditions multiply with wonderful rapidity.

Freezing or drying destroys but few of them—boiling or burning kills them all.

It is important, as well as interesting also, to know, at least approximately, how long the infection lasts in given cases. The following shows the average period of such infection:

Cholera, until complete recovery from the vomiting and purging.

Consumption, as long as the tubercular bacilli are found in the sputa.

Diphtheria, at least three weeks after nose and throat are well.

Measles, from three days before eruption until scurfiness has gone—two to four weeks.

Scarlet fever, from five to six weeks, until the throat is well and desquamation (peeling off) has ceased.

Small pox, from four to eight weeks, until all the scabs have fallen off.

Typhoid fever, from five to seven weeks, until the fever has disappeared and the diarrhœa relieved.

Whooping cough, until the "whoop" is gone—from four to six weeks.

The following illustrate some of the best known and most reliable methods of caring for those sick with infectious diseases and of destroying the disease-producing germs:

CLEANLINESS.

A careful inspection of the premises, inside and out, should be made, including the cellar, well and outhouses, not only with a view of ascertaining the breeding places of the disease germs, but for the purpose of destroying every thing that is a menace to health. Cleanliness of dwellings, closets, cupboards, privies, alleys, person, clothing, and bedding should be enjoined and enforced. Carpets, dirty and dust-laden, and successive layers of paper on the walls, especially when partially detached, form most excellent receptacles for preservation of these disease germs.

ISOLATION.

The isolation of a patient suffering from any infectious disease is of the utmost importance in restricting its spread.

If possible, so soon as a disease is discovered to be infectious in character, the patient should be removed to a hospital for the care of such diseases.

Where this can not be done, isolate the patient as perfectly as possible in one room in the house.

The room should be on the upper floor, facing south and east, to secure the greatest amount of sunlight; it should be large, and if possible, have two windows for free cross ventilation.

Remove from it all carpets and curtains, and all furniture (more especially upholstered furniture), not absolutely necessary.

It is better without paper on the walls or any thing to which dust or the germs of disease may adhere more readily.

It should contain a small stove with a wood fire constantly burning in cool weather, to aid the ventilation, and for the destruction of soiled rags and unused portions of solid food.

The door should be kept closed and also have hung over it from the frame a sheet kept constantly wet to entangle as much as possible of the dust and germs of disease floating in the air, when the door has necessarily to be opened.

No one should enter or occupy the room but the nurse or nurses in actual attendance, and these should remain there or in an adjoining room, not intermingling with the other occupants of the house.

Persons attending on the sick should not wear woollen garments, as the germs of disease readily cling to such. Dresses of cotton or of some washable material should be worn.

Allow abundance of air and sunlight, which are two of nature's great purifiers.

In cases of scarlet fever, diptheria, small pox, etc.:

When the patient can not be removed to an infectious-disease hospital, or properly isolated in a room in the house, the healthy occupants of the house should be removed, disinfected, and kept by themselves until the period of incubation of the disease is over, and the infected persons and nurses quarantined strictly upon the lot upon which the house is built.

All commingling with other people should be rigidly prohibited.

The visits of the medical attendant should not be prolonged. He should wear a covering for his clothes while in the room and disinfect his hands, face and hair after each visit.

DISINFECTION.

Disinfection is based upon the only practical and plausible theory that all these communicable diseases are caused by a micro-organism—specific in character, whose multiplication and vitality are dependent upon favoring conditions, that can be successfully combatted by agents denominated *disinfectants*. The terms "antiseptics," "deodorants" and "disinfectants" are, by many, thought to express the same thing. They are widely different.

An ANTISEPTIC is an agent which retards, prevents or arrests putrefaction, decay or fermentation. It may also arrest the development of the germs of disease, and may be used as a preventive of such diseases, but it does not destroy the life of disease germs and hence can not be relied upon when such germs are present.

A DISINFECTANT or GERMICIDE is an agent which has the power of destroying germ life.

A DEODORANT has the power of removing offensive odors but may have no disinfectant powers whatever, and, *vice versa*, the disinfectant may have no deodorizing power. Therefore, the removal of an offensive odor by means of a deodorant does not remove the danger from disease germs already present.

The following is a list of the most useful DISINFECTANTS:

I.—FIRE.

Complete destruction of every infected thing of little value.

II.—STEAM.

Under pressure, superheated, temperature 221° F. Exposure to this for ten minutes will destroy all germs. Ordinary steam at 212° F. will not penetrate sufficiently. Pressure is required to secure penetration. Every well-regulated local health department should have ample facilities for the application of "steam" and "dry heat," where all infected articles suitable for such methods of infection that are too valuable to be destroyed should be officially disinfected. For this service a small fee might be charged.

III.—DRY HEAT.

Baking in an oven at temperature of 230° F. for two hours. Greater heat than this is liable to destroy the texture of most articles.

IV.—BOILING IN WATER.

Actively for half an hour. This will destroy all known germs of disease.

V.—FRESH CHLORIDE OF LIME.

Six oz. to one gal. of soft water. Specially useful for fæces, urine and sputa.

VI.—CORROSIVE SUBLIMATE.

(Bichloride of mercury.) This is a powerful poison, and when the solution is made it should be colored by some aniline dye or permanganate of potash, so that it may not be mistaken for water. Specially useful for soaking clothing, bedding, towels, etc., and for scrubbing walls, floors, wooden furniture, etc. Always use wooden or crockery vessels for holding this solution.

VII.—CARBOLIC ACID.

Useful for most purposes.

VIII.—SULPHUR FUMES.

IX.—FRESH AIR AND SUNSHINE.

The following rules for the use of disinfectants are recommended:

RULE 1.

Precautions to be taken when removing a patient suffering from a contagious disease.

Remove all clothing, linen, coverings or other effects of the patient, and replace them by others which have not been used since the beginning of his illness, or which have not remained in the room in which he has been isolated, unless, however, such clothing, linen, coverings or other effects, after having been used by the patient or having remained in his room, have been disinfected in the manner described in Rule 4.

Provide the patient with rags for receiving his expectorations or evacuations during the transport, and burn these rags or disinfect them according to one of the three methods destribed in Rule 4.

RULE 2.

Disinfection of a house or apartment, and of the furniture and effects contained therein.

First Method: Close all outlets of the premises to be disinfected, then fumigate with sulphurous acid by burning for at least six consecutive hours, four pounds of sulphur for each 1,000 cubic feet of space. (a)

Second method: Remove all the effects, furniture and articles contained in the premises in order to disinfect them in the manner described in Rule 4, then thoroughly wash the walls,

(a) Many health boards have discarded the use of sulphur entirely as a disinfectant, because of the careless manner of its use.

To have a successful disinfection, every aperture, hole, joint, etc., must be impermeably closed, and the windows so arranged that they may be opened from the outside, either by a string or by some other contrivance, after disinfection is completed. It must be borne in mind that sulphurous acid gas (vapor of burning sulphur), when inhaled in large quantities, is destructive to life.

To insure the combustion of the sulphur, and as a precaution against fire, place the sulphur, either in powder or in small fragments, in an iron pan which should be placed upon a couple of bricks or stones in a tub partly filled with water. In order to insure the ignition of the sulphur, the surface should be well moistened with alcohol before applying the light. Several twisted slips of newspapers imbedded in the sulphur and projecting above the surface and ignited at their ends will answer the same purpose.

After the room has been subjected to these sulphur fumes twenty-four hours, throw open all doors and windows, and air the house well, after which, sponge all exposed surfaces with a solution of carbolic acid, two ounces in each gallon of water, and give a final scrubbing with soap and hot water.

ceilings and floors with a solution of bi-chloride of mercury: one drachm to a gallon of water.

RULE 3.

Disinfection of a vehicle or boat used in the removal of a patient, or of the body of a person who has died of a contagious disease.

First method: Remove all cushions, curtains and other accessories, and disinfect them according to one of the methods described in Rule 4, then wash out the vehicle or boat with a solution of bi-chloride of mercury: two drachms to one gallon of water.

Second method: Put the vehicle in a closed-in place and fumigate with sulphur as described in Rule 2.

Wrap the body in a well sewed sheet completely saturated with one of the following solutions:

1. Bi-chloride of mercury: two drachms to one gallon of water.
2. Carbolic acid: four ounces to one gallon of water.
3. Chloride of lime: six ounces to one gallon of water.

RULE 4.

Disinfection of everything taken out from the room where the contagious patient is isolated.

Food:

Burn the remains of the food which has been served to the patient, or sprinkle them with a solution of carbolic acid or bi-chloride of mercury; or sprinkle them with chloride of lime and bury them.

Vessels and utensils:

Wash them in boiling water.

Clothing, sheets, napkins, coverings and other linen.

1. Burn them, if of little value; or,
2. Boil them in water for at least half an hour; or,
3. Steep them for four hours in a solution of one drachm of bi-chloride of mercury to one gallon of water; or,
4. Steep them for four hours in a solution of two ounces of carbolic acid to one gallon of water.

Furniture, mattresses and articles which might be injured by the foregoing methods of disinfection;

1. Expose them for ten minutes to a current of steam in a suitable apparatus; or,

2. Expose them for two hours to dry heat, at a temperature of 230° Fahrenheit; or
3. If neither of the two preceding methods can be employed put them in a well closed room, and expose to the fumes of sulphur, as described in Rule 2.

Expectoration and evacuations:

Collect them in vessels and mix with them one-half their quantity of one of the following disinfectants to be left in contact with them for half an hour:

1. Bi-chloride of mercury, two drachms to one gallon of water.
2. Carbolic acid, four ounces to one gallon of water.
3. Powdered chloride of lime.
4. Chloride of lime, six ounces to one gallon of water.
5. Lime-milk prepared as follows: sprinkle gradually lime of good quality with one-half its weight of water; dilute the powder so obtained with twice its volume of water. (a)

RULE 5.

Disinfection of persons and effects before leaving a house which has been quarantined.

Wash, at least, the uncovered portions of the body, the hair and beard, with a solution either of carbolic acid in the proportion of a tablespoonful to one gallon of water.

Completely change clothing, and put on other which has not remained in the infected house, or if it has remained there, which has been disinfected in the manner described in Rule 4.

RULE 6.

Disinfection of the patient and his effects after his recovery.

Wash the body with one of the following solutions:

1. A solution of a tablespoonful of carbolic acid to one gallon of water.

Disinfect as described in Rule 4, all clothing and other articles used by him since a period of fifteen days before the beginning of his illness.

(a) Lime-milk keeps only for a few days, and only when the vessel containing it is kept carefully closed.

RULE 7.

Disinfection of a stable, enclosure, litters, excrements, blood and other contaminated liquids.

Stable:

First method: Close all outlets, then fumigate with sulphur as described in Rule 2.

Second method: Wash the walls, ceilings and floors with a solution of bi-chloride of mercury: Two drachms to one gallon of water.

Third method: Whitewash with lime the walls, ceilings and floors.

Enclosure:

Remove the earth to a depth of three inches and bury it at least a foot deep.

Whitewash with lime the walls of the enclosure.

Litter, excrements, blood and other liquids from the sick animal:

Burn them, or bury them a foot deep, at least, after covering them with quick-lime.

RULE 8.

TO DISINFECT A PRIVY.

Almost impossible to do it if full. Empty it.

1. Corrosive sublimate, two drachms to one gallon of water.
2. Carbolic acid, four ounces to one gallon of water.
3. Sulphate of copper (bluestone), four ounces to one gallon of water.
4. Chlorinated lime, one-half pound to one gallon of water.
5. Fresh slaked lime to cover the contents.

Whichever is used must be used in large quantities and added frequently.

In preparing any disinfectant solution, always use soft water, because the chemical constituents of hard water injure the solution. Always use a wooden or crockery vessel for any solution of corrosive sublimate.

Since the Iowa State Board of Health publishes circulars upon small pox, diphtheria, measles, etc., and gives therein specific directions for the sanitary care of each, including quarantine, isolation, disinfection, etc., the special application of the foregoing disinfectants is omitted in this circular.

PUERPERAL FEVER

is, however, one of the infectious diseases not so treated by the Board. It is highly infectious and very fatal, and its presence is a rebuke to the medical attendant and nurses.

It is a disease that has no right whatever to exist, and fortunately, rarely is known where perfect cleanliness is observed.

The best known means of prevention are perfect cleanliness of person, both of patient, physician and nurse; cleanliness of bed and bedding, and the most perfect ventilation procurable. When the disease exists every thing in contact with the patient that could by any possibility be contaminated, should be disinfected, as recommended in Rule 4. The physician should thoroughly disinfect himself, especially his hands; and under no circumstances visit another lying-in-woman until he has put himself by disinfection in such a condition that there is no possibility of transmitting the disease to another. Diphtheria, scarlet fever, small pox and measles, serious and generally fatal in character, may be, and frequently have been, communicated to a puerperal woman by physicians or nurses previously in attendance upon these diseases, when proper disinfection has not been observed. To point out the danger and the cause is to suggest the best means of prevention.

THE DROWNED.

TWO THINGS TO BE DONE: RESTORE BREATHING; RESTORE ANIMAL HEAT.

Fig 1.

RULE 1. Remove all obstruction to breathing. Instantly loosen or cut apart all neck and waist bands; turn the patient on his face, with the head down hill; stand astride the hips with your face toward his head, and, locking your fingers together under his belly, raise the body as high as

you can without lifting the forehead off the ground (Fig. 1), and give the body a smart jerk to remove the mucus from the throat and the water from the windpipe; hold the body suspended long enough to slowly count one, two, three, four, five, repeating the jerk more gently two or three times.

Fig. 2

RULE 2. Place the patient face downward, and maintaining all the while your position astride the body, grasp the points of the shoulders by the clothing; if the body is naked, thrust your fingers into the armpits, clasping your thumbs over the points of the shoulders, and raise the chest as high as you can (Fig. 2) without lifting the head quite off the ground, and hold it long enough to *slowly count* ONE, TWO, THREE. Replace him on the ground with his forehead on his flexed arm, the neck straightened out and the mouth and nose free. Place your elbows against your knees and your hands upon the sides of his chest (Fig. 3), over the lower ribs, and press downward and inward with increasing force long enough to slowly count ONE, TWO. Then suddenly let go, grasp the shoulders as before and raise the chest (Fig. 2); then press the ribs, etc. (Fig. 3). These alternate movements should be repeated ten to fifteen times a minute for an hour at least, unless breathing is restored sooner. Use the same regularity as in natural breathing.

Fig. 3.

RULE 3. After breathing is commenced RESTORE THE ANIMAL HEAT. Wrap him in warm blankets, apply bottles of hot water, hot bricks, or anything to restore heat. *Warm the head nearly as fast as the body,*

lest convulsions come on. Rubbing the body with warm cloths or the hand, and slapping the fleshy parts, may assist to restore warmth, and the breathing also. If the patient can SURELY swallow, give hot coffee, tea, milk or a little hot sling. Give spirits sparingly, lest they produce depression. Place the patient in a warm bed, and give him plenty of fresh air; keep quiet.

BEWARE.

AVOID DELAY. A MOMENT may turn the scale for life or death. Dry ground, shelter, warmth, stimulants, etc., at this moment are nothing—ARTIFICIAL BREATHING IS EVERYTHING—is the ONE REMEDY—all others are secondary.

DO NOT STOP TO REMOVE WET CLOTHING before efforts are made to restore breathing. Precious time is wasted, and the patient may be fatally chilled by the exposure of the naked body, even in Summer. Give all your attention and effort to restore breathing by forcing air into and out of the lungs. If the breathing has just ceased, a smart slap on the face, or vigorous twist of the hair, will sometimes start it again, and may be tried incidentally, as may, also, pressing the finger on the root of the tongue.

Before natural breathing is fully restored do not let the patient lie on his back, unless some person holds the tongue forward. The tongue by falling back may close the windpipe and cause fatal choking.

If several persons are present one may hold the head steady, keeping the neck nearly straight; others may remove wet clothing, replacing at once clothing which is dry and warm; they may also chafe the limbs, and thus promote the circulation.

PREVENT FRIENDS FROM CROWDING AROUND THE PATIENT AND EXCLUDING FRESH AIR; also from trying to give stimulants before the patient can swallow. The first causes suffocation, the second, fatal choking.

DO NOT GIVE UP TOO SOON. You are working for life. Any time within two hours you may be on the very threshold of success without there being any sign of it.

IN SUFFOCATION BY SMOKE OR ANY POISONOUS GAS, as also by hanging—proceed in the same manner as for drowning, omitting effort to expel water, etc., from the windpipe.

IN SUSPENDED BREATHING FROM EFFECTS OF CHLOROFORM, HYDRATE OF CHLORAL, etc., proceed by Rule 2, taking especial

pains to KEEP THE HEAD VERY LOW, and preventing closure of the windpipe by the tongue falling back.

There should in cities and towns be a room provided near bathing places in which should be kept a gasoline stove with two burners, a supply of gasoline, a large water vessel or boiler, two or three blankets, a small electric battery, a supply of mustard for plasters, one or two rubber bottles for the application of hot water, and dry woolen clothing.

No medicines will be needed, as swallowing would be dangerous, if not impossible. There should also be provided a syringe for injecting hot water or stimulants into the bowels, and one for hypodermic medication.

THE HALL METHOD.

The following is the well known "Hall method," originated by Dr. Marshall Hall, of London:

1. Place the patient gently on the face for a moment to allow the escape of fluids from the mouth.

2. Turn the patient on his back and irritate the nostrils with a feather, ammonia, etc., and dash hot and cold water alternately on him.

3. Place the patient on his face, with the waist under the forehead, then turn the body gradually, but completely, on the side and a little more, then back again on the face. When replaced on the face, apply pressure along the spine and ribs, then proceed as before, repeating these measures sixteen times in a minute only.

4. Rub all the limbs upward, firmly but energetically.

5. Replace wet clothing by such other dry covering as can be procured.

THE SYLVESTER METHOD.

A later and better method prepared by Dr. Sylvester, is as follows:

1. Clear the mouth and throat of dirt and saliva and draw the tongue forward by the thumb and finger, or by a pair of forceps.

2. Place the patient on his back with his shoulders partly raised.

3. Let the operator kneel behind the head of the patient and grasp the arms just behind the elbows, drawing them gently and steadily upward until they meet above the head; then bring them down again to the side of the chest, compressing it in a slight degree, so as to imitate expiration. This is to be done sixteen times a minute.

THE HOWARD METHOD.

The following is the "Howard method":

1. Turn the patient on the face, with a bundle of clothes underneath the stomach, at the same time pressing on the spine to eject the fluids.

2. Then place the patient on the back, with a bundle of clothes underneath to elevate the pit of the stomach.

3. Let the operator kneel astride or beside the body, near the hips and with the ball of the thumbs resting on either side of the pit of the stomach, let the fingers fall into the groves between the ribs, then let the operator throw himself forward and squeeze the waist, and then suddenly let go. At first make four or five movements of this character in a minute, then gradually increasing to fifteen.

METHOD OF UNITED STATES LIFE SAVING STATIONS.

The directions given in the regulations of the United States life saving stations are as follows:

1. *To arouse the patient.* Unless in danger of freezing do not move the patient, but instantly expose the face to a current of air. Wipe dry the mouth and nostrils, rip the clothing so as to expose the chest and waist, then give two or three quick smarting slaps on the stomach and chest with the open hand.

2. *To throw off water.* If the jaws are closed separate them, and keep the mouth open by a cork or bit of wood. Turn the patient on his face, having a large bundle of clothing tightly rolled, placed beneath his stomach. Then press heavily over it for a moment, or so long as the fluid keeps flowing from the mouth.

3. *To produce breathing.* Clear the mouth and throat of mucous by introducing the finger covered with a handkerchief into the throat, turn the patient on the back, the roll of clothing being placed under the back so as to raise the stomach above the level of the other parts of the body. If another person be present let him hold the tip of the tongue out of the corner of the mouth, with a piece of dry cloth, while with the other hand grasp forcibly both wrists and keep the arms stretched back above the head, thereby increasing the prominence of the ribs, which tends to enlarge the capacity of the chest.

Kneel beside the patient's hips and with the balls of the thumbs resting on either side of the pit of the stomach let the fingers fall into the grooves of the short ribs so as to afford the best grasp of the waist. Using the knees as a pivot, throw all the weight forward on the hands and at the same time squeeze the waist between them as if you wished to force every thing in the chest up out of the mouth. Deepen the pressure while slowly counting one, two, three, then suddenly let go with a final push, which brings you back to a kneeling position. Remain erect on the knees while you count one, two, three, then repeat the same motion as before, gradually increased to fifteen times a minute, imitating the same regularity observable in the natural motions of breathing.

4. If natural breathing be not after a trial of the bellows movement for the space of four minutes, then without interrupting the artificial respiration, turn the patient on the stomach a second time, and rolling the body in the opposite direction from that in which it was first turned for the purpose of freeing the air passages of any remaining water, continue the artificial respiration as above.

5. Rub the limbs briskly and upwardly with a firm upward grasping pressure and energy. Warmth should also be promoted by applying hot flannels.

THE SATTERTHWAIT METHOD.

Dr. Satterthwait gives the following plan:

1. Try and get something warm to exchange for wet clothing. Get at once hot water, or have a fire built, into which bits of metal or stones may be thrown and heated, and from which warm blankets, and the bystanders' clothes, which are to be applied in rapid succession.

2. Try and get rid of the water by slightly elevating the body while the mouth is wedged open and the tongue depressed. To do this effectively roll the person on the face, raising the body, lower extremities and feet slightly, then wedge the mouth open with a bit of wood or knot in a handkerchief, then place the left fore finger on the base of the tongue and depress it. The finger will not be bitten because the mouth can not close. This opens the wind-pipe better than if the tongue is drawn out. Then, getting bestride, or aside of the person, press with the flat of the hand upon the bowels, pushing them upward at the same time. In half a minute, or less, the water will be driven out sufficiently to commence artificial respiration.

3. Turn the person on the back, with the head a little lower than the body, and make upward pressure on the bowels. Press the right hand upward toward the spine until you hear the air passing out of the mouth. Commence first slowly, and having driven the air out, remove the hand that the air may enter again. Then make upward pressure again, trying rather to exhaust the air thoroughly than rapidly. Three or four motions will be sufficient at first, then gradually increasing to ten or fifteen a minute, until there are evidences of life, or it is plain that it is extinct.

CHATTLE'S METHOD.

Dr. T. G. Chattle, of Long Branch, gives the following as the result of his personal experience in resuscitating many persons who had been drowned while bathing at that popular resort:

1. Cleanse the mouth and nostrils and face with a cloth or handkerchief before the body is disturbed.

2. Tie a knot in a cloth or handkerchief and draw it in the corner of the mouth between the teeth. This presses down the tongue and keeps the mouth open, saving the necessity of an assistant to pull out the tongue.

3. Turn the body toward the right side, over on the face, with the head resting on the arm of the body, or any thing else, to raise it three or four inches from the ground. By turning the body toward the right side the gravity of the fluids in the stomach will force a certain amount through the pylorus, or lower orifice of the stomach, which is relaxed in asphyxia. After the body is turned on the face, clasp the arms around the body, interlacing the fingers just below the hollow of the breast bone, or over the pit of the stomach, then give several quick jerks with the interlaced fingers, upward, as if trying to jerk the breath out of the body. This produces the same movement as the stomach undergoes in vomiting, and will eject the contents of the stomach; it will also force from the trachea froth, water or other foreign substance that may have penetrated to the lungs. A few seconds will serve for this purpose.

4. To excite respiration, turn the body on the back; with one hand press heavily and suddenly on the pit of the stomach, while with the other hand just above it press the chest inward and upward, then release it quickly, then grasping the body around the waist, with the operator's arms under the patient's

armpits, raise the patient forward gently and quickly to the sitting posture, then lay it down again and press the pit of the stomach as before. The pressure upward creates an impulse toward the heart, as well as an expiration. In lifting the body the weight of the abnormal viscera serves to draw the respiratory muscles down, which produces inspiration, while laying the body down and pressing upon it pushes the diaphragm up, producing expiration.

5. As the body is grasped, to raise it, the operator should slap the sides of the chest below the ribs, to excite action of the phrenic nerve. These motions should be repeated about twelve times a minute. So soon as breathing is established, remove the wet clothing, replacing with that which is dry and warm, even if it be the operator's own coat. The above can all be accomplished by one person, and had better be done mostly by one, even if assistants are near.

6. When there are bystanders or assistants at hand, while the operator is going through the method of respiration, let some of the others strip the patient of wet clothing. Keep the chest bared to the waist, get hot water and dash it upon the chest to produce shock. Let others rub the extremities and limbs briskly and upwardly, either with the hand or warm cloths or blankets.

If when a person is taken from the water the fingers are contracted, or hands clasped, it may be considered an evidence of remaining vitality, and should stimulate to exertions until relaxation shows returning consciousness or the presence of death.

After persons have been recovered, they should be warmly covered, and remain undisturbed if possible, or if necessary to remove them let it be gently done and give them a little coffee with animal broths, to aid returning vitality, as there is danger of a secondary shock after apparent recovery from drowning, which is just as severe as the original asphyxia.

How long a body may remain under water and be revived, or at what precise point the vital functions are so far destroyed as to make it impossible to call them again into activity, is not definitely determined, but practical experience has demonstrated that three minutes is the limit, though Dr. Chattle gives instances in which he has resuscitated persons who had been in the water eight to sixteen minutes. One case, a woman who had been in the water twelve minutes was resuscitated in an hour,

came near dying from secondary shock two hours later, and was saved only after the most strenuous exertions by means of artificial respiration, friction and stimulants.

Dr. M. H. Lackersteen, of Chicago, formerly of the British army, says he resuscitated a person four hours after submersion had taken place, and himself when in the army in India was submerged thirty minutes and resuscitated by the Marshall Hall method by his fellow officers.

The chances of revival depends very much on whether or not any great quantity of water gets into the lungs, but in most instances, however, the drowning person receives a shock which causes spasmodic closure of the glottis, and prevents the entrance of much water. In such cases revival can be secured with prompt and persistent effort.

Warm rubbing, warmth, ginger tea, hot coffee, champagne or wine, beef tea and egg should be ready for use, if there is resuscitation and ability to swallow. A portable bed should be at hand, so that in transfer to a building there may be no exposure but a complete recovery of animal heat. Special effort must be made against secondary shock, often resulting fatally, by quiet, warmth, food and rest.

How to keep the tongue out.—Feel with the finger where the tongue is, draw it forward to one side of the mouth, then pass a lead pencil or stick as large as your finger in from the side across to the opposite back tooth, which opens the mouth, when the tongue can be pulled forward or out at the angle of the mouth and held by a handkerchief wrapped over the finger, or, if there is no one to hold it, a pin may be passed through the end of the tongue, a string looped over the pin and the string made fast. This will do no harm.

How to use the hypodermic syringe.—Fill by suction or remove the nozzle and fill the barrel with whisky or brandy. Pinch up the skin of the upper arm or shoulder and insert horizontally, so that it passes through the skin on one side. Then push the piston down until the barrel is emptied of a teaspoonful. A drop or two of the fluid in the syringe should be always expelled before inserting to avoid forcing air under the skin. Repeat this every few minutes.

How to use the battery.—Have a small Faradic current battery which should be kept at every station. Mix a little water with a half teaspoonful of the bi-sulphate of mercury. If this is not at hand use any strong acid, and put it in the metal cup. See

that the battery works strongly by taking the tin handles, one in each hand. Apply one handle closely at the side of the neck and the other at the pit of the stomach, moving the latter around, and between the ribs of either side, and below the short ribs. It is much better to have the battery handles supplied with needles which can be thrust into the intercostal, pectoral and diaphragm muscles, so as to reach the phrenic nerve and the larger nerves of the solar plexus. A good battery, such as will answer every purpose, will cost about ten dollars.

HINTS ABOUT BATHING.

The following rules for bathing should be borne in mind by all persons:

Do not bathe upon an empty stomach, nor immediately after any meal, neither enter the water when perspiring, or when chilled.

The best time for bathing is either in the early morning or late in the afternoon. The middle of the day is objectionable from the excessive heat.

Never walk slowly into the water, but always wet the head, neck and chest immediately, otherwise the blood is driven to the head, causing sometimes headache, congestion, dizziness, faintness and nausea. When possible, it is better to enter the water head first, by diving.

Expose the body as little as possible to the air. Do not stay in the water, as a rule, longer than twenty minutes. So soon as the body becomes chilled stop bathing. Do not bathe when very tired or exhausted, or if in delicate health. Children should bathe but once a day. Persons of full habit of body, with a tendency of blood to the head, should exercise special caution in regard to bathing. The very aged or very young should not bathe, from the risk of shock.

After bathing leave the water at once. Rub the body briskly and thoroughly with a coarse towel or flesh brush, employing aid if possible. The reaction should be immediate, and if not felt, then a brisk walk or run, or in case of delicate persons, a little hot water or milk should be taken.

Special care should be taken to avoid cold currents, quicksand, rapid currents, undertow, and the chilling effect of fresh water in lakes and ponds fed by springs, which cause cramps.

In case of cramps, strike out forcibly with the contracted limb, with the toes turned outward. If this fails, turn on the back. Keep perfectly calm, and with the hands paddle until assistance comes, or the cramps pass off. Do not raise the hands above the head, as you will instantly sink. Keep the head above water, and don't become frightened.

RESUSCITATION FROM LIGHTNING SHOCK.

The following directions for procedure in case of apparent death from lightning or electric shock is given by Dr. Augustin H. Goelet and Dr. W. F. R. Phillips, of the United States Weather Bureau, at Washington:

If the body has actually been submitted to a current of sufficient volume to produce destructive tissue changes, all efforts at resuscitation will, of course, be futile. If, on the other hand, only respiration and the heart's action have been temporarily arrested, there is a condition of syncope similating apparent death by drowning, or from anæsthetics, and the physician knows that patients in this condition are frequently revived. Laymen will appreciate the nature of this condition if it is explained as one of exaggerated faint, and would not feel appalled upon encountering it if previously instructed how to cope with it. In an ordinary fainting spell the necessity to stimulate is universally appreciated. In syncope resulting from an electric shock stimulation is likewise indicated, but more vigorous measures are required. This is the only difference.

The direction to treat one shocked by electricity as one drowned may be misleading, as the conception of the layman of the necessities in this case would be to roll the body on a barrel. Let him understand that the condition is one of exaggerated faint; prompt stimulants are necessary. *The man must be made to breathe*, if this is possible, and the efforts to induce respiration must not be suspended until breathing is fully and normally restored, or until it is absolutely certain that life is extinct. This can not be assured in less than an hour's persistent, energetic, tireless effort.

The body must be placed upon the back. A roll made of a coat, or of anything else convenient (*rolled*, not folded), is placed

under the shoulders, and must be sufficiently large to so prop the spine up as to drop the head backward. The operator should kneel behind the subject's head, grasp the elbows and draw them well over the head, so as to bring them almost together above it, and hold them there for two or three seconds. Then carry them down to the sides and front of the chest, firmly compressing it by throwing his weight upon them. After two or three seconds carry the arms again above the head, and repeat the maneuver fifteen or sixteen times per minute. At the same time the tongue must be drawn out to free the throat. This manipulation stimulates respiration in the following manner, viz: When the arms are extended over the head the chest walls are expanded, just as in inspiration, and if the throat is clear the air will rush into the lungs. When the arms are brought down to the sides of the chest, compressing it, the air is expelled, just as in expiration. This manipulation must be executed with *methodical deliberation*, just as described, and never hurriedly nor half-heartedly. To grasp the arms and move them rapidly up and down like a pump handle is both absurd and absolutely useless.

If an assistant be at hand, the tongue, held by a cloth or handkerchief to prevent slipping, should be seized and drawn forcibly out during the act of inspiration, or when the arms are extended above the head, and when the chest is compressed it may be allowed to recede. The rythmical traction upon the tongue is in itself an excellent stimulant of respiration. It acts not only by freeing the throat of the tongue, which may fall back and obstruct breathing, but also by reflex irritation, through the frænum or bridle under the tongue being drawn forcibly against the front teeth.

In addition to these measures it is important to maintain the warmth of the body by the application of hot flannels, bottles of hot water, hot bricks, warm clothing taken from bystanders, etc. Firmly and energetically rub the limbs upward so as to force to blood to the heart and brain.

When swallowing is established a teaspoonful of warm water, wine, diluted whiskey, or brandy, or warm coffee should be given. Sleep should be encouraged.

WATER.

CONTAMINATION OF WELLS.*

Among the causes of the spreading of disease the common well is prominent. This is especially true of the shallow well, which is usually less than thirty feet in depth, and is not so frequently noticed of the artesian or deep well. We often see cases of typhoid fever or other diseases taking victim after victim from the same family, or school, or village, and, upon investigating the affair, find that those who were affected had used water from the same source. Here the disease germs had doubtless been thrown off from the body in excreta and had, after a longer or shorter time, found their way into the water.

These shallow wells are supplied chiefly from the *ground-water*, that is, water which has fallen as rain or snow upon the surface and which has then percolated slowly downward until it has come to an impervious layer, it may be of rock or of clay. It may be regarded as a sort of underground lake, filled with earth, it is true, yet having a definite form. It lies on this bed of impermeable material and its surface is nearly level. Its distance from the surface of the ground is somewhat dependent upon the amount of rain or snow. If there is a depression of any great size in the surface near by, the ground-water moves sluggishly toward the lowest level. The ease with which it moves depends upon the nature of the soil, being greatest through sand or gravel, and much less where the soil is compact. It is impossible to judge from the surface configuration what the conditions below are.

If a well is sunk so that this ground-water is reached the water slowly flows down into the well. If the level of the ground-water is at some distance above the bottom of the well, there is a considerable *fall*, if we can so speak of water which moves with such slowness. This is true where, in consequence

*By Prof. E. W. Rockwood, A. M., M. D., Iowa City, Chemist of the State Board of Health.

of much rain, there is a great deal in the soil. Under such conditions the well is supplied by water from its immediate vicinity. On the other had, when, during a dry season, more is drawn from the well than is furnished by the rainfall, the difference in level between the ground-water and that in the well is much less. At such times the water of the well is drawn from a greater area, and dangerous substances may find their way into it from a distance. This happens when the wells are low in Summer or Autumn.

Instances are not uncommon, however, of an outbreak of some disease when the Fall rains set in. Here the germs of the disease were probably carried into the soil with a quantity of liquid, which was not sufficient to saturate it, but which was evaporated, leaving an increasing amount of decomposing material in the soil. This is washed into the well directly, or into the ground-water, and ultimately finds its way there. On the contrary, some wells are purer after heavy rains, because the objectionable matters are diluted, though not removed, by the increased amount of water. It is evident, then, that a well may at one time furnish a perfectly unobjectionable supply of water, and at another, under different conditions, be contaminated with the germs of disease.

Some shallow wells do not draw their supply from the ground-water entirely, but are fed partly by springs, or water which flows through fissures in the rocks. There is often, in such cases, more danger of contamination than where the water moves slowly through the soil, because it may come through a fissure from a considerable distance.

The source of pollution is from the excreted matter from the body, whether it is thrown out upon the surface of the ground or enters it from a cess-pool or leaky privy vault. These latter are often dug merely with a view to convenience and with not much consideration whether their contents may escape. Cesspools are regarded by many as most successful when the liquid drains most rapidly away so that they need not be often cleaned out. Wells are similarly located where convenience demands and where water is likely to be found.

A specimen of water was brought me for examination by a worthy farmer and was condemned because of the results obtained by chemical analysis. The remainder of the sample, after the analysis had been made, was allowed to stand in a warm place for several weeks, though with no particular object

in view. In that time the water became filled with the green vegetable matter which is seen growing in pools of stagnant water, and which can only grow when the water contains enough impurities to support it. This water, as I afterward ascertained, was from a new well dug at a lower level than the barnyard and privy, and according to the owner's estimate, about twenty-five feet from one and fifty feet from the other. It was dug to obtain water for domestic purposes and demonstrated the fact which possibly does not need any demonstration that care must be used in locating a well in order to avoid the danger of contamination.

Since natural waters from different localities often differ in taste, and sometimes in appearance or odor, it may be of interest to consider how far our senses of taste, smell and sight can be depended upon in judging of the wholesomeness or dangerous contamination of water. We can certainly perceive some impurities by their aid. The question before us is: Are there not many which can not be so detected, or can we be sure that a water is unsuitable for use because it has an unnatural smell, taste or appearance?

Many kinds of organic matter give a decided odor to water. Among these are included such as decaying vegetable substances and the refuse material from manufacturing processes. Hydrogen sulphide, which may have its origin in the decomposition of mineral substances, not unfrequently manifests its presence by its offensive odor. The odor of water can be most plainly perceived on shaking it with air in a partly filled bottle after warming.

Water containing hydrogen sulphide may be drank for a long time with no ill effects, and it could not be condemned because of small amounts of vegetable matter, although with a large quantity it might be considered suspicious. On the other hand a well may have been polluted by dejecta from typhoid fever patients and give no evidence of this by its odor unless there was a large amount of decomposing matter accompanying the disease germs.

Here the danger would not be measured by the organic matter, but by the presence of a pathogenic bacteria. Our present knowledge of the cause of the disease indicates that one such micro-organism introduced into the body under favorable conditions, owing to its powers of self-propagation, is as dangerous as a million.

Pure water is commonly called tasteless, yet when such water, for example, from a spring has been boiled for some time it is said to taste "flat." This flat taste is simply due to an absence of the dissolved gases which have been driven out by boiling. It is largely to them that the water owes its potability. It is as pure as before boiling, but would not be chosen by most persons for a drinking water if unboiled were to be obtained. Again, water which contains large amounts of mineral salts may have a taste, and perhaps, to those unaccustomed to its use, a decidedly unpleasant one, but still be perfectly suitable for use.

We expect to find pure water bright and sparkling, with no discoloration, but many substances which are not at all deleterious may be found in natural waters giving them a decided color, and even one which might render them objects of suspicion. For instance, streams which flow through a region where the soil contains peat are yellow or brownish yet perfectly wholesome.

Water in which algæ are growing has not an attractive appearance, but it is not necessarily dangerous though it may have an unpleasant odor from some kinds. The common green algæ are probably harmless in themselves. Still, since they can not grow in absolutely pure water, and since the substances which form their food are among those which are produced by decaying organic matter, a rank growth of these might be taken as an indication of decaying material. Some varieties at least grow best where this is present. In spite of this fact it would be unjust to condemn water from a stream solely because algæ grow in it, or water in which they would grow if it were allowed to stand for a considerable time exposed to the air and sunlight. Although this might be some confirmation of results obtained by their means, it alone would not be sufficient to depend upon.

Disease germs in water can not be seen by the eye without the aid of a high power of the microscope, and not even then unless they have been treated by bacteriological methods.

The sense of sight, then, like those of smell and taste, can not be depended upon to judge of the purity or impurity of drinking water. Some impurities would not be perceived, and some substances, harmless in themselves, might lead to a rejection of the water. The only tests which can be of value are chemical or, in some cases, bacteriological ones.

PURIFICATION OF CISTERNS.

It is generally accepted as true, that water shut away from air will become unfit for use, hence it is necessary to keep it exposed to air to secure its purity. The exception to this is when water contains organic matter undergoing decomposition.

The water of many deep wells retains its purity indefinitely, and to which no air has had access, possibly for ages. The term deep wells applies to those which receive their supply below the rock formation and at great depth.

The water of cisterns is contaminated from various sources. It is the recipient of vast aggregate quantities of impurity derived partly from the combustion of great quantities of fuel; partly from excrement of birds and from excremental dust, the fine particles of which in dry weather become suspended in the air to the extent of over hundreds of tons, remaining there for weeks unless washed out by rain. Rain, therefore, so universally considered the purest water, is the washings of this more or less dirty atmosphere, laden with mineral and excrementious dust, zymotic germs, and the products of animal and vegetable decay and putrefaction. A half pint of water often condenses out of $3\frac{1}{2}\frac{5}{0}$ cubic feet of air.

The offensive odor which is so frequent from cistern water arises from the putrefaction of organic matter and soluble gases; from algæ in the water. These algæ are a low order of plant always growing in surface water—in fact they have been found in driven-well water at a depth of seventy-five feet. Different species emit different odors. A large majority of them are not injurious to health. When water in a cistern becomes offensively odorous, aëration is productive of good results. Water impregnated with sulphureted hydrogen, having an odor similar to rotten eggs may be completely freed from this gas by aëration. So, also, from the odor caused by excessive development of algæ or infusoria. But the aëration of water containing nitrogenous matter will not, as shown by experiments, accelerate the oxidation of nitrogen which renders water unfit for potable use. The oxidation of organic matter in water is not secured by agitation with air. To secure fitness for potable use of cistern water, alum, filtration and boiling are necessary.

Artificial chemical processes have long been used to clarify or purify water. The waters of the Nile, Ganges and Indus centuries ago were purified by the use of certain bitter vegetables. The Canadians have been long accustomed to purify

rain-water by introducing three ounces each of pulverized alum and borax to each barrel or thirty-one and one-half gallons of water. One part of a solution of alum in fifty parts of water will cause a floculent precipitate which carries down the organic matter in suspension and renders the water clear.

Another process is that of agitation and aëration, in which many methods are used. That of the leafed branch of a tree is a familar one. The chain pump and a modification of that, having small buckets, the bottoms of which are perforated with small holes, so that when the bucket enters the water in an inverted position, it carries into the water a volume of air which escapes in small bubbles, thus aërating the water. With the temperature below the freezing point, this method becomes practically useless. The most effective means for aërating is by forcing air into the water by pressure, or breaking it into spray. For this purpose a pump has been devised, attachable to any cistern, which by a simple rotation of valves will raise water or force to the bottom of the cistern a volume of air which rises diffusively, thus agitating the water and chemically burning out, by the introduction of oxygen, the gases which cause the bad odor. It is admirably adapted to the purpose, and has the further advantage that it can be easily protected against freezing, and can be set inside the house.

With the use of alum and proper aëration the water in cisterns and reservoirs can be kept clear and wholesome. Where coal is used for fuel so extensively as in Iowa, they should be cleaned at least once each year of all sediment.

STANDARD OF POTABLE WATER.

After several years' observation and investigation the State Board found that as an average for the State, the standard of potable water as hitherto fixed was too high in some of the constituent parts. A change was made and the following was fixed as the standard for potable use. The standard given on page 66 contains an error, in that it fixes the maximum of chlorine at 1.4665.

	Maximum Limit of Impurity. Parts per 1,000,000	Grains per U. S. Gallon
Total solids	600.000	35.000
Loss on ignition	Qualitative	
Chlorine	8.000	.4665
Free ammonia	.080	.0046
Albuminoid ammonia	.150	.0087
Nitrogen in nitrites	Trace	Trace
Nitrogen in nitrates	1.000	.0583

For explanation of the results of an analysis, it may be said that the total solids consist of the organic and inorganic residue of the water. Though the amount should be low there is no resulting significance of the quality of the water unless the amount be excessively high. The value of the determination of loss on ignition consists chiefly in the change of color of residue and the odor evolved in heating the solids. A deep charring indicates much organic matter, while an offensive odor is evolved from animal pollution. A large amount of chlorine is generally found in deep well waters, but where surface waters contain it in large proportions they are suspicious, as the chlorine may be derived from sewage. Water should not be condemned on account of its chlorine, unless the ammonia, nitrites and nitrates are high, and the history of the surroundings is unfavorable. Ammonia is a product of the decomposition of animal substances, and an excess of albuminoid ammonia suggests animal matter, or the mixing of sewage with the water at its source, or through soil percolation. Nitrites are the partially oxidized products of animal matter, or the partially reduced products of nitrates by decaying organic matter or by bacteria, and they should never be in potable water beyond a mere trace. Nitrates are the final products of oxidation of animal matter, and they are a measure of the past pollution of water.

INVESTIGATION OF PUBLIC WATER SUPPLIES*.

One of the most important factors in the prolongation of life and preservation of health in any community is a pure and wholesome water supply. The necessity of measures which enable municipal authorities to secure such water, in quantities to meet all demands, is now fully realized by every intelligent citizen, who also knows that pure sources of supply can generally be determined only by thorough and careful investigation.

As the population of our country increases, the sources of contamination likewise multiply, so year after year it becomes more and more difficult to secure an adequate supply of water for cities and towns, that shall be entirely free from dangerous

* By Floyd Davis, E. M., Ph. D., formerly chemist of State Board of Health.

impurity. In mountainous regions, where the conditions for self-purification are most favorable we generally find the purest waters in sufficient quantity to meet all demand; yet in the Mississippi valley where the streams are generally sluggish and frequently heavily laden with organic impurity, and in the Eastern States, where the rivers are sewer-polluted, the problem of securing pure water is difficult, and it is sometimes almost impossible with limited means to furnish a water that is beyond dispute in its quality.

Many of our cities and towns lie adjacent to public water courses, from which the water, polluted or otherwise, is pumped through mains, without proper purification, to be drank by the people. Under such a disregard for sanitary considerations it is not strange that we are still maintaining in some parts of the country the highest typhoid fever rate of any civilized country on the face of the globe. Our typhoid fever death-rate is too frequently many-fold what it is in some European cities, like London and Berlin, which have expended millions of dollars to secure for their citizens a pure and wholesome supply of filtered water.

The ideal water for manufacturing and domestic purposes is distilled, and the amount of impurities, both inorganic and organic, found in natural water is, therefore, a measure of its purity. It is rare that the mineral constituents have any marked effect in the quality of a water for drinking, since the poisonous compounds of barium, iron, lead, zinc, copper and arsenic, which may exist in it, are not often found in sources that are available for the supply of cities and towns; and in the sanitary investigation of a water supply we do not usually look for these substances. But the mineral constituents have a bearing upon the use of a water for boiler and manufacturing purposes. Its suitability for the generation of steam is determined mainly by the amount of lime and magnesia and the mineral acids which it may contain, since these bases incrust the boiler and the acids corrode it. Magnesia chlorines is especially objectionable. The mineral salts also characterize a water for manufacturing purposes, since a hard water containing much iron is unsuited for the manufacture of starch; a water having much magnesia in it is not desirable in the manufacture of beer, while water for distilleries should be as pure as possible.

These are considerations of importance only for particular purposes, but all water supplies must be used by large numbers of people for domestic use, and the substances which vitiate it for such purpose are of greatest importance in its sanitary investigation. They are organic, both vegetable and mineral, and exist, in different proportions in all natural waters, which have any communication with the surface of the soil. The manner in which they gain access to water, and their relations to health and disease have been discussed in a former paper published by this Board. Suffice it, therefore, to say here that decaying animal matter is indirectly far more dangerous than decaying vegetation, for it is from animal sources that the infectious bacteria, now considered the real agents of disease, are mainly derived. Upon the danger from these various impurities is based our classification of water supplies.

Whenever I am called upon to investigate the water supply of a city, which may include wells and other sources, I generally classify waters under five divisions, as follows:

1. *Excellent waters*, or those which are so pure and free from suspended matter that aëration and filtration would scarcely improve them. Aërated distilled, water and the water from some springs in granite regions, belong to this class, but it is rare that a chemist has to investigate them.

2. *Permissible waters*, or those which can be used constantly for all domestic purposes, without any danger of injurious effects. They are waters which, however, can be improved by better methods of storage, or by a thorough filtration. Nearly all drinking waters belong to this class.

3. *Suspicious waters*, or those which are liable at any time to produce ill-effects, or to become so polluted by an influx of filth that they may become bad, or even very dangerous. I always recommend that suspicious waters be first thoroughly boiled, and then filtered, before being used for drinking.

4. *Bad waters*, or those which are sufficiently polluted to render them unfit for domestic use. They may not be immediately productive of disease, but I believe that they lower the vitality of the system and render it very susceptible of zymotic infection. They are waters which, from the nature of their pollution, common decency should prevent using.

5. *Very dangerous waters*, or those which are polluted by the direct communication with cess-pools or privies, and in which pollution is of so high a degree that they should be immediately

condemned. Such waters are often productive of typhoid fever and other filth diseases.

In passing upon the quality of a public water supply it is, therefore, essential that all water flowing into it should be rejected which is seriously polluted with sewage. There are other waters not thus polluted, which have a disagreeable taste and odor, that are manifestly unfit for drinking. Still they are sometimes largely used from necessity.

Cisterns and common surface wells are too infrequently used for public purposes to be considered here, and there are few or no apoligies for such a supply in any wide-awake town, although from a sanitary standpoint they deserve our most careful consideration. Springs are used as a source of public water supply in many mountainous regions where the topographical conditions are favorable for their utilization, but in other localities ground waters, stored surface waters, rivers and lakes are generally used.

In many parts of Europe several of these sources are introduced into one city, sometimes at great expense. In this country the usual source is the one that is most convenient to adopt, which is somewhat determined by the topographical conditions of the locality. Thus Denver has a delightful water supply furnished by mountain springs and melting snow; some cities, like Columbus and Des Moines, located near never failing streams, utilize the ground waters in the adjacent gravel beds; Boston and New York, having no adequate supply of fresh water near by, stores in artificial lakes or reservoirs the rainfall on the nearest elevated water shed; some cities like Cincinnati, St. Louis and Omaha, situated on rivers, secure their water supply from these natural channels; while other cities like Cleveland and Chicago, having great lakes at their doors, reach out into these for their waters.

Spring water which flows from subterranean sources is generally pure and wholesome because from necessity it is free from organic contamination, and when the springs are remote from the agencies of pollution their water is certainly our healthiest beverage. It is so much superior to surface water for domestic use that some cities have incurred great expense to introduce it for a public supply, and in some instances have thus freed themselves of much sickness and a high rate of mortality.

Ground water in regions remote from habitations is generally very pure, and although it may be, and often is, derived from

polluted rivers, yet, owing to its thorough natural filtration, it can not often be considered unwholesome. Indeed, with the exception of springs and some mountain streams, I consider ground water by far the best general supply for a city, and in the Mississippi valley this can generally be easily found. When such water is secured from wells and filtering galleries in beds of gravel above a city or along a river course some distance from its channel, it is generally clear, sparkling and nearly free from organic matter. This is especially true when the gravel bed is separated from the surface by an impervious stratum of clay, and the supply of water comes for long distances by filtration from rivers or other inexhaustible sources. Such water owes its purity to sedimentation and thorough filtration, combined with oxidation; for during the passage of the water from its source to the well or gallery, the suspended decaying organic matter and the bacteria are retained in the soil, while the soluble organic substances are oxidized into harmless inorganic compounds. It is generally superior to artificially purified water, inasmuch as it is rendered pure long before it is utilized, while surface water is purified as used.

Stored surface waters, rivers and lakes are quite similar in their impurities. The former, when gathered on uninhabited water sheds, will contain little else than decaying vegetable matter. But rivers are the receptacles of the waste products of the inhabitants of the districts through which they flow, and are sometimes very dangerous to use. When it becomes known that a surface water is in any considerable degree contaminated with the washings of feed-lots, slaughter-houses, the refuse of manufactories, dead and decaying animals, and with the drainage filth of many thousand square miles, it should be avoided; and when it is further contaminated with sewage, privy and cess-pool drainage, or in any way mixed with the waste products of the human body, its use for drinking and cooking should be prohibited, for some of our most dreaded diseases are now traced to such water supplies.

My reasons for rejecting all such water as unfit for human use depend also upon two other principles well established in all civilized communities. The first is that common decency compels every intelligent person to rebel against the use of sewage-polluted water, for no one but a savage or a lowly-organized scavenger will wilfully devour the urine, excrement, washings and filth of man and beast. That such filth is actually finding

its way into many rivers is beyond dispute, for the many thousand head of cattle and hogs now kept along our Western rivers during the feeding season contribute annually an immeuse amount of filth to these waters. By tramping on it the dry soil soon becomes impervious to the rains, so, consequently, nearly all the filth finds its way, in rainy seasons, through the small streams into these rivers. In times of high water there is only little sedimentation of these impurities, and they are consequently carried in suspension and solution down to and past the intakes of water works of cities and towns located below. In times of low water much of the heavier suspended matter settles to the bottom of these rivers, there to decay and pollute the water or to be washed down the stream at the next fall of rain.

The second principle is that when a water has once become infested with disease germs it can never be entirely purified, except by distillation or by sanitary filtration. Such germs are liable to be contributed to these rivers at any time should a sporadic case or an epidemic of typhoid fever occur in the drainage area above, and the dejections of the patients go into the river. The impurities in these river waters are such as will favor the multiplication and development of germ life, and instead of the water becoming freed of living organisms, I have found them more numerous as the rivers are descended.

During time of high water when there can be no permanent sedimentation, these waters become constantly more impure in their flow down the river; so in using them as a source of supply we must expect to be confronted with all the evil effects that can arise from the sewage and filth that go into them.

From whatever source a public water supply is derived it should be borne in mind that it will not remain constant in purity throughout a whole season, for there are fluctuations depending upon the rainfall, temperature, season, vegetable and animal contamination, and communication with morbific agents.

These variations and the probable degree of contamination of the public water supply should be investigated by the health officer, city physician or other responsible and capable party who should communicate his results to the people; and these investigations should extend to the surface wells and other sources of water which the more ignorant and less fortunate classes are often compelled to use.

It is a comparatively easy matter for one somewhat skilled in scientific manipulation to make a few qualitative tests that will enable him to determine with considerable accuracy whether or not a given water is badly polluted. For such examination I usually recommend two tests, one for chlorine, and the other for decaying organic matter.

In most parts of the country away from the sea and salt wells, the purest ground and surface waters do not contain more chlorine than enough to give with a solution of silver nitrate a faint opalescence. In testing waters with this reagent its action on a sample of known purity near by should be determined, to use as a guide in comparing other waters. And wherever an experimented sample shows a decided milkiness with this reagent, then sewage contamination is to be suspected in proportion to the amount of the precipitate, for sewage, dishwater, cess-pool drainage and other similar agencies generally contain much chlorine. This is also a valuable means of detecting drainage from a privy-vault into a well. It may be made by first determining the degree of opacity produced in the water by this reagent. Then throw about fifty pounds of salt into the vault together with several barrels of water. After a few days again examine the water with the silver solution, and if there is a noticable increase of chlorine, contamination is quite certain, because the salt, which contains this element, has probably washed from the vault to the well. By this method of testing the results will frequently be surprising to those unfamilar with the subject.

Decaying organic matter is never found in appreciable quantity in pure water. If to a glassful of such water a few drops of sulphuric acid and a few drops of a dilute solution of potassium permanganate be added a permanent pink color is produced; but if the water contains decaying organic matter, then the pink color becomes fainter and finally disappears. In the hands of an expert this is an important test, but it can not be relied on with the novice, since ferrous sulphate, hydrogen sulphide and other reducing agents, sometimes present in water, produce similar results. But when a water shows an excess of chlorine and bleaches potassium permanganate it is certainly suspicious and should be analyzed by an expert. My advice in all cases where parties seek counsel is to have them make the experiments given above, and if the results are not satisfactory then send the water to an experienced

chemist, with necessary information, and have a thorough analysis made of it.

The most extensive investigation of the quality of a water supply involves questions of a chemical, microscopical and biological character, together with an examination of the surroundings of the source of supply; and in all these much depends upon the judgment and experience of the analyst, for water analysis is certainly among the most delicate of all chemical operations and its proper interpretation requires great experience. The chemical analysis should determine the present and past pollution of water, and distinguish between vegetable and animal matter; the microscope should reveal the floating matter, like fragments of hair, excreta, and other filth derived from surface drainage or sewage, which requires no argument to show that the water containing them is loathsome and unfit for domestic use; the bacteriological investigation should be for the purpose of detecting infectious germs, but it is more frequently to determine the number of organisms in a given volume of water. Since bacteria are now believed to be the direct or indirect agents of all zymotic diseases, the determination of the conditions favorable for their development, as shown by the chemist, or of their actual existence in water, as shown by the bacteriologist, is the real aim of sanitary water analysis. Without discussing the relative importance of the chemical, microscopical and bacteriological examinations, it is only necessary to say here that whenever a chemical and microscopical analysis reveal an excess of filth and sewage in a water, its use should be discontinued without further investigation, for the time required for a thorough bacteriological analysis renders such too expensive for general use, to say nothing of the common failure to recognize the infectious germs. The most experienced water analysists look more to the chemical and microscopical results than to the bacteriological, because the chemical and microscopical methods of study are highly perfected, while the bacteriological is yet in a chaotic state, so far as reliability is concerned.

It is my opinion that the past history of many waters and their associations are often sufficient to condemn them, no matter how free they may seem to be from organic impurity, and it is not always necessary to make a laboratory investigation to condemn some of the polluted ones. Then, too, every analyst knows, or should know, the importance of having a thorough

knowledge of the surroundings of the source of supply before giving an opinion of the quality of the water for drinking; and I believe that no competent analyst will claim that a water high in chlorides and nitrates, although organically quite pure, is good, without a knowledge of the agencies which may pollute it. Inexperienced chemists are frequently at error in relying wholly for the quality of a water upon the Wanklyn process, which determines the free and albuminoid ammonia, but gives no knowledge of its past history, nor of the products of oxidation of the organic matter. Any analyst who finds a water contaminated beyond a reasonable limit of safety is justified in condemning it; but because he may fail to find any of the immediate products of decomposition of organic matter he would not, in my judgment, be warranted in saying that such water is good unless he is sure that these products have never existed in it; for it sometimes happens that a water having direct communication through the soil with cess-pools and privy vaults has but little organic matter in it. The same is true when lime is used to disinfect privy vaults. In all such cases the amount of chlorides and nitrates in the water is necessarily high, and generally the total solids and loss on ignition are also large. Still, this is not different from what we often find in good mineral waters; and a chemist who relies solely on his laboratory determinations might claim that such water is good and safely potable, while in fact it may be a most dangerous beverage and badly infected with disease germs. Thus it is that an opinion of the quality of the water should only be given after a careful consideration of the surroundings of the source of supply. More than this, I believe that no chemist should, and no respectable chemist would, venture a *decisive* opinion as to the purity and wholesomeness of a water supply for a city or town without a *personal* knowledge of the topography of the surrounding territory. It is unwise, if not impossible, to predicate an opinion upon the present and prospective soil pollution without a personal knowledge of the entire drainage area.

England formerly led the world in the investigation of public water supplies, but in recent years Massachusetts has given us classic results on this as well as on the filtration of water; so in this country we are just beginning to realize that pure water, which was once the luxury of the few, is now the necessity and pleasure of the many. The benefit which has resulted from these investigations is attested by the healthful development

and increased civilization of our race; for it is now admitted by all competent judges that the progress made by the inhabitants of manufacturing towns in decency, cleanliness, self-respect and morality since the introduction of a pure public water supply is as striking as the improvement in their health, which shows that pure water is a great moral as well as hygienic agent.

DISEASED MEAT FOR FOOD.

The question of diseased meat for human food is a broad and mooted one, respecting which there is a variety of opinions. That diseased meat is the cause of disease in those who ate it was known many centuries ago. The Mosaic code recites it, and the Jewish rabbis formulated rigid regulations for the inspection of meat, while that of animals dead from certain diseases was strictly inhibited. Among the diseases there specified are many which can be identified by modern nomenclature, and none is more clearly defined than what is now called tuberculosis.

It must be admitted that what was beneficial to the life and health of those ancient people, is equally good for the race to-day, for it is demonstrable that those old rabbis were eminently versed in medicine, and learned in pathology and anatomy, hence it is warrantable to assume that those laws were founded in sound hygienic principles, rather than in religion.

If tuberculosis was communicable to human beings by innoculation and ingestion in the days of Moses, and the flesh of animals infected with it was deemed dangerous for human food then, so it is to-day, for it is now settled beyond controversy that the disease is transmissible to man, not only in the flesh, but in the milk.

While it is not assumed that where the flesh of an infected animal is eaten, tuberculosis inevitably follows, yet the possibility remains.

There are many other diseases transmissible to man from animals, and there are other causes which render the flesh of animals unfit for food.

Lethby says, as regards the injurious quality of meat infected with parasitic disease, there can be no question.

Coplin and Bessau* say animals, dying from, or slaughtered while suffering with parasitic diseases, especially epidemic pleuro-pneumonia, foot and mouth disease, Texas fever, cattle-plague, anthrax, tuberculosis, actinomycosis, black quarter, variola ovina of sheep, phthisis of sheep, strongylus filaria, fluke disease, gid, hog cholera, measles of pigs, trichinoses, or general septic conditions should be condemned. If there is no danger from the organism itself, there may be from the toxines which are the result of its physiological activity. This latter fact probably explains why so many cases of poisoning are reported when the meat which constituted the main portion of the meal was apparently healthy. The tissues in the animal parasitic diseases ultimately become wasted and innutritious, and are wholly unfit for food.

Tuberculosis may be transmitted to man from cattle from eating meat or drinking milk containing viable spores, or bacilli. The bacilli have been found in the blood, secretions, and in the juice expressed from muscles. The meat or milk of animals affected with tuberculosis should never be used for food.

Anthrax is not common among cattle; is very infectious and communicable to man by the inhalation of spores, or by inoculation into abrasions of the skin of those handling the animals, the dead carcass, or the skins or wool. The meat is wholly unfit for food.

Black quarter, "black leg," or "quarter ill" is an anthracoid disease, communicable to man. It is not uncommon among cattle, and is very infectious. The flesh of an infected animal should not be used for food, even if slaughtered at a very early stage of the disease.

Foot and mouth disease is infectious, and is common among cattle, sheep and pigs. It is usually so mild in its course as to interfere but slightly with the flesh, which under ordinary circumstances can not be distinguished from that of perfectly healthy animals. The affected parts, at least, and the head, feet and udder should be destroyed.

Pleuro-pneumonia and Texas fever are both probably due to microbic poison. Admitting they are not transmissible to man the meat contains bacterial products (ptomaines) which may give rise to poisoning, therefore it should not be eaten.

*Practical Hygiene, 1893, p. 353.

Actinomycosis (lump-jaw) is an infectious disease communicable to man, and meat infected with the parasite (actinomyces) should be rejected for food.

Trichiniasis is a parasitic disease and communicable to man, with usually fatal results. It is most frequent in the hog, and as the parasite penetrates the entire animal, the whole carcass should be rejected.

Hog cholera is a terribly infectious and contagious disease. The carcasses of animals infected by the disease are required by law to be buried.

Flesh from animals which have died, or which have been damaged or killed by accident, or drowning, or by lightning stroke should be condemned. In cases of fractures, wounds or bruises, so extensive as to necessitate killing immediately, if the animal is properly bled and dressed, the undamaged portion may be safely eaten.

The flesh of cows at seven months of pregnancy, and sows at ten weeks of pregnancy is unfit for human food.

While it is true that harmful consequences do not necessarily nor always follow the eating of the flesh of animals infected with the diseases herein specified, yet the fact remains that the meat is unsound, and unsound meat is unhealthful and innutritious, and has not the qualities which the consumer requires, and if entitled to receive.

Lapse of years and even centuries has not improved the hygienic code of the Pentateuch under which the Israelites, superior sanitarily, and consequently physically, to other nations of the world, had long and healthy lives. As it was three thousand years ago, so to-day a strict observance of the Mosaic hygienic code is most likely to preserve health and prolong life.

FRUIT.

FOOD VALUE OF, FROM A SANITARY STANDPOINT.*

In consenting to write upon fruit from a sanitary standpoint, I had no idea of the small amount of literature I would be able to find upon the subject. While this fact has been an inconvenience and a disappointment to me in the preparation of this paper, yet my loss in this respect will, I hope, be your gain—at least in time; since, in consequence, my paper must have the virtue of brevity as well as of originality.

* By J. F. Kennedy, Secretary State Board of Health. Read before the State Horticultural Society, November 22, 1893.

The fact is, in nearly all the works I have consulted relating to the value of fruit products, I have been able to find but little on the food value of fruit; and what I have found has generally been to the disparagement of fruit. The statement is almost universally made that fruit does not occupy a very high place in the dietetic world, as containing much that is essential or greatly helpful to healthy living. It is usually asserted in the text-books on food that, while fruit is appetizing, grateful to the palate, pleasing to the eye, it is greatly lacking in, if not really destitute of, the essentials for bone, muscle, blood and nerve making.

Prof. Victor C. Vaughan, of the Michigan University, in a prize essay on "Healthy Homes and Foods for the Working Classes," says: "The real food value of fruits, judged by their chemical composition, is small, but when thoroughly ripe and well preserved they act beneficially upon the system, improving the appetite and maintaining a healthy condition of the various vital organs." He also says: "Probably no fruit is necessary to life, and fruits may be regarded as luxuries, but man's instincts and cravings prompt him to obtain them often, even when their cost is considerable."

I think here is illustrated a proposition that may not be generally accepted, and that is that man's instinct is sometimes—oftentimes, in advance of and more reliable than his judgment based upon scientific knowledge. It has been asserted that this instinctive desire for fruit is one of the strong arguments of evolutionists in favor of our descent from the ape.

So strong and so overpowering is this instinct for fruit, that I have known persons—not boys only—to even violate the eighth commandment in their determination to have it; and a very old book tells us that this craving for fruit that was "pleasant to the eye and a thing to be desired" was the cause, long ago, of very much of the grief we have to-day. There is, perhaps, no more pathetic sight than a group of hungry children with sparkling eyes, dilated nostrils and watering mouths standing around a fruit-stand with no money to buy, and no ability or pity to give.

Surely an all-wise Creator would not have made fruit so attractive to the eye, so pleasant to the taste, so grateful to the

stomach, and so longed for by bird and beast and man, unless to prompt the system to demand it as an essential to the proper development of the body.

But, laying aside instinct, let us consider this subject from a scientific standpoint. In order to do so it may be well to call your attention to some well-established facts relating to the nutritive value of food products.

The essential constituents of all food-stuffs may be divided into five general classes. To maintain a healthy standard of living the daily food should contain the following necessary elements:

1. Albumens, or proteids.
2. Fats or oils.
3. Starches, or carbohydrates.
4. Inorganic salts, and
5. Water

Any article of diet that most nearly contains all these essentials in due proportion may be regarded as a perfect food-substance. Milk, of all substances, is thus the most perfect of all food, since in the early and growing period of animal life it alone meets all the physiological demands of healthy living.

Adopting this standard, one of the most important elements of a perfect food is wanting in most of all fruit. I mean the first named, the albumens or proteids. The muscles, blood and all the vital organs contain proteids as their chief constituents, and to preserve their integrity the food taken daily by a healthy working adult must contain at least four or five ounces of albumen or proteids.

With the single exception of the strawberry, none of our fruit contain an amount of proteids to exceed one per cent. Therefore, to get his required four or five ounces of proteids daily he would have to eat from twenty to thirty pounds of fruit. This would not only be expensive, but distensive to his stomach and ruinous to his digestion.

The second essential element of food I named was "fats or oils." As this is consumed in the body by combustion, it supplies animal heat and thus gives vital energy—very important considerations. It has been demonstrated that about two ounces of fats or oils should be eaten daily to supply the physiological demands of an healthy adult. Fruit, excepting nuts, is totally destitute of fats or oils—except a vegetable oil obtained from the olive, which has some nutritive properties.

The third division I named was "starches or carbohydrates." This includes a large and very important group of substances—the great majority of which belong to the vegetable kingdom. The most nutritious, and hence important food elements in the vegetable kingdom are starch, sugar, gum and dextrine, and many kinds of fruit are very rich in these. Like fat, they give energy to the body, although for this purpose a much larger quantity is required—the amount for a healthy man being from seventeen to eighteen ounces per day. To this class of "starches or carbohydrates" belong all fruit—some being much richer, however, in sugar, etc., than others.

The fourth class named was "inorganic salts." The most of fruit contain these salts in varying proportions.

The last named division, "water," is particularly abundant in fruit of all kinds.

As about seventy per cent of the adult human body is water, which should be replaced as rapidly as it is evaporated or excreted, substances rich in this element should be used freely.

Milk on an average, even if not supplemented by the pump, contains about eighty-seven per cent of water; meat about seventy-five per cent, and vegetables and fruit from seventy to ninety per cent. Fruit differs greatly in the amount of water contained—oranges having as high as eighty-nine per cent, and scarcely any fruit less than eighty per cent.

The most delicious, enjoyable, and important part of fruit consists in the juices, which are largely composed of watery solutions of sugar and acids.

Apples contain on an average 7½ per cent of sugar and grapes from fourteen to fifteen per cent. The cellular parts of fruit are not easily digested and contain but little nutriment, hence those fruits are most highly prized which contain the greatest amount of juice with the least per cent of cell structure.

A minute classification of fruit and the relative value for food is not necessary, and yet a grouping into three or four natural divisions may be interesting and instructive.

First. The drupaceous or stone fruit.—Such as the peach, plum, apricot, nectarine, cherry and date.

Though some contain more acids, and acids containing organic salts in varying proportion, and others more sugar, yet there is not much difference in their nutritious properties—especially when taken with the substance supplying the lacking desirable properties. As the ripening process advances they cease

to grow; they absorb carbon from the air and give out oxygen; the acids and astringent materials they contain to a great extent disappear; the starch is converted into sugar, and those peculiar qualities are developed that give to fruit its peculiar character, its rich coloring, its distinctive smell, its delicious taste, its nutritious properties.

Such fruit constitutes an agreeable, refreshing food, digestible and wholesome, and of a value not to be estimated by the apparently small amount of nutritious material. The date itself is the great food of the Arab, sugar being its main nutritive constitutent.

Second Pomaceous fruit.—Apples, pears and quinces are leading representatives of this class.

In the raw state the pear is much more easily digested than the apple; but the apple because of its keeping quality whether in a raw state or dried, is an important article of food. The quince in a raw state, is too astringent, and contains too much acid to be a desirable food, but cooked or preserved and properly sugared to neutralize its acid, it is palatable and healthful in moderation. Cooked apples are more easily digested than raw apples and pears—especially the former are laxative and contain much that is valuable as an adjunct to good feeding.

Third. Baccate fruit or berries.—Currants, gooseberries, cranberries and elderberries belong to this group. The currant, gooseberry and cranberry are highly prized for their acidity, and in moderate quantities are not only agreeable and palatable, but advantageous. The seeds and skin being indigestible, if taken too liberally often prove a source of irritation to the stomach and bowels.

The strawberry, raspberry, blackberry and mulberry are clearly akin, and when fully ripe are delicious and wholesome, though if eaten too freely, especially without other food, because of the large number of indigestible seeds, often produce obstruction or irritation to the bowels.

The banana (*Musa Sapientium*)—The chief food of the Brahmins—the wise men of the East—and the plantain are highly prized in the tropical countries where they constitute the chief article of food. When ripened in their native climes they are delicious and highly nutritious, as they are rich in saccharine, and other desirable food properties.

The orange tribe of fruits because of their acidulous juices are highly valuable to stimulate an appetite, and as preventives

of scurvy. They also furnish very agreeable acidulous drinks that are especially refreshing in the Summer. Except the grape there is no fruit so useful in sickness, and so little likely to disturb the bowels even of children as the orange. The seeds and pulp should always be rejected.

The fruit, however, that is a favorite everywhere and with everybody, that has been immortalized in poetry and song because of its lusciousness, as well as refreshing qualities, is the grape. It contains a large amount of sugar—grape sugar, which is easily assimilated by the system and in consequence is highly nutritious. It is most agreeable to the taste, refreshing and cooling, and may always be taken not only with safety, but with much profit by all—even invalids.

Without further specifying particular kinds, many of which I have omitted, I wish to state briefly some of the physiological and diuretic advantages of fruit.

It lessens the force and action of the heat in Summer; cools the blood; refreshes the system in the debility of Summer and corrects errors of digestion. The acid fruits are especially antibilious and anti-scorbutic and incite the liver to healthy action, and act upon the bowels causing healthy and natural evacuations. When taken with other food they greatly aid in peptonizing it; that is, in preparing it to be more easily digested and assimilated.

Figs, peaches and prunes when taken with other food act upon the albumens or proteids contained in them, break them up and greatly facilitate their absorption by the vessels of the intestines.

A couple of comparisons may be interesting as shown by analysis:

One pound of starch, or five pounds of potatoes, are as a food product equal to 5½ pounds of grapes, 6½ pounds of apples, eleven pounds of currants and twelve pounds of strawberries.

The albumen of one egg is the equivalent of 1½ pounds of grapes, two pounds of apples, two pounds of strawberries and four pounds of pears.

While these comparisons speak well for fruit as a food there are other and more subtle qualities which analysis fails to discover though they are just as real and obvious in their beneficent effects upon the system.

Fresenius says on this point: "All fruit contain albuminous or protein substances which are tissue (making) food. However

they are not taken so much for this reason as for their vegetable salts and agreeable flavors." They thus not only contribute in a large proportion many invaluable and necessary elements, but are real tonics and invigorators.

Perhaps I should refer briefly to preserved fruit—dried or canned.

While nearly all fruit is eaten either raw or cooked, there is some which can not be preserved or kept in the natural condition and must be dried.

The importance of dried fruit as food is not sufficiently understood nor appreciated. As fruit loses a large part of its water in drying, the nutritious parts are left for our use in a more condensed form.

Bread is called the "staff of life," and science shows that dried apples are very near to bread in their per cent of nutrient material; and the dried pear is so generally used in Germany as to be called the "date of Germany." While this fruit is too expensive with us, a writer says he has seen dried pears in Germany commonly exposed for sale by the barrel, and they are eaten by the common people in great quantities. They make dried pears and apples into a variety of toothsome and nutritious dishes with meats, potatoes, beans and maccaroni.

Canned fruit, if properly put up, differs little, if any, from raw fruit. If put up with syrups it is richer in saccharine material and hence more nutritious. It should not contain any salicylic acid or other drug as with care it can be as well preserved without such positively injurious substances.

Three general rules should always be observed in the selection and use of fruit—quality, quantity and occasion.

All admit that imperfect or impure bread, meat or milk are unfit articles of diet; and yet when perfect in quality they must be partaken of in proper quantities and on fitting occasions. So with fruit.

Quality.—It must be fresh, sound, clean and ripe. Pasteur, the great French scientist, has shown that all fruit and vegetables when undergoing even a partial process of decay, contain numerous bacteria, which, under certain circumstances, if taken into the human stomach, might become a source of disease. Hence fruit should be fresh and sound.

Clean fruit is even more important, since it has been shown that fruit grown near to the ground may contain dangerous bacteria, such as produce typhoid fever, tetanus, diphtheria or

cholera, which have found their way into the manure used for fertilizing, or have become incorporated with the dried dust. Hence one should never neglect to cleanse the fruit under the impression that sound fruit is the equivalent of safe fruit. Especial care should be taken with imported or shipped fruit, more particularly when known to be from districts where there are infectious diseases. Such fruit may be soiled in handling, or may be covered with bacteria-laden dust. The only safe course under such circumstances would be to wash it thoroughly and strip it of its outer covering or, if suitable, cook it.

Fruit to be suitable in quality, therefore, should be fully ripe, as green or imperfect fruit is always a menace; nor, as I said before, should it be so over ripe as to have entered upon its process of decay; it should be clean and sound.

Quantity.—No rule can be laid down specifying the amount of fruit required or appropriated comfortably and safely by the stomach. While fruit is a desirable food and an apparent necessity, it is also a luxury and should be eaten in moderation. It is not a safe thing to fill up on. Experience and good judgment will be the best guides.

When should fruit be eaten?—It is an old adage, and a truism as well, that "fruit in the morning is golden—at night leaden." It is best used as a supplement to other food—best taken at meal time. As it is lacking in some essentials of a perfect food and rich in others, it will be readily seen that taken with other food the best results are obtained. It has been found that fats and fruit are not congenial companions in the stomach, and their contemporaneous presence therein is often the occasion of a severe falling out—thereby entailing not only severe pain, but a useless waste of raw material.

In conclusion I wish you Godspeed in your enthusiastic efforts to secure for our grand commonwealth fruit the most varied in kind, the most abundant in quantity, the most perfect and nutritious in quality, believing that by so doing you most effectually promote the health and wealth, as well as the pleasure, of yourselves and the people.

AS A DIET.*

Gladstone says, "Nothing goes so far to prevent the terrible thirst which bad cookery and salted dishes cause to be chronic

*By Mrs. L. H. Pammel, at the State Horticultural Society meeting, November 21, 1895.

over half this country, as a free indulgence in the cheaper kinds of fruit."

John Burroughs, who writes so entertainingly about the apple in his book, "Winter Sunshine," says: "Not a little of the sunshine in our northern Winters is surely wrapped up in the apple. How could we winter over without it? How is life sweetened by its mild acids? A cellar well filled with apples is more valuable than a chamber filled with flax and wool. So much sound, ruddy life to draw upon, to strike one's roots down into, as it were."

The use of fruit as a diet by the human race, carries us back to ages before Christian civilization. The ancient Chinese, Greek and Roman writers mention the use of fruit as an article of human food. And the Book of all books, the Bible, frequently alludes to the use of fruit. But ages before this, long before any human hand had recorded any historical facts, fruit was extensively used as indicated by the material found along with the Swiss and other lake dwellers. Our own aborigines relied extensively on the native fruit of this country. The blueberry, huckleberry, wild plums, etc., were used to a considerable extent.

We should pay more attention to fruit rations, since fruit is not only nutritious, but it is an antidote for many of the ailments that man is afflicted with. If persons are inclined to be sad and morose, fruit will stimulate the diet and add cheerfulness. Fruit is an excellent tonic and will stimulate digestion. It is a common saying, when a person's digestion is out of order they are inclined to be "out of sorts," or that "the liver is out of order." Now, nothing will correct this evil so quickly as a free use of fruit, which will quicken the torpid liver and invigorate the whole system. How refreshing is the first fruit of the season, the strawberry. "It snaps to the ear as it smacks to the tongue." What an excellent tonic it is. Again, how refreshing is a drink of lemonade during the heat of Summer. Pimples, eruptions, and similar skin diseases that are not hereditary, may be cured in a very short time by a diet of laxative fruits, varied according to the season. It should not be understood that edible fruit exerts direct medical effects; it simply encourages the natural processes. Under laxatives, oranges, figs, tamarinds, prunes, mulberries, dates, nectarines and plums may be included; grapes, peaches, strawberries, whortleberries, prickly pears, black currants and melon seeds under diuretics.

Taken in the morning an orange acts very decidedly as a laxative, sometimes acting as a purgative, and may generally be relied on. Apples are corrective, useful in nausea and seasickness. Barberries are very agreeable to fever patients in the form of a drink. Grapes and raisins are nutritive and demulcent and very grateful in the sick chamber. The juices of various fruit, especially of grapes, have long been used as drinks. Almost every one has a liking for a mild, stimulating beverage. It has been found that the pure, sweet juice of any fruit will entirely satisfy the normal appetite and furnish the desired stimulant, and also much nourishment, without leaving behind any injurious effect, as do wines and other fermented beverages. The juice, pure and simple, or sweetened to suit the taste, is heated boiling hot, then bottled and sealed air-tight to prevent fermentation. A glass of this juice given to a convalescent or invalid will refresh and strengthen him. The juice of the blackberry and of the grape are most valuable for invalids, and that of the raspberry stands next.

It would be a saving of time and work, a promoter of health and pleasing varieties to bills of fare, if the housewife would supply her family abundantly with fruit in season at the table, not between meals. With such a bountiful supply in the markets, it ought to be found on every table at least once a day. Much of the money spent for some kinds of meat had better be expended for fruit. A simple course of fruit after dinner is all that is needed, and is much more wholesome than pies. Ripe fruit is especially appropriate at the breakfast-table, and can be taken before or after the principal dishes. Let your table be ornamented with what fruit is in season three times a day. There is nothing so ornamental to a table as a choice lot of apples, grapes or oranges. The high color of a Spitzenberg apple suggests cheerfulness and health. Allow the family to help themselves whenever and as often as they may desire, before the soup, or after the principal dishes.

Milton says: "In what thou eatest and drinkest, seek from thence due nourishment, not gluttonous delight. So mayest thou live till like ripe fruit thou drop into thy mother's lap; or be with ease gathered, not harshly plucked, for death mature."

HOUSE DRAINAGE.

FOR CITIES AND TOWNS.*

The last fifteen years have seen a remarkable improvement in sanitary science. The demand for better sanitary surroundings has brought into the field men who make a specialty of sanitary engineering. The concentration of many able men upon one subject and the natural tendency to succeed that prevails among the American people, has made sanitary science just what it is to-day. A grand improvement, indeed, over old methods, and the undoubted means of saving the health, if not the lives of many. One of the first things that a prospective tenant asks is: "Has the house modern improvements?" And in fact, such houses rent so much better, that the great majority of builders insist upon putting in these conveniences.

The proper drainage of a house depends, in a measure, upon existing conditions, and where these are not at all complicated, or if the building is a large one, the tendency is to refer the work to a competent sanitary engineer.

For a country dwelling where they do not have the convenience of a sewage system, the common practice is generally by the old "slop pail" method, and a good plan in such a case is to cover the deposit with ashes, and no odor will arise from it.

It is, however, of the city residence, and a city that has a sewage system, that I wish to speak especially. I believe that a house should be, so far as possible, on high ground—that is, there should be a natural drainage away from it in all directions if possible, and that it should be so constructed as to afford ample light to all parts of it. Another necessary feature and one, too, that is often overlooked, is a cellar, or basement, as the case may be, which is thoroughly damp-proof.

The earth below and about a building is apt to collect filth, and air currents passing through this find ready admission

* By Warren Dickinson, civil engineer of the State Board of Health. Read before the Board February 5, 1895.

through faulty walls or floors. A preparation of asphalt is the best coating to obtain an air-tight cellar wall and floor.

The main drain for a house of ordinary size should not be less than four inches in diameter, and should be laid with as much fall as is possible to obtain. The fall should not be less than one in fifty. Where there are sewerage systems built, as in this city, the common plan is to connect the sub-soil pipe with the sewer, but they must by all means be kept isolated. This is done by a check-valve, which prevents the sewage from filling up the sub-soil drains should the street sewer get clogged in any way.

The main drain should be, if possible, easy of access, and removable hand-holes should be provided at intervals so that any obstruction may be easily cleared away. All drains should be made as straight as possible. The immense variety of curves, traps, branches, and so forth, which we have to-day, there is no excuse for, since they only serve to obstruct a perfect flow of the sewage.

There is always some waste matter that will accumulate on the sides of sewer drains, and obnoxious and dangerous gases are formed which must be permitted to escape, which is done by a vent-pipe which opens above the house. Some engineers think it best to enlarge the upper portion of this vent to about six inches to prevent the possibility of its becoming obstructed by frost—a cowl of some kind on top of this prevents the introduction of any articles that would be likely to obstruct the free passage of air.

It is a common practice to enclose plumbing fixtures in wooden casings. The practice is a bad one, for there will almost surely be some accumulation of filth, and the air which is thrown out from this is bad. Elaborate fixtures are to be avoided for they are the harder to clean and tend to the easy secretion of filth.

In rainy weather when the air is filled with moisture, one can often see little drops of water on those plumbing fixtures which have a constant flow of cool water through them. These fixtures if enclosed would not be noticed and the accumulation of the water and filth is oftentimes very offensive.

Most sanitary engineers do not favor plumbing fixtures in the sleeping apartment; I think it is not the best place for them. Too many fixtures are to be avoided. A fixture not often used is apt to be dangerous for it is not generally kept clean, and the

filth accumulates until there is an unhealthy gas formed which is especially to be feared. Every fixture should have a trap, and as the object is to clean the interior surface of the waste-pipe, it should be as near as possible to the fixture. There are many styles in use and each has its claim before the public as to perfect self-cleansing, etc.

When all the pipes are in position, and before the fixtures are put in it is best to test the thoroughness of the work. There are several ways to do this, one of which is as follows:

Close the main drain where the iron pipe terminates outside the house wall, and also the open ends of the pipes where fixtures are to be connected, and if there is a fresh-air inlet, close that. It is best to leave the ends of all lead pipes somewhat longer than will be used, so that they may be bent down and soldered tightly. Now that all of the system of soil, waste and ventilating pipes are tightly closed below, the entire system should be filled with water from above until it comes nearly to the top, and then mark the height at which the water stands. Let it remain for several hours, and if there is no apparent leakage, the job may be considered a first-class one. The whole system should be thoroughly examined while under this pressure, and any calking that may be found necessary should be attended to at once. Sometimes, in order to be able to trace any leakage, an essence of peppermint is injected, and its well-defined odor gives evidence of a badly calked joint.

A refrigerator should never be connected directly with a sewer or waste pipe. The discharge can easily be taken in a common pan and emptied into the sink. Neither is it a good plan to admit the roof-water to the sewer where a portion of it is gathered in a cistern for household purposes.

To sum up this paper, I should like to present several rules which, if followed, will tend to give good household drainage:

1. Have the house well lighted and well heated.
2. All pipes as straight as possible.
3. Avoid a multiplicity of plumbing fixtures.
4. Don't have your closet stuffed off in a little alcove or poorly lighted portion of the house. You need light, heat and room there as well as in any other place.
5. If possible, have your fixtures open.
6. Have your cellar or basement damp-proof.
7. Have all pipes easy of access, so that if necessary, they may be thoroughly cleaned.

8. All waste pipes or sewer pipes should be subjected to a thorough test before any fixtures are placed in position.
9. Every fixture should have a good trap, with such a flow of water as will thoroughly cleanse the basin.

FOR COUNTRY RESIDENCES.*

The proper disposal of the sewage of larger country or suburban residences, fitted up with all the usual plumbing appliances, without creating a nuisance either on one's own premises or on those of the neighbors, is a question of much interest to thousands of householders who live in the better class of country or suburban houses, and who are often compelled to meet the difficulties as best they can. The problem has long engaged the attention of civil engineers who make a specialty of sanitary drainage, and while it is possible that the best solution has not yet been discovered, there are several methods which are in more or less successful use. Whatever method may be adopted, one must decide about it before arranging the house drainage system inside of a house, for the best arrangement of the main drain and its branches in the cellar or basement of a house will depend upon the direction in which the sewage tank will be erected, or upon the location of the final outlet. Generally speaking, an isolated country house, not in reach of sewers, may dispose of its sewage by one or the other of the following methods:

1. It may discharge its sewage into an open surface ditch or gutter, removing every thing from the house, and carrying the water into a more or less distant sink-hole, or to some low spot where the sewage is allowed to soak away and to evaporate slowly. This method has not a single feature of merit. As a rule, such a system becomes highly offensive to the immediate vicinity of the house.

2. The house drain may empty the sewage into a large pen or leaching cess-pool, allowing the liquids to ooze away through underground porous strata, or by fissures and cracks in the rock. This, although a very common method of disposal, is in reality one very dangerous to health, particularly so where the water supply is local, being derived from a well, a cistern or a spring on the premises. It is a method utterly to be condemned as both unsafe and nasty.

The most primitive form of cess-pool is a hole dug in the ground, into which all the sewage is continually poured, the

* By Paul Gerhard, Sanitary Engineer, New York.

result expected being that at least the liquids will soak away through unknown underground recesses and disappear. Occasionally the sides of such a cess-pool are lined with loose stones, laid dry, the liquid sewage escaping at the numerous open joints into the surrounding soil, while more or less of the solid matter and grease are retained in the cess-pool, undergoing at once a very dangerous process of decomposition, in the presence of moisture, heat and darkness—all conditions known to be particularly favorable to the growth of dangerous bacteria or germs of disease. In dealing with sewage, a cardinal principal always to be observed is to avoid all stagnation. In the leaching cess-pool we have the worst possible example of stagnation and of accumulation of putrefying filth on our premises.

The great objection to a leaching cess-pool is not only that it constitutes in itself an abominable nuisance, comparable to a powder magazine, which merely needs a single spark to create destruction, but that it unavoidably and invariably pollutes the sub-soil in the neighborhood of dwellings, contaminates the water supply, and renders the air which we breathe obnoxious by its exhalations. It is of the utmost importance that the local water supply of isolated dwellings be kept as clear and free from contamination as possible.

In a sparsely populated country district, a leaching cess-pool located at a great distance from, and at a lower level than the house, may sometimes be used without causing any harm to the occupants of the house. As a matter of principle, however, sanitary science must condemn such devices in every case. If the principle is true that we should speedily return all organic dirt and filth to the earth, it should be carried out in such manner that the soil may accomplish the complete destruction of organic filth.

In pouring sewage into leaching cess-pools, on the contrary, we bury all matter deep in the ground, remote from the cleansing, oxidizing effects of the atmosphere, of the purifying action of plant life, and of the help which is rendered by some of the low organisms, or so-called bacteria, in the process of nitrification and destruction of organic matter.

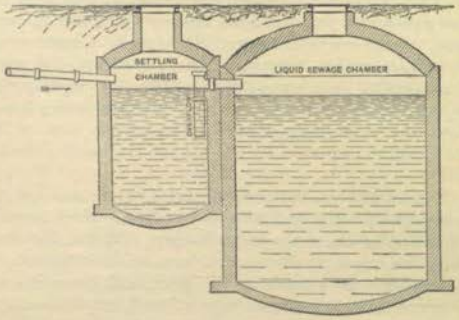
Occasionally such cess-pools are built with sides cemented up, leaving only the bottom loose for the escape of sewage, or in cases where they are originally open on the sides, the pores soon clog, and the removal of the liquid then takes place in a still more imperfect manner.

3. The house drain may deliver the sewage into a tightly built cess-pool, provided with an overflow pipe carried into some ditch or water-course. Such an arrangement may be considered a direct outcome of the leaching cess-pool. Desiring to avoid the pollution of the soil, the architect or owner built the cess-pool with tight sides and bottom, but finding that it would rapidly fill up, and that frequent pumping out would be expensive, an overflow was taken from the cess-pool and the surplus of liquid sewage carried away. While such a tight cess-pool with overflow located far away from the house, and with the overflow carried into some large volume of rapidly flowing water, may be unobjectionable where but little water is used in a house, the arrangement constitutes in the case of larger houses a fearful nuisance, for the sewage is already putrid when removed.

4. The alternative is to empty the sewage into a cess-pool built absolutely tight and without overflow. Such a cess-pool avoids the pollution of the water supply, and also the contamination of the sub-soil. It is, therefore, an arrangement much to be preferred to a leaching cess-pool, and one which is permissible under certain circumstances, but it can not be approved from a sanitary point of view, and its objections are many and serious. Since it is the object of all good drainage to get rid of filth from the premises at once, or else to dispose of it on the premises while fresh, so as to be completely taken up by vegetation and purified by the soil, it is evident that a vast receptacle of accumulated filth can not be considered a sanitary device. The stagnated sewage within the walls of a cess-pool undergoes a process of decomposition, and the gases generated are extremely unwholesome, often causing, by improper escape or by entrance into houses through the sewer pipes, a nuisance. To ventilate such a cess-pool successfully is a difficult and often an impossible matter.

There are, however, some cases where no good feasible way of dealing with sewage may be devised other than to run it into a tight cess-pool. In that case the following precautions are to be observed: The cess-pool should be located as far away from the house as possible, and there should be proper disconnection between the house and the cess-pool. The latter should be built in two compartments, the first of which constitutes an intercepting chamber for the solids, while the second and larger chamber will receive the liquids. Both chambers should be

built thoroughly tight, of hard-burned brick, laid in hydraulic cement, preferably of a circular shape, and the walls should be rendered impervious inside and outside with Portland cement. Each chamber should be arched over and topped with a manhole, covered with a tight iron cover. (See Fig. 1.) The cess-pool should be as well ventilated as it is possible to do, and it should



TIGHT CESSPOOL
Fig. 1.

be emptied, cleaned and disinfected at frequent intervals. The separation of the liquid from the solid facilitates much the disposal of both. The liquids may be bailed, or better, pumped out and used to sprinkle and irrigate the lawn or kitchen garden, shrubbery, vine trellis or apple orchard. The solids should be removed and dug as fertilizers under the soil. The oftener this is done the better, and the less offense will be caused by the application of sewage to land.

Some objections to the cess-pool always remain. If it is built, as it should be, *absolutely* tight, and of moderate size only, to avoid the retention of too large a volume of sewage, then the necessity of frequent pumping arises, and with it the annoyance of constant attention and of manual labor. If we enlarge the dimensions of the cess-pool to avoid the frequency of pumping out, we increase the dangers always resulting from stagnant sewage and create, as it were, a large gasometer for noxious gases.

The utilizing of old wells for cess-pools should not be permitted in any community. Not only do they endanger the water

supply of other wells on the same premises, but those at long distances therefrom. Many instances of typical epidemics have been traced to such sources. Abandoned wells should be filled with earth, thus preventing the pollution of underground water courses by the decomposition of dead animals liable to get therein.

SCHOOL ACCOMMODATIONS.

School boards are entrusted with a very grave responsibility in constructing school houses and supplying them with heating and ventilating appliances, and methods for disposing of excreta. Not only are they responsible for the money they expend, but what is more important, the lives and health of the children and teachers.

One-third of the population of this State spend one-fourth of their life in the school room during the formative period of the body when most susceptible to injurious influences.

From unhygienic conditions of the school room and its environments the life and health of pupils are continually and dangerously menaced.

THE SITE.

Every condition and consideration which enters into the selection of a site for a dwelling should be deemed vastly more important in a selection for a school building. Dry soil, pure air and sunlight are the important conditions to be secured. Avoid the neighborhood of factories, saw-mills, foundries, railway yards and stations, engine houses, police stations, gas works, oil works, fat-rendering houses and all forms of nuisance and danger.

Consider also the social character and moral nuisances of the neighborhood. There can be no excuse for locating a school house in exposure to any of these objectionable influences. In the country avoid main lines of travel; in cities, select a quiet, side street, and with reference to the future growth of the city.

The lot should be sufficiently large to allow not less than sixty feet distance to other buildings. It should be dry and the soil porous. Dampness should be rigidly avoided. It should

have as large a play ground as possible, on the south and west sides of the building. Avoid corner lots in towns as noisy and expensive.

No school building should be erected without careful consideration of the three important essentials, light, ventilation and heating. We know the sun rises in the east; is highest in the south and sets in the west; we know also the good and bad effect of different degrees of light and amount of sunshine upon the eyesight of children. Next to the north aspect the steadiest and greatest amount of light, or sunshine comes from the south, and all conditions considered, it is best to front the building to the east or west. A cellar should be provided under the entire building, one-half of which should be above the outside ground, with large windows and cemented floors. This could be used as a play ground in bad weather. For country buildings ample air space under the building should be provided with openings in the foundation wall.

The building should not be over two stories high, and so faced that the sun can enter every room. The rooms should be in the form of parallelograms, not exceeding forty by twenty-four feet in area, as that is the greatest distance rooms can be well lighted and the blackboard seen plainly by pupils, and not less than thirteen feet high; the walls painted light blue, green, yellow or gray—never papered. The floors should be of hard wood and splinterless.

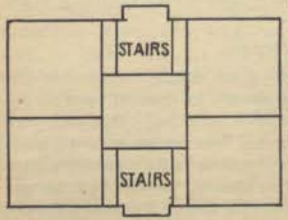


Fig. 1. Plan of building to give maximum light in each room. (From Lincoln's School Hygiene.)

The halls should be wide and well lighted. Stairs should be not less than five feet wide, broad, low steps, broken with one or two square landings—never circular—with hand rail on each side. All doors should open outward and be wide.

Rooms and windows should contain no pillars nor posts. The window surface should be one-third to one-ninth the floor space. The top of windows should be square, not curved, and reach the ceiling. The heighth of the top of the window should be three-fifths of the width of the room. The bottom of the window should not be less than four feet from the floor. Windows should be as near together as possible. If curtains are used they should roll upward from the bottom.

Pure air and proper heat are absolutely indispensable in all school rooms. To secure this is one of the most difficult prob-

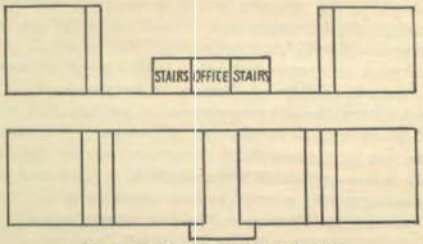


Fig. 2. No. 1 Improved. (From Lincoln).

lems in school house building, and, unfortunately, the least understood by designers of school buildings. Architects, as a rule, know little or nothing of heating, and less of ventilation. There are many systems in use, some good, many bad, and many a good system is rendered ineffective by bad management. Whoever says that any particular system is better than all others, is uninformed, cranky or an agent. The heating and ventilation should be combined as the best and least expensive. This may be secured by heaters in the basement. Where steam is used for warming separate appliances must be provided for ventilation. In country buildings, jacketed stoves, with air from out-doors passing over them.

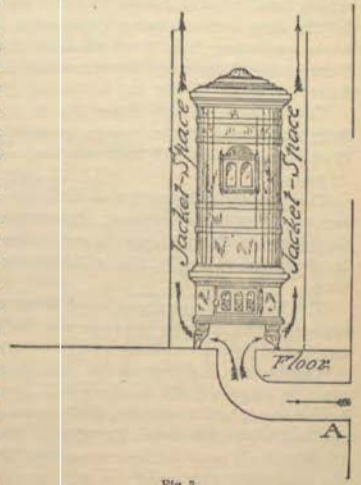


Fig. 3.

Within a few years there has been added to the heating and ventilating systems another, called the dry-closet system for the disposal of the excreta, which is no more nor less than a privy-vault in the basement of the building, with iron hoppers over it connected with the ventilating shaft in which a stove is placed, or heat otherwise secured. It is a good sanitary principle to get rid of human excrement as soon as possible. It had foundation in the old Mosaic law, as perfect as it was complete. This system is simply one of storage of excrement in the cellar, the success of which is entirely due to the efficiency of the plans for ventilation with which it is connected, and the continuous movement of wind and air currents in one direction, while it is always subject to neglectful care, the prevalence of adverse winds and down drafts, by which fecal odors are carried into the school rooms.

One feature of this system is the drying of the fecal matter by hot air passing over it. The objection to this is, it does not destroy the disease germs which may be contained therein, and which may be carried even into the school room, or dispersed in the open air, carrying diphtheria, scarlet fever, typhoid fever and other infectious diseases throughout a community. Neither does it prevent the saturation of the flooring with the filth.

The opinion of the State Board respecting this system is fully expressed in the report of a special committee of the Board after a thorough investigation, and which will be found on page 5.

The proper temperature of a school room is sixty-eight to seventy degrees Fahrenheit. To determine the temperature a thermometer should hang in each room about three feet from the floor and at a point that will indicate the average temperature.

The heating apparatus should be at least one-third larger in capacity than actually necessary to avoid excessive and over heating in extreme cold weather.

Ventilating shafts must be heated to be efficient, and they must be large enough to allow foul air to escape. No matter how many inlets there are, fresh air will enter only so fast as the foul air passes out. The size of the foul air ducts or ventilating shaft must be determined by the area of the rooms and the maximum number of pupils they will contain.

Suppose that an allowance of one thousand cubic feet per hour be made, which is much too low, and there are forty-five pupils. It will require the removal of forty-five thousand cubic feet of air every hour. Ventilator shafts vary with the size, height and the difference in temperature of the atmosphere outside and inside.

In a shaft two feet in diameter, vertical, smooth inside, twenty feet high with twenty degrees difference in the outside and inside temperature, the velocity of the air would be about two and one-half feet per minute, or nine thousand cubic feet per hour, hence, to exhaust the foul air for forty-five pupils would require a shaft having a sectional area of five square feet. In Winter this velocity is increased, and so also if the shaft be artificially heated. It will then exhaust more than is necessary. This may be regulated by registers. In Summer when the outer and inner air are at the same temperature, artificial means must be provided to secure a withdrawal of forty-five cubic feet of air per hour, and this can best be done by maintaining at the bottom of the shaft a heating apparatus as from a light coal fire, a gas jet, or a lamp. In such case it will affect a greater and quicker movement of the air by placing a metal pipe six inches square over the lamp or flame, and extending it one or two feet in the center of the shaft. This system is shown in the diagram.

Good ventilation implies that cold draughts from open windows are to be prevented. It also implies a rapid change of air each *hour*. No pupil should be compelled to sit in a draught from an open door or window. A very simple and efficient means of admitting air and avoiding draughts is to place a strip three inches wide under the lower sash, the full width of the window. This will admit fresh air between the lower and upper sashes.

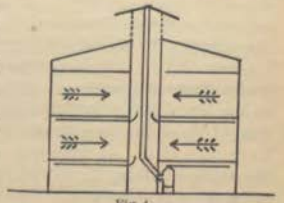


Fig. 4.

The air in all school rooms should be completely changed at the noon recess, and at night after dismissal, and the room should be kept free from dust.

WATER CLOSETS.

In cities, schools are usually provided with water closets or flush tanks. Good water closets having a hopper with full quick discharge are the best, provided they are kept in order. The common privy, attached to most country schools, needs no description. It is uniformly a nuisance, the remedy for which can be found in a more intelligent and active supervision by the school board. Privies ought not, and need not, become offensive. The illustration, Fig. 5, gives a sectional view of a privy for boys. The room is eight feet high and seven feet wide, and attached to the school building. Four feet space under the floor, for storing dry earth, to be floored with brick. A locked door gives access thereto. The vault should be brick laid in cement (not mortar) and coated with coal tar a distance of two feet from the bottom to the top. The curved bottom should be bedded in cement and smooth faced inside with the same. The floor should be impervious to water. At the right is the urinal, all parts of which should be of slate, three-fourths inch thick, oiled several times, so as to be impervious to water. The floor of the urinal should slope, to discharge the water through an outlet pipe to be connected with the slate slab by a brass collar with screw joint. The outlet pipe may be protected from freezing with straw wrapping. The floor of the vault should project so as to facilitate the hoeing out the contents into buckets.

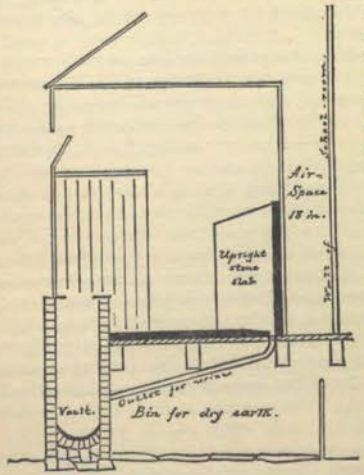


Fig. 5.

The girls' closet has a pit of similar construction.

SCHOOL SEATS.

The school seat should fit the pupil. Inventive genius is doing much to secure the proper shape and form, but no seat should be long used by a healthy child, otherwise the bodily growth is impaired and deformities caused. The edge of the desk should overlap the seat an inch or two. The seat should be of a height that when the leg is at right angles to the floor, and the foot square upon the floor, the lower part of the thigh will touch the seat with a very slight contact. The height of the desk should be such that when the pupil sits upright and the arms swing freely, the elbows will be just below the edge of the desk. No two pupils are of the same height, and the desk and seat should be adapted to each individual.

LIGHTING.

Bad air and defective light are important factors in causing myopia, one of the most unfortunate diseases of school life, The proper proportion and disposition of light is one of the difficult questions to determine. Too little light is much more frequently provided than too much. The multiplicity of spectacled children to be seen on the streets of cities and towns evidences the lamentable neglect to properly care for the eye. Perfect eyesight is not only necessary for the doing of ordinary school work, but the mental habits and moral character may be subject to serious impairment and modification, consequent upon defective vision.

The myope or near-sighted pupil, subjected to constant eye-strain, can not compete with more fortunate companions. By perseverance and pain he may succeed, but it is at the expense of his eyes. On the other hand he succumbs to the painful struggle, becomes discouraged, abandons the school, and starts out into the world with a defective education and elements in his character the sequelæ of defective vision, which will hinder his progress in any direction he may go.

The seats of a school room should be so arranged that the light will come preferably from the left, permissibly from the rear; never from the front. Windows, when possible, should be on the north and south sides of the school room. If the room does not exceed twenty-four feet in width the windows may be wholly on one side.

Blackboards should be placed on walls having no windows; never between two windows. They should be a dead white

color without gloss. Black absorbs all prismatic rays and reflects none. A black line on a white board can be seen at oblique angles better and at a farther distance than a white line on a black board.

Near-sighted pupils should be seated relative to the blackboard according to their eye-sight, regardless of age, stature or grade of scholarship.

PLAN FOR MODEL COUNTRY SCHOOL HOUSE.*

The house is elevated four feet from the ground. The small windows in foundation wall may open either into a shallow sub-floor space or into a cellar. This part should be secured against the entrance of animals by wire screen, which would also insure sub-floor ventilation.

The entrances for boys and girls are separate; are in sheltered angles; protected by porches, in which are seats.

The roofs are arranged simply: there is necessarily a wing at each end, and each wing requires a separate roof. The porches are covered with a continuation of the wing roofs.

The windows of the school room are drawn six feet by three feet in size, which with four windows on a side, gives sufficient opening. They stop at two feet from the ceiling. For so small a room with windows on the two sides, this deviation from the general rule to place window heads close to the ceiling is excusable. There is a special reason for not carrying the window heads higher, namely, the projection of the cases which would cut off the right light. The studs being twelve feet, the window heads are ten feet from the floor.

The windows in the east wing are small. In the side exposed to view are three each one foot by two in size, and one foot square. They are placed near the ceiling; this with the elevation added by the sub-floor space of four feet protects the occupants of the cloak-room and privy from annoyance. The windows should be easily opened. Those in privies should be hinged at the lower side so as to tilt inward.

The small windows, one foot square open into the passage which isolates the privy. There is a corresponding window in the rear so that a through air current is maintained. These windows are not glazed, but fitted with a lattice or louvre, which ought to be white to allow light to pass.

* Designed by Ernest N. Boyden, of Boston, for Connecticut State Board of Health

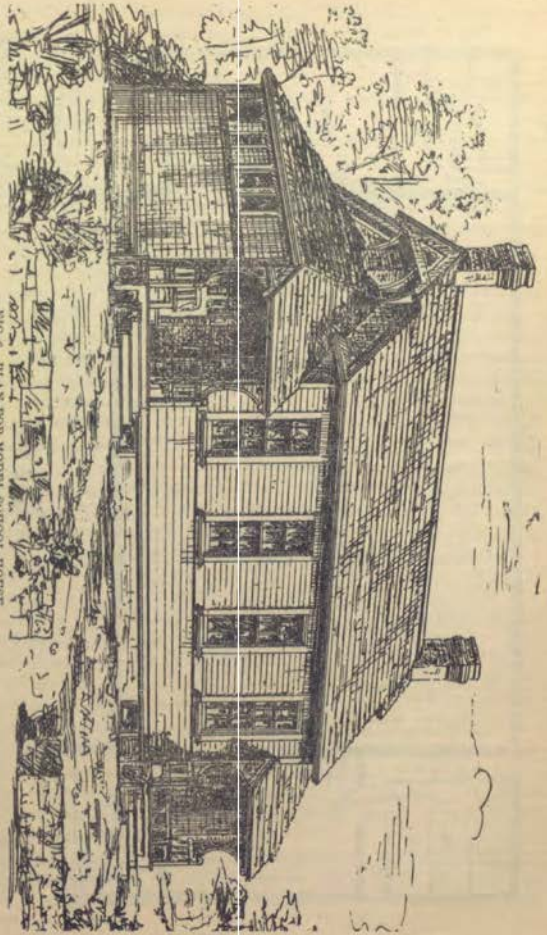


FIG. 3. PLAN FOR MODEL SCHOOL HOUSE.

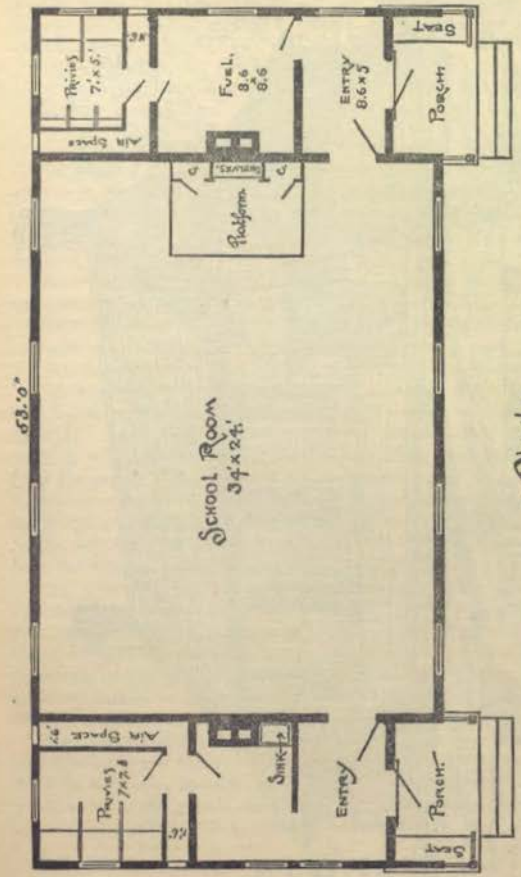


FIG. 1. GROUND PLAN OF MODEL SCHOOL HOUSE.

* PLAN *

There are few exterior ornaments. The chimney is placed outside the school room and a trifle of wood work is added to relieve the bare effect. The diagram plan represents a room with an east and west wing.

There is no room nor passage shared by both sexes except the school room.

Behind the teacher's desk (right) is an arrangement for two small closets and book-shelves.

The chimneys are placed so as not to break the line of the walls. The stoves are not indicated, but it is expected two will be used; their position will depend on the nature of the spot where the school is built, but the northeast and northwest corners are suitable. If two chimneys are built and only one stove is put in—or if at any time only one stove is put in operation—it will then be necessary to close all openings in the unused chimney; a valve, cover or register will be required for each orifice.

If but one chimney is used, it should have two flues, twelve by eight inches, one for smoke and one for the escape of foul air from the room. The foul air flue should have an opening the size of the flue at the floor and near the ceiling, the upper opening to be closed in cold weather. The smoke flue should receive the stove-pipe near the ceiling and have an opening eight inches square near the floor, to be closed while the fire is making. The inside of the flues should be plastered smooth, to prevent obstruction to the escape of air and smoke. It is economy to plaster inside the flue with cement, as the sulphur and creosote which impregnate Iowa coal destroy the cohesiveness of lime plaster, and it falls away.

For a larger room more space would be required for the escape of foul air. This can be secured by placing an eight-inch cast-iron pipe in the center of the chimney for the smoke pipe, in place of the partition. This will also increase the efficiency of the ventilation by warming the flue. The iron pipe should rest on solid masonry at the bottom of the chimney.

The floor should be of double thickness, as protection against cold and economy in fuel.

Plastered walls are usually constantly broken. The walls and ceiling should be of wood, the former painted a light bluish gray, the latter white.

If it be thought the boys' closet as shown in the plan will not be properly cared for, it may be set away from the building, but the closet for the girls should be placed as shown in the plan.

CISTERNS.

In those parts of the country where is no town water supply, wells, streams, nor springs, water storage is a matter of no small importance. In such localities dependence must be had upon rain-fall for supply, and for storage there must be a cistern.

Rain is the great atmosperic scavenger and purifier, removing and bringing to the earth floating filth and dust. In rural districts removed from cities and towns water may be stored in cisterns fit for potable use; such water is altogether the most healthful.

The cistern should be placed where it will not be affected by frost in Winter, nor by the heat of the sun in Summer. It should be large enough to contain a supply for at least fifteen to sixteen weeks together. While it is true a month seldom passes without rainfall yet several months may pass without sufficient for a water supply. Suppose the rainfall be thirty-six inches per year, which is very near the average in this State. A roof forty feet by twenty-one feet would gather about fifteen thousand four hundred and thirty-five gallons of water. To store a supply for three months a cistern must hold at least four thousand gallons.

Fig. 1.

It should be so constructed that it can be cleaned out, for it should be borne in mind that even in the country there are pollen and seeds of plants,

particles of straw, fragments of rags, feathers of birds, floating constantly in the air; while in cities and towns the dust of the street filth, coal soot, excreta of birds, insects and worms gather on the roof, are swept into the cistern to be decomposed and poilute the water, rendering it unfit for potable use, and for lavatory use only by frequent aëration.

Another method and very frequently used is illustrated in Fig. 1. A curved wall of soft or porous brick is placed so as to cut off one-third the area. Water turned into the compartment *a*, will percolate through the partition wall into the smaller chamber *b*. With a charcoal filter attached to the end of the pump pipe the water would be well purified.

A man hole should be provided for entering and cleaning both compartments. The cover of the man-hole should be perforated to admit air, and be protected by wire gauze against the entrance of insects, etc.

A serious objection to this method is that the partition wall will become choked in time, and, like all filters, useless, and have to be removed and rebuilt.

A better method is to provide a separate filtering basin as shown in Fig. 2. A wall of hard-burned brick is built, having openings four inches square, sixteen inches apart at the bottom, on the floor of the basin. In the compartment *c* twelve inches of coarse gravel is placed at the bottom; over this six inches of fine charcoal; over the charcoal six inches of fine sand. The gravel, charcoal and sand should be washed before placing. The water entering the compartment *a* will pass through the openings in the wall, through the filtering material, and flow over into the compartment *c*. The filtering material should be frequently removed and cleansed. An automatic "cut-off" should be put into the leader pipe from the roof at the water table of the house, to catch the first washing of the roof and divert it from the cistern. They can be procured ready made at all tinware stores and shops. They are so constructed that upon receiving a certain amount of water it is discharged automatically and

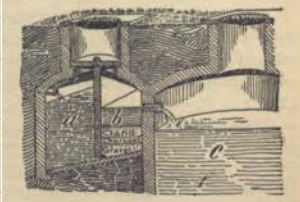


Fig. 2.

the leader and cistern pipe at once connected. The idea prevails that rainwater is pure; whereas, the air is at all times filled with impurities, and the first fall of rain swarms with living organisms, thus rendering the water unfit for drinking. The automatic cut-off, by deflecting the first rainfall and washing of the roof, removes these impurities.

The plan illustrated in Fig. 3 is taken from the *Sanitary Engineer*, and is very simple in construction. The compartment *C* placed next the house is the cut-off, and receives the water direct from the roof through the inlet pipe *D*. There is an overflow outlet at *E*. The compartment *B* is filled with filtering material, as shown in Fig. 2, which illustrates the construction of the filter. At *F* is a partition having an inch space at the bottom. The compartment *B* is filled with a layer of small stone, *K*, at the bottom; then a layer of coarse gravel, *J*; then a layer of fine sand, *I*, the whole reaching to the line at *H*, which is level with the outlet into the cistern at *A*. The stone, gravel and sand must be previously washed clean. The maximum water line is at *M*, or just over the overflow outlet at *E*. The bottom is made sloping, as shown at *L*, so that dirt and sediment will collect at *N*, instead of entering the filter. Floating matter can be readily removed from compartment *C*. All water that enters the cistern must pass through the filter in the direction of the arrows. The water in compartment *C* may be used for any purpose, and the drawing out of this water will draw the water downward in compartment *B*, through the sand, and thus wash the filter.

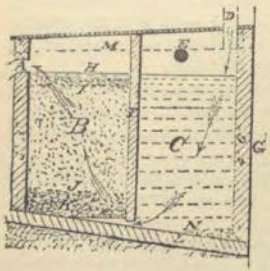


Fig. 3.

The filter from which the illustration was made was constructed as follows: The bottom is a flagstone, five feet long and four feet broad, set with a slope of six inches toward the house, *G*. On this stone is placed four walls up to a point just above the ground, all laid in cement, both sides coated with Portland cement, the inside smooth coated. The partition, *F*, is a flagstone in one piece, two and one-half inches thick, four

feet broad and four feet high, built into the side walls and raised one inch from the bottom. The overflow pipe at *E*, and the cistern outlet pipe at *A* are of vitrified, glazed stoneware, built in the walls and protected with wire cages against insects. The top is matched boards, made light, to be easily removed for inspection. The filter holds about five barrels of stone, gravel and sand. It cost complete sixteen dollars.

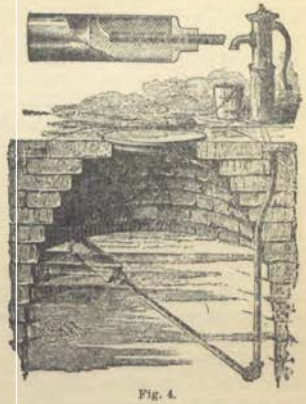


Fig. 4.

An American device for filtering the water in a cistern is shown in Fig. 4, copied from Nichols on Water Supply. A cylinder with perforated shell is filled with silicious, clean sand, is attached to an air-tight compartment to float it, and the whole attached by a swivel joint to the suction pipe. The swivel joint permits the filter to accommodate itself to the stage of water. The filter can be easily removed and cleansed.

TO PURIFY WATER.

The sources of rain-water must be considered. It is the recipient of vast aggregate quantities of impurity, derived partly from the combustion of great quantities of fuel; partly from excrement of birds and from excremental dust, the fine particles of which, in dry weather, become suspended in the air to the extent of hundreds of tons, remaining there for weeks unless washed out by the rain. Rain, therefore, so universally considered the purest water, is the washings of this more or less dirty atmosphere, laden with mineral and excrementitious dust, zymotic germs and the products of animal and vegetable decay and putrefaction. A half pint of water often condenses out of 3,⅔ cubic feet of air.

Artificial chemical processes have long been used to clarify or purify water. The waters of the Nile, Ganges and Indus

centuries ago were purified by the use of certain bitter vegetables. The Canadians have been long accustomed to purify rain-water by introducing three ounces each of pulverized alum and borax to each barrel or thirty-one and one-half gallons of water. One part of a solution of alum in fifty parts of water will cause a floculent precipitate which carries down the organic matter in suspension and renders the water clear.

Another process is that of agitation and aëration. It is a prevalent idea that water must be exposed to the air to be pure. This is an error. Pure water, free from contact with organic matter, remains pure. Deep well water, noted for purity, contains no air, and in this airless condition it is kept pure continuously. By the term deep well is meant those wells which receive their supply below the rock formation at great depths.

The bad odor from cisterns is to be attributed to algæ in the water. These algæ are a low order of plant always growing in surface water—in fact they have been found in driven-well water at a depth of seventy-five feet. Different species emit different odors. A large majority of them are not injurious to health. When water in a cistern becomes offensively odorous, aëration is productive of good results. Water impregnated with sulphuretted hydrogen, having an odor similar to rotten eggs may be completely freed from this gas by aëration. So, also, from the odor caused by excessive development of algæ or infusoria. But the aëration of water containing nitrogenous matter will not, as shown by experiments, accelerate the oxidation of nitrogen which renders water unfit for potable use. The oxidation of organic matter in water is not secured by agitation with air. To secure fitness for potable use of cistern water, alum, filtration and boiling are necessary.

Many methods have been used for aëration. That of the leafed branch of a tree is a familiar one. The chain pump and a modification of that, having small buckets, the bottoms of which are perforated with small holes, so that when the bucket enters the water in an inverted position it carries into the water a volume of air which escapes in small bubbles, thus aërating the water. With the temperature below the freezing point, this method becomes practically useless. The most effective means for aërating is by forcing air into the water by pressure, or breaking it into spray. For this purpose, the Enterprise Company, of Sandwich, Ill., have devised a pump attachable to any cistern, which will raise water, or force to the bottom of

the cistern a volume of air which rises diffusely, thus agitating the water and chemically burning out, by the introduction of oxygen, the gases which cause the bad odor. It is admirably adapted to the purpose, and has the further advantage that it can be easily protected against freezing and can be set inside the house.

With the use of alum and proper aëration the water in cisterns and reservoirs can be kept clear and wholesome. Where coal is used for fuel so extensively as in Iowa, they should be cleaned at least once each year of all sediment.

The popular idea that a filter once placed will render the water pure indefinitely is a great error. Organic matter lodged in a filter furnishes an excellent medium for the growth of bacteria, many of which are a cause of disease, hence the filter may become a very hotbed of disease. Where leaves and decaying vegetable matter gain access to the filter the upper layer of sand should be frequently removed and cleansed.

It is of the highest importance in constructing cisterns for storing water for potable use that they be absolutely impervious to the drainage from cess-pools, privies and barnyards. The walls should be laid in cement and mortar and faced with Portland cement dressed smooth, to facilitate washing and cleansing. To face with mortar will charge the water with lime and render it hard.

HEREDITARY INFLUENCES*.

We know, by every day observation, that form, features and manner are transmitted from parent to child, but we too often forget that desire, appetite and mental characteristics are transmitted as well.

The belief has become quite general that we enter this world endowed with the same attributes. Our own Declaration of Independence which all Americans love and revere, tells us all men are born free and equal and endowed with the rights of life, liberty and happiness. This is a most beautiful sentiment. I wish it were true. Surely the world would be better if it

*Read before the Young Men's Christian Association, at Sioux City, by H. E. Conniff, M. D., member of the State Board of Health.

were. Unfortunately, it is not, only perhaps in a political sense.

Who can say all men are born free when a large proportion are the victims of inherited vices whose chains they can not break; or that we are born equal when one child inherits a healthy mind and body, while another inherits an uncontrollable passion for intoxicants and a feeble, unhealthy organization; or that all are equally endowed with life, liberty and happiness when two-thirds of all the children born die before reaching adult life, and a large proportion of the remainder are the slaves of inherited vices, and are carrying burdens so heavy that they long for the time when they can lay them down in death?

Our misfortunes are the price our fathers have paid for their liberties.

The Bible teaches no truer gospel than that the sins of the fathers shall be visited upon the children to the third and fourth generation.

Who can look over our insane asylums, penitentiaries and institutions of charity and doubt that the Divine command is still in force.

"The Divine injunction has not been removed, and it will never be removed so long as we violate every law, both Divine and human, in propagation of the human species."

The child, we know, is an exact representation of the parent. Every faculty of the parent is represented in the child. The material for the child's growth and development is deposited in the *exact* order it is found in the parent. Every cell in the parent may reproduce a like cell in the child. The child is in every sense bone of the mother's bone and flesh of her flesh. Each individual cell is capable of reproducing its own kind and never, under any circumstances, any other kind. Cell generation is always the same, either before or after birth. A bone cell is only capable of producing bone. A muscle cell will only produce muscle, and a nerve or brain cell will only produce its own kind.

These daughter-cells produced by the division of the parent cell are endowed from earliest embryonal existence with the peculiar characteristics of the parent cell. Thus we account for the transmissibility of disease and certain mental and physical characteristics as well.

To make myself better understood we will suppose a mother has an acquired disease, say tuberculosis. The microbes of consumption have produced a change in the natural characteristics of the cells of her organization, limiting their resisting powers. The microbes of consumption existing in the mother-cell are not transmitted to the child, but the resisting power natural to the cell is gone, and the child is more apt to develop consumption than if the mother had never had the disease.

This fact, and the further fact that the brain is connected with every portion and part of the body by an intricate and extremely delicate system of nerves, capable of carrying strong mental impressions, help us to better understand how certain appetites, characteristics and passions have their origin, and how they are transmitted from parent to child.

Williamson says a mother can not transmit to her child what she does not herself possess, but she may from having a very small faculty *strongly excited* produce in the child a very strong faculty of the same kind. So depend upon it, in whatever way the twig is bent the tree will ever after incline.

One child may be born with a strong tendency to become a thief, a drunkard, a criminal, while another is born with a mental equipment that makes him an honorable, upright citizen. It is as natural for one person to have licentious, impure and wicked desires as it is for another to have pure and virtuous ones.

How little do the fathers and mothers of to-day realize that the secret thoughts and evil desires which they suppose so securely locked within their own hearts may be lived openly in the everyday lives of their children, to silently but perpetually reproach them.

> "Know thyself. Presume no God to scan;
> The proper study of mankind is man."

The lesson this paper would teach is this: Our appetites and desires are the true source of our sin, misery and degradation, and not the physical agent used to gratify them.

Some one has said: "It matters little what agents of destruction the world may contain, but it makes a great difference what the inclinations of men are to employ them."

I may use opium in a hundred ways, all legitimate, and do a great deal of good; but if I contract the habit of opium smoking and ruin myself, mentally and physically, it is the desire I have

for the pleasant effects of the drug that does the harm, and not the fact that some one over in Turkey had cultivated a field of poppies.

So it is with the use of intoxicants. I am convinced the true solution of the temperance question lies only in the direction of education. We never can hope to remove the effects of intemperance until we first remove the cause. It is the desire and appetite men have for the effects of alcohol that lead to the abuse, and not the fact that the means of gratifying that appetite are easily obtainable.

Men with strong cravings for stimulants, who are denied alcohol, often find relief in opium, chloral or other drugs equally as injurious.

I am not advocating the sale or manufacture of intoxicants. I would limit the sale and reduce the temptation to drink to the minimum. At the same time I believe that the present policy of attempting to eradicate the evil of intemperance by legislative enactment will fail to accomplish the desired result, which can only come through careful and painstaking education. And as Dr. Hershey has well said: "The time to begin such education is not at three or five or seven years, but on the other side of the cradle. The education must begin when the corner stone of life is laid, if the millions yet unborn are to be brought into the world freed from inherited tendencies for vice and crime."

Of the various mental characteristics, none shows a plainer descent than insanity in its various forms. Writers on this subject, who have given the subject the most careful study and investigation, estimate that as high as seventy-five per cent of the cases of insanity in our asylums are due to hereditary influences. But as my friend, Dr. Emmert, has shown in a very valuable address before the Iowa State Medical Society, other diseases and abnormal conditions may be transmitted as well when either parent has shown traces of insanity. One member of a family may have epilepsy, another hysteria, another become a criminal, and another a drunkard, and so on through the whole list of nervous disorders, the whole family not only becoming unproductive of good, but dangerous to society and a burden to the State."

A small volume entitled a "Hand Book of Iowa" has lately come into my hands. Among other valuable bits of information, I find our last legislature appropriated for the maintenance of the various institutions for the insane in our own State

something over two hundred and thirty-seven thousand dollars, and about one hundred thousand dollars additional for repairs. From other sources I learn that there are something over two thousand inmates in these three institutions. Now, aside from all moral considerations of the subject, let us look at it from a purely business standpoint. Is not this an enormous sum of money for the taxpayers of this State to pay for something that can and ought to be prevented by law? In this statement we have not taken into account the institutions for feeble minded children, the institutions for indigent and orphan children, and the reform schools for boys and girls, maintained at an enormous expense, and which are the outgrowth, to a great extent, of the marriage of persons of unsound mind, who ought never to have been permitted to take upon themselves the marriage relations.

Another most important question and one that deserves more space than the limits of this paper will permit, is the relation of venereal disease to marriage. No intelligent person will doubt that certain forms of venereal disorders are transmitted directly from parent to child. This fact is very often impressed on the minds of medical men.

An eminent authority exclaims: "How many physicians see, perhaps in the teeth of a child, the horrible secret of a loving father or mother which exposes the family skeleton with all its sufferings and remorse. How many parents would gladly give all, even life itself, to be able to undo what had probably been done through ignorance. You nor I can not, unless we have studied this question carefully, appreciate the enormity of the crime committed against humanity and those we hold most dear, by taking upon ourselves the marriage vows, while our system is contaminated with the virus of venereal disease."

Who can say that it is not right to offer protection to innocent wives and children, and say to the person with contagion in his blood, you shall not, so long as you have the germs of disease in your system, jeopardize the lives and happiness of others by taking upon yourself the marriage relation.

Williamson estimates that ninety-nine hundredths of all the sin in the world is due to intemperance, licentiousness and avarice. "This surely is a good tripod to hang our misfortunes on." We know that we are all greatly influenced by our environments. A child habitually surrounded by drunkenness and who sees on every hand crime and licentiousness, must

necessarily have a strong will if he does not fall into the same practices.

"Vice is a monster of so frightful mein
As to be hated needs but to be seen;
Yet seen too oft, familiar with her face,
We first endure, then pity, then embrace."

The laws of heredity teach us this, if they teach us anything: the propensities of the parents are transmitted to the children, be they good or bad; and that "criminals and drunkards are born as well as made." Hereditary influences "play as great a rolé in criminality as they do in disease." There are "families of thieves and murderers as well as families of musicians and poets."

Nora Marks, in her story of the "Tribe of Ishmael," affords a striking example of this fact. She traces the genealogy of a family originally from the mountains of Kentucky, but for years located in the vicinity of Indianapolis. She found of the fourth generation five hundred and fifty-seven souls, almost all of whom were either criminals or paupers.

A still more striking illustration is found in the well authenticated history of the "Juke" family. There lived of this family seven hundred and nine persons whose genealogy traced back seventy-five years, brings us to five sisters, the daughters of a licentious, idle, drunken pair. Mr. Dugdale carefully traced the history of this family while he was a member of the Prison Association of the State of New York, and he makes the following summary: Of this family of seven hundred and nine persons, two hundred and eighty were paupers; one hundred and forty were criminals; seven were murderers; one hundred and sixty-five were prostitutes. There were ninety-one illegitimate children, and four hundred and eighty had syphilitic disease. This family cost the State in various ways one million three hundred and eight thousand dollars.

Shall our laws permit the multiplication of criminals in this manner?

Our Savior was asked: "Did this man sin or his parents, that he was born blind?"

Who can tell which is the more responsible for the crimes committed on every hand against our fellowmen, against society, against right—the criminal himself, or those who were nstrumental in bringing him into the world?

"It is not ours to separate
The tangled skein of will and fate?"

We know, says one writer, "That inheritance—acquired vices, wrong methods of education, and the demands of modern society—*all* contribute to the lowering of the vital forces and are the factors in the degeneracy of a large proportion of the human family."

What remedy can we apply to prevent the demoralization? I say prevent, for I believe the laws of the future, like the medicine of the future, will be in the main *preventive*.

Wilson says: "The day has arrived when the people must be aroused to a deeper and more earnest sense of the people's welfare, and suitable measures must be adopted for their protection, as well as for the development of their physical, moral and intellectual powers."

I am fully aware there is in every one of us an inborn feeling that we are by birth entitled to a certain amount of freedom of thought and action. And under our democratic form of government we very readily display a natural jealousy of any attempt to encroach upon what we consider our popular rights. Be that as it may, we find in every State and community laws against theft and murder and drunkenness and other crimes. These laws, as a rule, do not aim to prevent, but prescribe a penalty for conviction of the crime. We also have laws compelling persons to remove nuisances, laws compelling persons exposed to contagious diseases to isolate themselves from other persons not so exposed.

Dr. Emmert argues that if the State has the right to protect itself from disease and crime by the enactment of law, why has she not the right to prevent marriage among persons who, by reason of certain mental or physical weakness, are wholly unfitted for the marriage relation when ordinary observation teaches us that the children of such parents are almost certain to become criminals or, by reason of other inherited weakness, a heavy burden to the community in which they live, and a nuisance to society generally. Indeed, nothing short of an act of Divine Providence or the most careful and painstaking education can save those poor souls who are brought into the world already ticketed over the shortest route to either the jail or poor house.

I am aware of the popular prejudice against stringent laws governing that most sacred, most ancient and most abused of divinely appointed institutions, marriage. But I believe our legislatures will be compelled in the near future to devise some means for protecting the race against the curse of inherited disease and the propensities for crime.

A bill was introduced into the legislature of Kentucky a few years since "prohibiting marriage with idiot, lunatic, pauper, vagrant, tramp, drunkard, gambler, felon or any other person physically helpless or unfit for the marriage relation, or any person with a violent temper or who had within one year been a frequenter of any immoral house." It is perhaps needless to say this bill did not become a law in Kentucky. It would not have become a law in Massachusetts, but it has served the very useful purpose of arousing a great deal of thought on the righteousness of the provisions.

I am told by a prominent attorney of this city that he knows of no law in any State prohibiting the most depraved drunkard, the most loathsome victim of venereal disease, the most abandoned and vicious criminal from marrying and propagating his kind.

Is it not high time the students of social science were urging upon the attention of our law makers the importance of this question, which more materially affects the future of the race than any other question the people of to-day are called on to deal with? Shall we not hope that the day is not far distant when we shall have national marriage laws, when those physically or mentally unfitted for the marriage relation will not be permitted to jeopardize the happiness of innocent children by bringing them into the world wholly unfitted for its duties and responsibilities?

Thoughtful men and women realize that the race can be made better and, consequently, happier. When parents are taught to consider the awful responsibility involved in the marriage relation; when they come to realize that their own qualities, good or bad, transmitted to their children, affect those children, not only for this life, but for eternity as well; when parents are taught that their children reflect their own true character, divested of all the flimsy coverings which may deceive their fellow-men, and when the fact is impressed on the fathers and mothers of the race that good and virtuous qualities are transmitted as well as vile and sinful ones, then we can hope for less sin, misery and disease to be born into the world. We can not expect the effects of centuries of transgression to be effaced in a few short years, but we can expect that every effort to improve the morality, health and purity of the race to be rich in results for good.

Do not understand me as saying that I believe the race, as a whole, is on the descending scale. Far from it. I believe there was never a time in human history when men were so loyal to the landmarks of truth. There never was a time when the plain teachings of the gospel were entrenched in so many faithful hearts. Ideals are higher to-day than ever before. Character means more. You and I are living in the golden age of the world. More is expected of us than ever before in human history. We are building school houses, churches, reformatories and hospitals. God expects great things of us. He has given us power, opportunities denied to any other age, and power means responsibility.

FURTHER STATISTICS.

Supplementary to the able paper of Dr. Conniff, the following striking illustration of the importance of the subject may be cited. At a congress in Dusseldorf, Germany, Dr. Clausener created quite a sensation by the statement of the following facts: An English physician visited, in the year 1874, a number of English prisons, with a view of studying relation between alcoholism and crime. In one of the prisons he found six persons all belonging to the same family—whose ancestors could be traced to a person born in 1740. From this man eight hundred and thirty-four descendants could be traced. The lives of seven hundred and nine of these had been investigated. Of these seven hundred and nine, over one hundred were illegitimate, one hundred and eighty-one of the women were prostitutes, one hundred and forty-two were beggars, sixty-four were in working houses, and seventy-six were criminals, seven of whom were murderers. The father of this clan was himself a vagabond and drunkard. These seven hundred and nine persons passed one hundred and sixteen years of their life in prison, in the aggregate. They lived, altogether, seven hundred and thirty-four years at the expense of the public, at an aggregate cost of one million four hundred thousand dollars. What could more forcibly illustrate the conclusions reached by Dr. Conniff?

"I have drank whiskey every day for thirty-five years," remarked a gentleman of sixty rather proudly, "and I don't see but I have as good a constitution as the average man of my age; I was never drunk in my life." He was telling the truth, but to learn the whole truth you would have to study his

children. The oldest, a young lady, had perfect health; the second, a young man, was of remarkably nervous and excitable temperament, as different from his phlegmatic father as possible; the third, a young lady of seventeen, was epileptic and always had very poor health. Did the father's whiskey drinking have anything to do with these facts? The instance may be duplicated in almost every community. Think over the families of your acquaintance in which the father has long been a moderate drinker, and observe the facts as to the health of the children. The superintendent of a hospital for children at Berne, Switzerland, has found by careful observation that only forty-five per cent of those whose parents used intoxicating liquors habitually had good constitutions, while eighty-two per cent of the children of temperate parents had sound bodies. Of the children of inebriates, only six per cent were healthy. Can any man "drink and take the consequences;" or must his children take the consequences?

CREMATION OR EARTH BURIAL, WHICH?*

Among the momentous questions of this generation, which under the authoritative touch of the *experimentum crucis*, have progressed from the domain of theorem into that of demonstration, the subject of cremation as a substitute for earth-burial has become paramount.

It is only within the last quarter of a century that special interest in the benign old-time custom has been revived, under such auspices and with such force and power as to make it the leading hygienic movement of the time.

Previous to the year 1869, no organized effort avouching the necessity of the return to the usages of the aforetime, had been inaugurated, although the question had been considerably discussed in foreign medical societies and journals. In the year aforesaid, an international medical congress met at Florence, Italy, and the eminent medical teachers of that nation—Professors Colletti and Castiglioni—introduced and forcibly advocated cremation, as being a question of vital moment to the

*By Edward A. Guilbert, A. M., M. D., LL. D., Dubuque, President Iowa State Board of Health.

public health. The proposition was favorably received by the congress, and was approved with practical unanimity. In 1871, the international medical congress reconvened at Rome. Here the proposition was again presented, and again favorably received.

In April, 1874, a cremation congress was called at Milan by the well known doctors Bono and Amati. Over five hundred physicians and scientists attended. The question was exhaustively debated, and the proposed reform unanimously approved. An appeal was formulated to the Italian Parliament asking that body to legalize cremation in the new sanitary code then being prepared.

Previously to this Milan congress, more or less numerously attended minor conferencss had been held, during the intervals of the major congresses, in various cities of Italy. Public interest in the subject had further and markedly been aroused by numerous articles in the papers, and by appeals personally made by medical men of eminence to the Italian Senate and Chamber of Deputies, and the decisive battle was on. It was very "meet and proper" that the world at large should be awakened to the vast importance of this purely sanitary method of disposal of the dead, by the scientists of a land where cremation prevailed as a national custom seven hundred years B. C. Indeed, in the antique world the usage was general, except in Egypt, where the State religion, based on the transmigration of souls made embalming of the dead obligatory: in Judea where they were sepulchered, and in China, where earth-burial was the rule, and where for ages that people have considered it to be a religious duty to bring home their dead, even from foreign shores, in order that they might lie in their native soil. The revival of the cremation idea promptly extended to other lands, and in 1874 was inaugurated in England by Sir Henry Thompson, whose articles in the January and March issues of the *Contemporary Review* attracted wide public attention. Simultaneously, January 13, 1874, was effected the organization of the Cremation Society of London. This body he founded. Its membership is drawn from all classes of society, scientific and social, and the active propaganda which began with its birth has never ceased. Its official publications have been numerous and effective, and its members have continuously appeared on record in the medical and secular press on this behalf. Under the stimulus of this society the fifth crematory in Europe

was built at Working, Surrey, in 1879. To it is also due the publication of the admirable little volume of Eassie on "The Cremation of the Dead," and through it, "Being dead he yet speaketh."

On the Continent, also, the reform rapidly spread from Italy, and aggressive cremation societies arose and still flourish in Germany, France, Holland, Belgium, Switzerland, Denmark, Austria and Portugal. This latter is the only European country, so far as I am informed, in which organized and violent opposition on the part of the Catholic clergy has appeared. But the advocates of this sanitary reform, there as elsewhere, were equal to the occasion. Their convincing arguments prevailed, and by the year 1891 cremation became lawfully optional in Portugal. The municipality of Lisbon has also decided that it shall be compulsory during epidemics. All the societies aforesaid became, as soon as formed, untiring and aggressive promulgators of the doctrine of cremation, and within ten years after the renascence the whole civilized "world was filled with the pious clamor" of a multitude of votaries, who affirm the demonstrative proposition that earth-burial is inhumanity to man.

The phenomenal progress of the revival conclusively proved that among thoughtful men and women there was a latent, general and profound conviction that the time had come for a radical revision of existing burial methods in the interest of the public health.

In our own country the keynote was struck about the time it was heard in England. Here the reform was specially fostered by the distinguished surgeon, the late Dr. S. D. Gross, and by Drs. F. J. Le Moyne of Washington, and M. L. Davis of Lancaster, Pa. and Hugo Erichsen of Detroit, Mich. Dr. Le Moyne built the first crematory in the United States at Washington, Pa., in 1875. Dr. Davis has been the devisor and constructor of a number since then. He, likewise, was the first to establish a paper in this interest, the *Modern Crematist*, which did yeoman service in the arduous educational campaign which was then being conducted. Whether it still lives I do not know. Dr. Erichsen was a contributor to this journal, and is the author of a volume entitled, "The Cremation of the Dead," of which the accomplished Cobb speaks highly. I have not been so fortunate as to be able to procure a copy.

The reform grew slowly yet surely, but it was not until after seven or eight years of seed sowing that the signs of the harvest began to appear. A rarely intelligent contingent of medical men, clergymen and laymen then materialized; cremation societies multiplied with rapidity; special literature in the form of monographs, magazine articles and books—of which Augustus Cobb's "Earth Burial and Cremation" is an admirable specimen—followed each other in quick succession; and in 1891 that valuable organ of the new crusade, *The Urn*, was founded in New York City. This journal is yet vigorously alive, is well supported, and is effectively edited by Mr. Louis Lange. It is as powerful a propagandist as is *Die Flamme*, the pioneer cremation journal of Europe. *Die Flamme* is the organ of the Berlin Cremation Society, a body which had, in 1892, over one thousand members. This membership has, doubtless, largely increased since that date.

Within the past five years, the benign idea has firmly intrenched itself into the very citadel of public appreciation. Its literature has been greatly enlarged, and this safe, pure and beautiful method of the disposal of the dead has become a subject of often discussion in the great newspapers of the land. No stronger evidence than this, of the present status of this question, could be adduced. The astute editors of these papers are always swift to hear and to interpret the heart-throbs of the people, and are ever ready to give to the reading world the conclusions experts have reached with regard to questions which nearly concern the public weal.

So powerful has been the impetus thus given to the gracious reform that it moves now almost by its own momentum. It is only a question of time when the hygienic revolution, formally begun in 1869, will have accomplished its righteous purpose. *Then* every considerable city will have its own crematory, built in churchly style, having its mortuary chapel, whose "dim religious light" and appropriate decorations evince a proper respect for the dead. From such solemnizing surroundings, amid the tearful benedictions of friends and lovers, the placid corpse, rescued from the worms and the prolonged and revolting putrescence of the earth-grave—whose pollution menaces the health and lives of the living—is reverently committed to the purifying incinerator which, "clothing the palpable and familiar with the golden exhalations of the dawn," "*tuto, cito et Jucunde*," resolves the effete earthly tabernacle of the soul into its primal elements.

I never think of a cremation but what I am reminded of the passing of Elijah: "And it came to pass as they went on and talked, that behold, there appeared a chariot of fire and horses of fire, and parted them both asunder, and Elijah went up by a whirlwind into heaven."

Speaking of the advancement this reform has made, I ought to state that among that remarkable people, the Japanese, whose evolution during the last generation from semi-barbarism to a high plane of modern civilization has been one of the marvels of this wonderful century, cremation has made greater progress than in any other country. It was estimated by Cobb, in 1892, that forty-seven per cent of the aggregate of that nation's dead were yearly incinerated, ten thousand annually being thus disposed of in the six public crematories of Tokio alone.

Previous to 1869—the year of renascence—not a crematory was existant in Europe or the United States. The first one was built in Milan, Italy, in 1874. This was duplicated at Lodi in 1876. In 1875 Dr. LeMoyne built the first one in America, at Washington, Pa. The first incineration in America was done there in December, 1876, on the body of the celebrated Baron de Palm, and many will remember the newspaper excitement which that event produced. The episode was an object lesson to the public and markedly increased the interest intelligent people were beginning to take in this subject. Like the "little cloud like a man's hand" which Elijah's servant saw from the top of Carmel, "arising out of the sea," it seemed to be of small moment and yet was prophetic of great results.

Since 1876, mainly through private enterprise, the number of crematories has largely increased. It was stated at a congress of cremation societies, held in Vienna in 1888, that there were then fifty active crematories in the world. Within the past seven years the number must have grown to nearly one hundred. The aggregate of annual incineration also grows, as is shown by official reports.

In 1888 the legislature of New York appropriated twenty thousand dollars for a crematory on Swinburne island for the use of the State quarantine station, thus setting an example that should be followed by every maritime commonwealth. This crematory cost the State five thousand five hundred dollars, and has been of vast service. It was erected after the plans and under the supervision of Dr. Davis, of Lancaster, Pa., who, as stated ante, has devised and superintended the erection of quite a number of these institutions in his own and other States.

In 1890, the municipality of Philadelphia erected a crematory in its public cemetery. The most recent great gathering of hygienists was the "International Congress of Hygiene and Demography" in London, England, August, 1891. The Iowa State Board of Health was there represented by its secretary, Dr. J. F. Kennedy. That congress was composed of representative medical men and other scientists from various countries of the world. In its section of State Hygiene, the question of cremation versus earth-burial was elaborately discussed. The chairman of the section, Sir Henry Thompson, opened the debate with an interesting and instructive paper. He took for a text the statistical fact that, during the three years next preceding 1891, the deaths from zymotic diseases in England and Wales alone had numbered sixty-eight thousand three hundred and eighty-two annually, or about one-eighth of the general mortality. He then proceeded to forcibly and convincingly speak of the malign influences exercised over the living by this enormous aggregation of earth-buried foci of infectious disease. He remarked: "It is not too much to say that this large number of deaths from maladies which are mostly preventable is itself partly due to the fact that the dead body is permitted to propagate disease in the living. Could we arrest at once and completely the injuriously active forces which pervade it, a marked diminution would be apparent in the progress of many a local pestilence. A long experience has demonstrated that all methods of dealing with the dead body, which have for their object its conservation entire, when charged with infectious elements, permit these to be disseminated, and have often occasioned fresh outbreaks, especially in periods of epidemic visitation. The intricate, continuous and universally pervading natural network of water-courses beneath the surface of the soil, associated as it is with innumerable artificial wells, reservoirs and channels of every description, for distribution of water and collecting sewage form a system, unseen, yet scarcely imaginable in regard to its extent, by those who have not practically studied it and realized the complexity of its ramifications. In a densely populated country this system presents, perhaps, the most formidable social health problem which the sanitarian has to encounter.

"The history of the chief epidemics of the last fifty years in this country, and of the local outbreaks of fever, small pox, etc., offers innumerable examples of propagation and extension of these diseases, due mainly, if not entirely, to the failure to prevent poisoning of these water-courses, not only by excreta during life, but by dead bodies committed to the soil—bodies which are deposited there solely in obedience to a sentiment that it is necessary to preserve the integrity of their form and the unaltered condition of their elements—elements at that moment so destructive and so mobile."

Sir Henry, in statesmanlike phrase thus concludes:

"Finally, by this process (that of incineration) two great advantages are secured to the public:

First. A diseased dead body is rendered incapable of communicating any malady to the living.

Second. The assignment of large and desirable tracts of land throughout the country for the imperfect, and sometimes hazardous process of purification by burial in earth, is rendered needless. Every acre hitherto thus devoted, may in process of time be made free for the production of food; or, in thickly populated neighborhoods, as open spaces for exercise and recreation, may be set apart forever to promote and maintain public health."

The points made by Sir Henry apply with equal force to our own country. Irrefutable testimony as to the dire results upon the health of the living of such avoidable contamination of the water supplies of numerous American communities, urban and rural, has long been before the public in official documents. Witness the revelations some years ago about the contamination of the Croton river by the seepage of the eighty-three cemeteries and the innumerable farm-yards and cess-pools along its banks.

The reformation of the water supply of the City of New York, it will be remembered, cost the city a collossal sum of money, no inconsiderable part of which was expended in the wholesale abrogation of ascertained sources of pollution. Witness likewise the official reports from the cemetery region, in Newton, Long Island, into which township thirty-five thousand bodies are annually carried for burial. The state of things existant here is a blot upon our boasted civilization. Certain soulless corporations, actuated by that familiar form of greed which has no respect for the command, "And as ye would

that men should do unto you, do ye also in like manner to them" there, in their public lots, in trenches ten feet wide and fifteen feet deep, bury bodies in tiers of fifteen, thus packing fifteen hundred of God's departed poor into a space ten feet by two hundred! These trenches are kept open at one end until full, that is to say, for many weeks, and when finally filled are only covered with a thin film of earth.

One of these Newton abominations rigidly requires each grave to be two feet by seven, with no earth space between coffins! Further, it permits six bodies to be buried in each grave, thus putting eighty-four hundred festering dead into each acre of ground at a profit to the owner ghouls of seventy-one thousand five hundred dollars annually, on each filled acre! In 1889 there were a million and a quarter of decomposing bodies in this township. Six years later, at this writing, this abhorrible menace to public health, this renate barbarism, must contain a million and a half of "earth inhabitants." Is it marvelous that Newton has about the highest death-rate of any township in New York?

Another common phase of the question is the desecration of burial grounds in obedience to the demands of city extension. It is no unfamiliar sight, during such events, to see rotting coffins and partly decomposed bodies lying for hours exposed while awaiting removal; emitting noxious gases, which are reinforced by the deadly exhalations from the upturned soil, where for many years, under the auspices of those inscrutable chemists, the worms, the products of animal decomposition have unremittingly undergone the dual process of generation and dissemination.

These poison fumes are often so obtrusively pungent as to asphyxiate the workmen engaged in the exhumation. Eassie mentions well authenticated cases, collated from various sources of grave diggers, who in plying their calling have been, some dangerously and others fatally, affected by the carbonic acid flowing from the graves they were excavating. The deleterious exhalations referred to above are not confined to the point of origin, but pollute the air at large, and as has repeatedly been proven, develop deadly epidemics of germ disease. Nor on such occasions is it unusual to observe the bones from charity lots tossed hither and yon, later on to be collected, perfunctorily for the purpose of reinterment in pits elsewhere.

Have we any reason to criticise the loathsome conditions presiding over the burial places of the Chinese, when such things as those just described can be done with impunity in our vaunted civilization "without our special wonder?" Did the far-seeing Master have us in mind when he said: "And why beholdest thou the mote that is in thy brother's eye, but preceivest not the beam that is in thine own eye? Or how wilt thou say to thy brother: Let me cast out the mote from thine eye; and behold the beam in thine own eye." Is *verbum sat sapienti* to be taken "in a Pickwickian sense," or does it state a truth worthy of our learning?

And these are not exceptional instances of cemetery vandalism, and might be abundantly multiplied by illustrations drawn from statistical sources in Europe as well as in our own land.

But to return. At the congress aforesaid, only one voice was heard in advocacy of earth-burial. Mr. Sidney Haden is a scholarly man, but his conservatism seems to be akin to that which roasted Servetus and smirched Calvin, sent Theist Bruno to the stake and prompted uncomprehending priestly bigots to discipline Gallileo. Haden warmly opposed cremation, mainly on account of the possibility of crime being thereby concealed; a medico-legal objection which has often been confuted. He made some points in his defense of earth-burial which, if the abuse is to continue, ought certainly to be incorporated into laws. They are as follows: The condemnation of double coffins and of coffins made of indestructible material, because they prevent speedy decomposition; the importance of ample soil intervals between coffins; the abrogation of the unwise custom of keeping the dead unburied for many days; and lastly the discontinuance of costly funerals, whereby the means of the survivors are so often sacrificed to a display which is a relic of barbaric days. His averment that cremation was an *unnatural* method of disposing of the dead was answered by Sir Spencer Wells, who affirmed that it was no more unnatural than earth-burial, or burial at sea; and he forcibly pointed out the dangers to the living from the large tracts of land polluted by burial. He illustrated his argument with a pertinent anecdote of Sir James Simpson, the discoverer of chloroform, who suggested to a lady consultant from Ireland that she take chloroform during her labor. She refused, declaring it to be unnatural so to do. Sir James asked her how she came from Belfast. "By steamer," she replied. Whereupon he remarked: "That was a most unnatural way; the natural way was to *swim*."

Nothing short of cremation, Sir Spencer held, would destroy the specific germs of zymotic diseases. The discussion was lengthy and full of interest. Mr. Haden, in his final reply, repeated emphatically his former averments and said: "As to the pollution of water, was not the Aldgate pump quite near a grave-yard, and yet one of the most wholesome in London?" His unfortunate query was promptly answered by Mr. Hart, who said: "At my instigation that pump had to be closed because of its deleterious properties." Strange that such a man as Haden should not remember that chemistry and its ally, the microscope, have often and often conclusively proved the clearest and most palatable well-water to be dangerously loaded with the poisonous nitrates of animal decompositions. Unhappily, these maleficient masked-batteries are not always discovered and their soundless guns spiked until the epidemics they begot have done a deal of deadly work. Another verification of Shakespearean axiom—"Fair is foul and foul is fair."

The debate was concluded by Sir Henry Thompson, who offered this resolution:

"*Resolved*, That cremation of the dead is a rational hygienic measure which is especially called for where the death occurs from contagious disease."

The proposition prevailed by acclamation, practically, there being but four negative votes. As showing the interest the public took in this discussion, it is stated in the official organ that the room in which the section convened was crowded to excess, standing room being obtained with difficulty, and that the audience did not hesitate to express audible approval or disapproval of the various speakers on occasion. The applause was almost entirely given the advocates of burial reform.

The statutes of the various commonwealths of this country do not prescribe methods of interment, therefore cremation is not an unlawful method of disposing of the dead, as some "pelting, petty cavillers" have proclaimed. Hence no appeals to State legislatures on this behalf are necessary. But organized and persistent petition endeavors should be brought to bear upon these bodies with reference to influencing the enactment of laws making it obligatory upon boards of health to incinerate the bodies of those dead from infectious disease. It seems to me that it is also our duty, as sanitarians, to foster in every way, the policy of the building of crematories, so that in time the means to the benign end may be brought directly to the

people of each considerable municipality, thus doing away with the present enforced transportation expenses, which can illy be borne by the many, a fact that materially interferes with a general exemplification of the process.

Aside from the cost of a building, the expense of a Siemien's reverberating furnace is not great, and is within the reach of even the smaller towns of the land. That cremation is the more economical mode of the disposal of the dead, notwithstanding the outlay on such structures, goes without saying when we compute the vast money cost to the public of avoidable epidemics. The economic argument is one of great weight in this utilitarian age, and now that sanitary science has demonstrated that the health of the living is also involved in the success of this movement, its ultimate triumph seems beyond peradventure.

It is not to be wondered at that the cremation idea has met with opposition, for from the time of the Master to this present such has been the lot of all reforms which aim to change customs that have been canonized by age. But in this case the opposition has been singularly inconclusive. With but few exceptions, it has come from men to whom even the alphabet of hygiene is unknown. Sentiment has been invoked to combat a reform founded in reason and approved by determinate experience. A limited number have sought to make earth-burial a test of Christianity, thus adding another to the many crimes that have been committed in her name. The Bishop of Lincoln, England, in 1874, during the dawn of the reform, evolved from his inner consciousness the surprising excathedra statement "that a revival of cremation would destroy belief in a final resurrection!" He forgot, in his affirmation of faith, be it said, to answer Earl Shaftsbury's pertinent question: "What has become of the blessed martyrs?" I might add, "Where are the innumerable, *they*, the Christian men, women and little children, who have suffered death in conflagrations on land and sea? Is that inscrutable essence within man, the myself, the very life, which thinks and impels, loves and hates, and which we call the *soul;* is *that* really 'of the earth, earthy,' and is it positively annihilated when the cremated body gently fades away, 'like the fabric of a vision, leaving no track behind?'" If the soul of the martyr died when his body burned at the stake, what meaning is there in the liturgical averment: "The noble army of martyrs praise Thee?" That which has been

annihilated can neither "praise" nor blame. The bishop's logic halts, and his rhetoric is cruelly faulty.

The only churchman in this country, so far as I now remember, who has sought to emulate the unwisdom of his brother, the bishop aforesaid, is Bishop A. Cleveland Coxe, of Western New York—an able man, a cultured writer and an author of repute, but who appears to look at this reform through the reverse end of his mental telescope. Ignoring a righteous verdict in which unite hundreds of fellow clergymen, thousands of scientists and scholarly laymen, and fully nine-tenths of the educated medical men of the world, who have studied these things, which he has not; ignoring the overwhelming evidence accumulated and being accumulated against the sanitary and civil evils of earth-burial, the which he seems, likewise, disposed to consider a test of Christianity, he says: "Christian civilization substituted for the burning of beloved bodies the gentle inhumation of the cemetery, in which they are laid asleep." He further asserts that "there has been no assemblage of thinkers to give the subject dispassionate consideration, those who are the first to be ignited by the craze being known as cranks." "Ignited" is good, "craze" is better and "cranks" is best, coming as they do from a Reverend Father in God, who at matins, when he intones the Ninth commandment, is supposed to join his people in the response: "Lord have mercy upon us, and incline our hearts to keep this law." I must infer, however, that the act is, in the bishop's case, somewhat perfunctory, and is done with a mental reservation that relieves himself of the duty of obedience, to which the other unpriestly fellow is held and firmly bound.

Writing upon a topic involving momentous interests, it was his bounden duty exhaustively to *study* the question in all its bearings, to the end that, as a stoled priest and a gentleman, he "might know whereof he affirmed." Then he would have learned that he was a tergivisator, one "most ignorant of what he was most assured;" who, as early as 1886, could assert that "*no* assemblage of thinkers had given this subject dispassionate consideration." Per contra, he would have found that several congresses, numerously attended by distinguished men, *had*, within the twelve years next preceding his *Forum* essay, been held in Europe; that very many cremation societies composed of men who, in scientific circles, had richly earned the right to be entitled thinkers, had for full ten years been in active

existence in Europe and America; that leading medical societies on both continents had formally approved the reform; that through the influence exerted upon public opinion by the cremation society of France—which was founded in 1880—a public crematory was erected in overcrowded Pere la Chaise cemetery, Paris, in 1886, the same year his phillipic was printed. This handsome building, I may say in passing, has two incinerators, and an annual capacity of five thousand bodies. It was first used for the purpose to which it is dedicate, October 22, 1887. It has been in constant use since then, thousands of bodies having been cremated therein.

Such ignorance as Bishop Coxe—a consecrated teacher of men—displayed, was as disgraceful as his epithetical violation of the Ninth Commandment was criminal.

In the *Forum* for May, 1886, the Rev. J. W. Chadwick, of Brooklyn, N. Y., replied effectively to Bishop Coxe, and thus dismissed him who had feebly attempted to

> "Prove his doctrine orthodox,
> By apostolic blows and knocks."

Said Chadwick in his summing up: "Those of us who believed in cremation before we read the Bishop's article, having read it carefully, believe in cremation certainly as much as ever, *and perhaps a little more.*" Said the Great Teacher: "If the blind lead the blind, both shall fall into the ditch."

There, or *thereabouts*, the Bishop and his meager following were found after Chadwick's rejoinder.

Contrast Bishop Coxe's exhibition of misinformation with the thoughtful utterances of another prelate, the late Bishop of Manchester, of England. Some years ago, in a public address he alluded to his recent consecration of a cemetery and used these timely words: "Here is another hundred acres of land withdrawn from the food-producing area of this country forever. I feel that before long we shall have to face this problem—How to bury our dead out of our sight—more practically than we have hitherto done. I hold that the earth was made, not for the dead, but for the living. Cemeteries are becoming not only a difficulty, an expense and inconvenience, but an actual danger."

This Bishop's humane utterances were: "the outward visible sign of the inward spiritual grace," which had descended upon him from the Master who examined before he condemned, who respected honest doubt and welcomed the doubter, and

who gave his followers to understand that "to break with prejudice and convention" was a condition precedent to right thinking when confronted by all reforms, especially by such as are not only hypothetical, but also demonstrable. The other bishop perhaps unconsciously emulated Ovid who said:

> "I see the right and I approve it too,
> Condemn the wrong, and yet the wrong pursue."

Since 1886, despite Bishop Coxe's anathema, this reform has spread rapidly among the clergy, very many of whom "have the courage of their convictions" and speak out. A notable instance of this fact recently appeared of record in the symposium on cremation published in the Chicago *Tribune*. The reporter interviewed such representative clergymen as Bishop Fellows, Jenkins Lloyd Jones, Dr. H. W. Thomas, John Rusk, H. A. Delano and Thomas C. Hall. The result was a very positive and unanimous expression adverse to the proposition that earth-burial *is* a test of Christianity; and an equally positive expression favorable to cremation as the most beautiful, the most speedy and the only sanitary method of fulfilling the law: "Dust thou art, and unto dust shalt thou return."

In marked contrast to the opinions expressed by those Chicago clergymen who, in learning, piety and good work are the peers of the hierarchy of Rome, one of the latter faith, Archbishop Ryan, of Pennsylvania, recently, as I learn from the *Urn*, "refused to permit funeral services to be held in his cathedral over the body of a parishioner about to be cremated, because it is not a Christian burial under the Catholic ritual." So it seems that there are Christian burials and *Christian* burials, and of these latter those performed under the Catholic ritual are alone canonical! I believe it is one of the dogmas of that church that only he who dies in that faith can be interred in consecrated ground. Why, then, could not this astute archbishop, for whom American popularity is claimed because of his supposed tolerance, this scholar and man of affairs, who ought not to be ignorant of the sanitary aspects of this serious question; why should he not rise to the occasion and erect and consecrate crematories in his cemeteries whose use should be optional, and thus solve the problem in favor of humanity, as it becometh one to solve it who is a prince and ruler of vast influence in his church? History avers that the church in the Middle ages favored cremation for opinion's sake. For a humanate, a more Christian purpose—that of the health and wealth of the peoples—why

should it not do so now? It seems very strange to me that the church whose policy led it, in its stormy dawn, to adopt and rechristen so many pagan holidays and customs, should have ignored cremation of the dead, the most gracious custom of all; one which is perfumed with mercy for the living and tenderness for the dead, and one which enforces in its every object lesson the comprehensive proclamation of the *Master:* "God is not the god of the *dead*, but of the *living*." I believe the church administers the sacrament of extreme unction only when it is supposed that the life drama of one of its children is in the last scene of the final act, Death being at hand to ring down the curtain; and that this last rite is the *pour prendre congé* act of the priest, the Catholic ritual providing no special service for the final interment. These being facts, I fail to comprehend how cremation is unchristian according to the Catholic ritual, the extreme rite having been performed, and the ashes of the dead having been inurned to await the resurrection. Certainly the archbishop's decree is not considered to be the rule in Europe, where several thousand of his fellow Catholics were cremated last year without prelatic interference.

Curiously enough, two years ago Grand Master Arnold, of the Masonic Grand Lodge of Pennsylvania, refused a subordinate lodge permission to perform the funeral service over the dead body of a brother about to be cremated. His objection was not that the act was unchristian, neither did he deny the right of a dying brother to dictate as to the disposal of his remains, as has been erroneously asserted, but his refusal was solely based on the proposition that the ritual of the Masonic burial service requires the mortuary scroll, the apron and the emblem of faith and remembrance—the significant evergreen—to be dropped into the open grave with appropriate comment, and these things, he says, can not be done "in a *furnace!*" He sums up with this statement: "A vault *is* a grave; a *furnace* is *not*." The lexicographers define the word "vault" more accurately. They call it a cave, a cavern, a cell, never a *grave*. He meant, I suppose, the familiar above-ground monstrosity provided by cemetery authorities for the temporary care of the dead. If the Grand Master had ever visited the crematory in the city burial ground of Philadelphia, and had examined that edifice, and had there witnessed a cremation, as he should have done before he made his decision, he would, perhaps, have decided differently. He would have seen that the mortuary

chapel is a sepulchre on a more magnificent scale, and one totally free of the charnel-house odors and the repellant gloom of the regulation cemetery *vault*. He would also have learned that a crematory is not a *furnace* in the sense that the body is buried directly in the flames, and thus reduced to nothingness, which is the purpose of all forms of burial. On the contrary, he would have seen that the incurious corpse is reverently placed in an inner sepulchre, hermetically sealed, around which the disinfecting fires fervently circulate, entering not the benignant tomb. There, saved from the worms and the menaceful pollution of a gloomy earth-grave, he would have seen the radiant mortal part serenely melt away "as the sunbeam drinketh dew." How could an intelligent Mason seriously assert that it is unmasonic to render funeral honors to a dead brother amid such surroundings as that chapel proffers? A few necessary verbal changes in the ritual could easily have been made, and the scroll, the apron and the evergreen could have gone with the body into the incinerator. It was as as Masonic to bury them there as to fling them into an open grave to *rot*. Let the ritual be changed to conform to the times. It is not immutable like the sacraments of the church.

Pennsylvania conservatism cropped out in a concurrent decision of the Grand Master. The Master of a lodge refused to entertain a motion allowing the cinerary urn of a cremated brother to be placed in the lodge room. The District Deputy Grand Master who affirmed the decision, Grand Master Arnold, said: "A lodge room is a place for lodge labor and refreshment, and not a place of sepulture." As an old student of "the strange, mysterious, glorious science," and as one who has been a not undistinguished actor in their governing bodies, I can not agree with Arnold. Given, a fire-proof hall, owned by the craft, it seems to me that a room, appropriately arranged and decorated, might very properly be set apart and dedicated as a columbarium. In this lodges of sorrow could statedly be held, and the memory and achievements of departed worth could thus be kept alive as lessons for the living. Stranger things than this may happen within the next decade, so rapid is now the progress of this wholesome reform. It amuses me to observe Masonry in staid old Pennsylvania in temporary at-onement with the Romish Church on this topic. Masonry, for generations, has been the *bete noire* of that far-descended and splendid autocracy. The Head of the Church has often

projected damnatory bulls at the institution at long range, and during occasional rests from this diversion the Church has sat in "the cool shade of *orthodox* aristocracy," meditatively "biting its thumbs" at the craft, wondering meanwhile, why these objugatory fusilades did not give the institution pause. These episodes amused their authors and did Masonry no harm, for the royal craft can only be "wounded in the house of its friends," and these wounds are generally unknown, as it is not permitted to "air them in the market place." So the imperial institution, in conscious rectitude, went on its stately way, "reviling not again," and utterly refusing to be annihilated. Now, *mirabile dictu*, the Church and Masonry—that is to say, quaint *Pennsylvania* Masonry—

> "In mutual, well beseeming ranks,
> March all one way."

The lion has lain down with, and outside of, the lamb, and a major sign of the millenium has appeared!

But it is safe to prophesy that while awaiting the coming of the Lord, an increasing number of Catholics—and certainly of Masons—will annually become converts to the wise doctrines of this salutary reform, which unselfishly seeks to eradicate costly evils that endanger the public health and jeapordize human lives. So far as I am informed, after due inquiry, the Hierarchs in Catholic countries of Europe have not directly and publicly condemned cremation. This benignant custom had its renascence in a Catholic country, and within the immediate shadow of the Vatican. It is largely, very largely, in evidence there now among intelligent people, and its educational influence constantly widens. In other Catholic lands on the Continent, it is favorably known of men as the sole solution of the problem of the disposal of the dead in the interests of the living, and is so proclaimed, unrefuted.

Cremation and earth burial are one in purpose—that of resolving the dead body into its primal elements. But earth-burial does this by a slow process, which, as a rule, it takes many years to complete, and this process is one of such repulsiveness, and so full of peril to the living, that it is no marvel sanitarians should advocate incineration as the better, safer, quick and more humane method, forasmuch as it substitutes purity for impurity, beauty for loathsomeness, and at the same time traverses no church rites.

Twelve years ago died a Past Grand Commander of Templars in Pennsylvania, Dr. Charles E. Blumenthal:

> "—— who bore without abuse,
> The grand old name of *Gentleman*,
> Defamed by every charlatan,
> And soiled with all ignoble use."

He was a man distinguished in medicine, in letters and in masonry. He had long been an outspoken advocate of cremation, and on his death-bed he directed that his body should thus be disposed of. His wishes were respected by his family, as is not always the case, and his remains were incinerated in the famous Le Moyne crematory, at Washington, in that State, October 16, 1883. No Masonic funeral service in his honor was performed.

Noting that sin of omission the writer hereof, in a review of the doings of Templary in 1884, used this language: "An appropriate and beautiful Masonic service could easily be arranged for such occasions. If this ancient method of disposal of the mere shell in which lives the man should ever become universal, as it ought for sanitary reasons especially, such a service will undoubtedly come into use." Eleven years later, after having actively engaged in the "reasonable vice" of this beneficent reform I can say: "The hour has come!"

In this connection I must refer to another phase of this semi-official masonic opposition, which materialized some months since in Ohio. A Cincinnati *Enquirer* reporter interviewed several Past Grand officers and published their views of the merits of a decision of the successor of Grand Master Arnold, who recently duplicated the ruling of his predecessor, hereinbefore mentioned. The subject of this later decision I am happy to say, had been a member of a lodge whose master and craft believed in lawful freedom of action, and their dead brother's body *was* honored by the usual masonic funeral service in the crematory at Germantown, Pa., and was *then* cremated. One of the aforesaid Free Masons—all the others distinctly differing from him—vigorously opposed the reform. His contention was—that it is a *heathen* method. He said: "My observation is, that its advocates are generally free-thinking *foreigners* (?) unbelievers in any kind of religion, except, perhaps some fanatical fad of their own; generally nuisances in church, masonry and politics," with much more of the same sort of stuff which was quite characteristic of a robustious man

who is habitually "intoxicated with the exuberance of his own verbosity," as Beaconsfield with undiplomatic frankness and less truth said of Gladstone.

The caustic editor of the *Urn* neatly disposes of the Ohio mal-content, in the July number of that valuable journal. He forgot, however, in his adequate reply, to inform the party whom he was flaying, that cremation is no more a heathen custom than is earth-burial, both methods having been employed by pagan nations side by side, for immemorial ages. So the supporters of earth-burial are really following a pagan custom after all.

Another Ohio Past Grand officer interviewed was Past Grand Master Goodale, who was unequivocally in favor of cremation as a sanitary necessity, and saw nothing *unmasonic* therein. This gentleman but a little while before had occasion to define his position on the question: Does a Masonic brother desiring to be cremated after death, really lose his right to funeral honors? The case was this: a Scotch Rite Mason, a druggist in Cincinnati died. He had expressed a wish that his body should be cremated. His family respected that wish, but desired that funeral honors should signalize the incineration. The Scottish Rite cathedral was asked for. The epithetical opposer aforesaid has charge of that edifice, and refused its use *because* cremation was to follow the service. The chapter room in the Masonic Temple was promptly tendered and accepted, and Most Worshipful Brother Goodale—honor be to him—himself, with ample Masonic assistance gave the dead brother his well-earned funeral due. Past Grand Master Goodale favors the proper changes in the funeral service to adapt it to cremation as well as to earth-burial.

Another distinguished Past Grand officer who, for many years, was Grand Secretary of the Grand Lodge of Ohio, was also interviewed. This was the Honorable J. H. Bromwell, then, and now, a member of Congress from the Cincinnati district. He, likewise, approves cremation for sanitary reasons, and knows of no Masonic law prohibiting the signalization of a fraternal incineration with Masonic honors. Like Most Worshipful Brother Goodale, he favors rearranging the burial service for this purpose. I am heartily glad to welcome Congressman Bromwell and his associate to the augmenting army of friends of this momentous reform. He occupies a conspicuous public position, and, being an able man, can render the cause efficient aid. His influence may be invoked on collateral phases of the question ere long, as for example: In support of the pending and yet unsettled proposition to organize in our national government a Department of Public Health, one distinctively nonpartisan, permanent and adequately endowed with legal powers, as well as means wherewith to enforce them. The enactment of a law inviting the coöperation of European governments in an effort to induce "the unspeakable Turk" to suspend his Armenian and other unchristian pastimes and turn his immediate attention to the absolute necessities of sanitary reform in Mecca, from whence, more obtrusively than from the region of the Ganges, where the disease may be said to be endemic, cholera is brought to Egypt, Syria, and thence to Europe and America, by returning Moslem pilgrims. No more fruitful field than Mecca can be found for the exemplification of the saving virtue of the cremation of the dead from infectious disease. There, as we well know, evils exist, which Turkey should be compelled to eradicate because they effect the world at large. They are legitimate subjects for international intervention, for the law of nations denies the right of any one country to become a persistent propagator of deadly epidemics, which menace the peace and lives of other peoples. And again: The passage of an appropriation for the erection of crematories at all government quarantine stations, so wording the law as to make cremation of those dying there of zymotic diseases obligatory upon the quarantine authorities.

Recently, during a conversation with that eminent statesman, the sagacious and courteous Senator Allison, of Iowa, who, I think, is more nearly resemblant of Addison's characteristics, as pictured by Pope in his charming Epistle V, than almost any other of our public men, I was greatly pleased to learn that observation and reflection had combined to cause him to recognize cremation of the dead as one of the most important and far-reaching of the sanitary questions of the time, and that, in his judgment, its general substitution for earth-burial would be a boon to the living.

Should the sovereign people, as is not improbable, sometime say to this cultured gentleman: "Well done, good and faithful servant—*come up higher*—" sanitary science would have a "friend at court" whose commanding influence might avail it much on occasion.

And so this grand reform pursues its majestic march, receiving new and valuable adherents to its disciplined militant forces

day by day. The resurgent reform needs them, and welcomes them to its counsels. Those who come to us have courageously risen above prejudice and conventionality, and have come to stay and to do. It is not long since this revival passed its tentative stage, in its journey toward its ordained goal of an accomplished fact. Its triumphs during its hitherto career have been many and conclusive. They are prophesies of greater victories in the future, and I firmly believe that our children will live to see the earth-burial blot upon our civilization wiped off, and this ideal sanitary method of disposing of the dead become the rule, instead of the exception, as now.

Finally: Let us all "be doers of the word, and not hearers only, deceiving *ourselves*. For if any one is a hearer of the Word, and not a doer, he is like a man beholding his natural face in a mirror, for he beheld himself, and has gone away; and immediately he forgot what manner of man he was. But he who looked into the perfect law, the law of liberty, and remained thereby, being not a forgetful hearer, but a doer of work, this man shall be happy in his doing."

SANITARY SCIENCE.

WHAT IT IS.*

Sanitation as we know it to-day, is not very old. It antedates little, if any, the birth of the State of Iowa. It is true that Moses gave to the Jewish race certain sanitary precautions which, it is said, have accounted largely for the greater comparative longevity of the Jews, and for their extraordinary immunity from the recurring epidemics of the Middle ages. The wonderful decalogue, written on Mount Sinai, applies to all peoples and to all times. So, also, the ancient Romans in their wonderful system of engineering, achieved great health-giving results with their cloaca maxima, massive baths and acqueducts. Yet these were not all of the science of sanitation as we understand it to-day.

Greece, in obedience to hygienic laws, at one time outgrew the little island on which her republic was founded. At her

* By L. F. Andrews, Assistant to the Secretary of the State Board of Health.

metropolis Hypocrites found a home; Æsculapius taught it was better to prevent than cure, and temples were erected to the worship of his beautiful daughter, Hygiea. Thus she remained great in letters, art and science, her people robust in mind and body, until she fell a victim of the greed of ambitious demagogues, passed into the control of Rome and, with that nation, became the plague-spot of the earth as the fruit of licentiousness, immorality, filthiness and every form of vice.

Sanitary science—modern sanitation—means prevention. It is practically preventive medicine. It is a systematic study of all things relating to or affecting human life; of the cause of disease based on reliable statistics. The result of such study is the effort to prolong human life and preserve the health of the people. In the language of an eminent sanitarian: "One of the first great objects of a sanitary organization is to watch the death-rate from month to month, from week to week; to watch it as affected by different diseases, and such diseases as are believed to be clearly preventable, and to make known the results so as to effectually bring home to the dwellers in darkness, ignorance and disease, the immense significance taught by these figures." It is the adaptation of any and all means, circumstances and habits by which human life is expanded, and physical strength increased; the various improvements in agriculture, animal and vegetable life by which better and more constant food is obtained; improvement in art by which man is better housed and fed. This is sanitation.

"But what is the use of statistics?" was once asked of Faraday. His answer was: "What is the use of the baby?" In both are the possibilities of the future. The conditions of soil, atmosphere, occupation and environments must all be studied, analyzed and compared before conclusions can be reached. All science must pass through a period of theory and speculation until facts are secured sufficient to establish that which is true and useful. The dull, dry statistics of to-day become to-morrow the brilliant, established facts of science.

To study sanitation without statistics would be like studying astronomy without the stars, the steam engine without the steam. As well may the physician attempt to prescribe for his patient without inquiry as to antecedents and the causes of the sickness. "In vain," said Dr. Gregory, President of the Illinois State Board, "attempt to put out a fire with a pitcher of water

while some one, through a hole in the wall, as in Bunyan's dreams, feeds the flame with oil."

All that tends to promote happiness, preserve health, prolong life, is hygienic. All that develops and sustains the physical and moral man is sanitation. Much of this is preventive medicine, the province of which is to find the cause, and suggest the means for preventing, arresting or removing all that tends to disease, injury or death.

ITS EVOLUTION AND DEMONSTRATION.

This is a practical age. Assertion avails little or nothing. Demonstration is demanded. What is the record of sanitation?

An investigation of any age or any people will show that their advancement in civilization, art, science, excellence and refinement was parallel with their observance of sanitary measures, and their decline in art, science and civilization was also parallel with their non-observance of those measures.

Ancient Rome, under the rule of the Pagan kings, with her magnificent system of sewers, baths and acqueducts, was noted for health, wealth and power, and as the very center of civilization. With her fall the baths, acqueducts and sewers were torn out to build churches and monasteries; sanitation was repudiated, and by her nastiness she became the plague spot of the world. Her history is blackened with accounts of the most horrifying plagues and scourges that have blotted creation. The present Rome under modern sanitation is slowly regaining her former high estate.

Six hundred years ago the old world was swept by the greatest scourge that has devastated the earth. For twenty-five years the people were dumb with fear or raved with terror. Says one writer: "Families deserted their homes; parents forsook their children, and children their parents; merchants forsook their business, leaving their goods and gold, and fled the cities. Prayers and incantations were mingled with curses; priests and bishops barred the doors of churches and the gates of monasteries; cemeteries were choked, and thousands were thrown into pits unshrouded and unmourned. The unburied dead clogged the streets and byways, their festering carcasses in the rays of the scorching sun adding wings to the terrible scourge. Over thirteen million died in China alone. In Carminia and Cesarea none were left to bury the dead. India became nearly depopulated; Italy lost over half her population; Germany two hundred thousand; England one dead for

each living. No pen can describe the horror and misery of that time." Hecker tells us that from 1347 to 1351, four years, the black plague swept hundreds of millions of people from the earth. London lost one hundred thousand a month; Venice the same; Paris, fifty thousand; Avignon, sixty thousand; while in all England not one-tenth of her population escaped. To the Royal College of Surgeons, of Paris, the boasted city of learning, the suffering looked for aid to stay the plague. The French government called the professors of the college together and, after long consultation, they issued the following bulletin, which is still preserved:

"*Causes.*—Constellations combatted the rays of the sun, had struggled with the waters of the great sea and originated vapors; that the sun and fire had attracted a great portion of the sea to themselves, and the waters were corrupted and the fish died and the vapor overspread the earth like a fog, and the like would continue so long as the sun remaineth in the sign *Leo*.

"*Prevention.*—Constellations striving with the aid of Nature, by virtue of their divine might, to protect and heal the human race, burning of vine wood and green laurel; also, that the fat man should not sit in the burning sun, nor rain water be used in cooking."

The priesthood everywhere proclaimed that pestilence and famine were pre-ordained messengers of God's wisdom and wrath against which it was useless to reason. To a very late date, this idea prevailed even in Europe. Dr. Lyon Playfair, now a professor at Edinburgh says that in his day, Scotch professors dared not preach such heretical doctrine as sanitation and that an English company was refused the liberty of deepening the channel of the Guadalaquiver, because if God had intended it to be navigated he would have made it navigable. The plague, the pestilence and famine were "dispensations of Providence."

The "will of God" theory has passed away. Plagues, pestilence and epidemics are now ascribed to specific and established causes. The plague which decimated Europe in the seventeenth century was a filth disease. Cholera, which marches round and round the world is born in the nastiness of Hindostan. Yellow fever fattens on filth and reaps its richest harvest where sanitation least abounds.

WHAT IT HAS DONE.

The ravages in England of typhus fever attracted the attention of John Howard the great philanthropist, and he began to agitate reform in the sanitary condition of London, and other cities. In 1802 the English parliament recognized the importance of his effort by the passage of a series of sanitary laws from which came our present system of State medicine or preventive sanitary measures. Prior to that time sanitation had been directed toward plagues and pestilence at maritime ports.

In Noah's time it is recorded the average duration of human life was seven hundred years. After the flood it decreased to eighteen to twenty years. At the beginning of the present century it was in England about twenty-seven. It is to-day about forty-five. Even during the reign of the present Queen Victoria it has been increased ten years.

During the last century the death rate in London has been reduced from fifty to twenty-two per thousand of population.

In France human life has been increased ten years.

In 1888, the eminent Dr. Chadwick said before the British Association of Sanitary Inspectors, of the progress of sanitation in the military service: "A quarter of a century ago the death rate in the guards was twenty per one thousand. It is now six and one-half per one thousand, and is much too high. In Germany it is six; in France ten; in Austria eleven; in Italy eleven; in Russia eighteen. In 1858 I began the agitation of applying to the Indian army the protection of sanitary science which had saved the second army in the Crimea. The annual death rate in the old Indian army was then sixty-nine in a thousand. From 1879 to 1884 it was reduced to twenty-four, and now (1888) it is about fourteen, thus in six years there was a saving of sixteen thousand nine hundred and ten lives, or on the military estimate of one hundred pounds per life of one million six hundred and ninety-one thousand pounds sterling."

"In London, in 1665," says De Foe, "from July to October, there were twelve thousand deaths per week. The people were panic-stricken. The dying and dead strewed the streets and alleys. Drivers of dead carts fell from their seats, their horses going on overturned the carts, scattering the dead about; dead carts stood at churchyard gates full of bodies, but the driver had fallen while receiving his ghastly load. I looked upon this dismal time to be a particular season of Divine vengeance."

In our own country, during the late civil war, the mortality in both armies, from preventable diseases, has astonished the civilized world by its low rate.

Read the history of the cholera scourge in France, Russia and Germany, and in the United States, in the years 1831-2, and again in 1873. In the former period the deaths were by millions. In the latter, it had become shorn of its venom, and, in England, it was scarcely noticeable, while in our own country, along the eastern shores, where sanitation had advanced, it was easily controlled and quickly suppressed.

In one city, New Orleans, notable for its filthiness, this disease and yellow fever always found a welcome nidus. In 1853, when yellow fever swept over the South, in New Orleans there was one death every six minutes for thirty days. In the one hundred and eighty visitations of yellow fever to this country, this city never escaped until 1863, when General Butler and the fever both started together for the same point. The general arrived a little ahead, having with him all the elements and fuel for a most disastrous epidemic, while the city, with its filth-enervated and depressed population, was ripe for a harvest of the yellow reaper. The general laid his hand upon it, and gave it such a cleansing as it had never had. He inaugurated and established a sanitary system which not only stopped the march of the yellow devastator, but secured immunity from all epidemics. To this has been added the wisdom of later experience and the test of trial, until to-day she stands disenthralled and redeemed—a model of cleanliness, thrift and prosperity. From 1886 to 1894 she had but one death from yellow fever.

Read the history of the yellow fever epidemic in 1878 in Memphis—a record of horror scarcely equalled in any country, and with no likeness in America. This city furnishes the most striking and conclusive evidence of the result of sanitation. The city had passed through six epidemics—one of war, one of reconstruction, wild speculation, extravagance and filth, two of yellow fever, one of cholera and one of small pox. Miles of wood pavement were rotting and sending forth poison in the air. There was no drainage system, and the soil was reeking with the offal and excreta of ten thousand families. The accumulations of forty years were decaying upon the surface. Dead animals lay decomposing in the hot sun. Stagnant pools covered with the scum of putridity were scattered here and there. Cellars everywhere were alembics for generating noxious

gases, which at night stole out to poison the atmosphere. The streets were beds of filth. For twenty years the city had been the center of terribly exciting political and civil excitement and commotion. She had become engulfed in debt and bankruptcy. The people were in constant agitation. There was no repose nor quiet. Every element was prepared for the coming of the destroyer. It was already in New Orleans, and moving eastward. The people of Memphis, cognizant of their condition, became alarmed, and when, on the second day of August, it reached them, they became wild with excitement. Business was suspended. Men, women and children poured out of the city by every possible avenue of escape, by everything that moved on wheels, or would float in water, or on foot, many of them carrying the seeds of disease, only to die on the way like dogs, shunned and neglected. Family and social relations were utterly ignored in the mad rush for escape. It was safety; each for himself. In less than ten days twenty-five thousand had got away. Those remaining were left to pestilence and death. And death quickly became triumphant. He invaded the houses of the chaste and the dens of the vilest. He seized innocence and infamy at the same moment, and spread terror everywhere. On the 7th of September, in the *Appeal*, was published the following:

"It is enough to move a stoic to tears; whole families swept away leaving not one of the name; nurses dying at their post; priests and ministers following those they succored so fast as to appall the stoutest heart; lisping childhood, venerable and hoary age, the vagrant and merchant, the man of God and the unbeliever, all are taken alike by the awful pestilence. Of all employed in the editorial, counting and composing rooms of this office, but two are living. Funerals abolished to give way to the ceaseless procession to the charnel house.

"On Main street a woman sitting stiff and stark in her chair, her dead babe hanging by the nipple of her left breast on which it had closed its mouth as its life went out. No pen can describe these scenes. Fear sits on every face, and dread on every heart that annihilation awaits us. Hope, we have none."

Thus the epidemic raged until November. There were seventeen thousand six hundred cases of the nineteen thousand five hundred population and there was one death to every three of the living.

Immediately after this epidemic the city began a thorough rehabilitation upon sanitary principles. A new charter was obtained, a complete sewage and drainage system constructed, a board of health established with summary and authoritative powers; the most advanced sanitary regulations adopted and enforced. The city put on a new life. A cordon was thrown around it, through which pestilence can not break, and to-day she sits enthroned upon a hill the home of health, wealth and prosperity, a forceful demonstration of the benefits of sanitation, the most remarkable of any instance that can be cited. During the past five years she has not had a case of yellow fever.

Read the history of the cholera outbreak in 1893. Starting in Egypt, it followed the paths of commerce eastward, devastating most those cities with the poorest sanitary conditions, until it reached London and New York, where it was completely shut out—the gates were closed and locked against it. In New York it got no further than Ellis Island, and there was buried. Closer and tighter were drawn the restrictions until every vessel carrying passengers was compelled to procure a clean bill of health for every person on board; and on reaching a port it was detained outside until examination and inspection was had of passengers, baggage and cargo.

The several States were prepared through their boards in conjunction with national authority for any emergency that might arise. Under this system on the arrival of a vessel at any port in the United States having a contagious disease on board with persons destined for any point in Iowa, notice is sent to the State Board of their departure and destination whereupon the State Board notifies the local board of the same with instructions to intercept them on arrival, demand their bills of health, and to take such measures as will protect their community.

During the epidemic in Liverpool and London in 1849, the report of the general board of health in lodging houses brought under sanitary regulations, showed there was almost entire exemption from the disease. In the metropolitan buildings, with a tenantry of five hundred people, not a case occurred. Every efficient sanitary improvement was followed by a corresponding decrease of sickness and mortality, whether in courts, alleys, houses of industrial classes, public insitutions, prisons or hospitals.

Read the record of small pox for the past century, the most conclusive evidence of the beneficial result of well directed sanitation. It is unnecessary to refer in detail to the millions of people who, before the wonderful discovery of Jenner's prophylactic of vaccination, were swept in terror and panic from the earth, like grass before a prairie fire. From the days of Jenner, the gains from vaccination have been accumulating. In 1881, the Local Government Board of England reported ten thousand four hundred and three cases of small pox. Of these, the mortality among those who had been vaccinated was 2.⅝ per cent, while of those unvaccinated under ten years of age, it was 56.⅝ per cent, and in adults, 37.⅜ per cent.

In Sweden, where, before vaccination was discovered, the annual death rate from small pox was two thousand and fifty per million of population, from 1810 to 1850, forty years, it was but one hundred and fifty-eight; in Westphalia it was reduced from two thousand six hundred and forty-three to one hundred and fourteen; in Bohemia and Selesia, from four thousand to two hundred; in Copenhagen, from three thousand one hundred and twenty-eight to two hundred and eighty-six; in Berlin, from three thousand, four hundred and twenty-two to one hundred and seventy-six, in England and Wales, from three thousand to two hundred and two.

During the severe epidemic of small pox in Chicago in 1894, there were two thousand three hundred and thirty-two cases. Of those who had not been vaccinated, 32.⅛ per cent died, while of those who had at some time been vaccinated, mostly in childhood, only twenty-five per cent died. Of those vaccinated immediately after exposure, and who had varioloid, not one died.

It is estimated that two hundred and fifty thousand persons die annually in the United States from clearly preventable diseases, and that in Iowa sixty-five per cent of the total deaths are from diseases which ought not to exist, an industrial value loss which is appalling, and yet we find the resistance and determination of the great bulk of the people and the corporations against the health department as desperate as that between two contending armies. The indications are, however, that the masses are beginning to consider and realize the actual facts of the mortality attending preventable diseases.

The time has come when mothers wailing for children slain by scarlet fever and diphtheria; husbands mourning for wives dead from typhoid and puerperal fever; wives lamenting for husbands dead from small pox, cholera or yellow fever; communities shocked or clothed in sackcloth from mine horror or railway disaster have the right, and they can say to the guardians of the public health: "Thou art the man;" for sanitary science has provided and established the means whereby these diseases can nowhere exist as epidemics except through the culpable negligence of those whose lawful duty it is to prevent them, and who should be held responsible therefor.

It is with sanitation as with all other reforms. Progress only comes with education of the masses. The province of the State Board of Health is largely educational and directory: to look after the physical, social, hygienic and vital welfare of the people. Coadjutors in this work are the local boards. For this protection, for this labor which involves a money expenditure, what has been given the State Board? The insignificant sum of five thousand dollars a year; not enough to properly provide for the supervision and care of a single city.

RAILROADS.

The fatality, and maiming of human beings from the deadly railroad car-coupler still continues, but progress is being made in its removal. Its obliteration was a stupendous undertaking, not only from a monetary point, but from the multifariousness of styles and forms of cars, and differences in equipments in the various railroads of the country, no two being alike, and frequently these differences exist on the same system of road.

The Report of the Railroad Commissioners for the year ending June 30, 1894, shows a decrease of the number killed, and injured in this State. The following are the casualties for the years named:

	1890.		1891.		1892.		1893		1894.	
	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.
Employes	35	442	73	579	82	601	81	682	48	367
Passengers	4	25	9	67	5	80	17	78	7	62
Others	33	46	69	101	91	92	79	64	90	62
Total	72	513	151	747	178	773	177	824	145	491
Coupling cars	8	149	14	208	13	242	10	196	7	91
Falling from trains	5	44	17	83	23	82	22	68	17	33
Overhead obstructions	......	......	4	4	2	17	......	3	2	6
Collisions	2	21	15	55	4	22	28	57	8	15
Derailments	3	16	5	42	5	19	8	65	5	46
At highway crossings	7	7	14	23	1	8	13	10	16	27
Trespassing on track	......	......	......	......	......	......	31	25	41	8
Caught in frogs	......	......	......	......	......	......	2	6	......	19
Getting on and off trains	......	......	......	......	......	......	12	49	15	33
Stealing rides	......	......	......	......	......	......	19	18	5	6
Intoxicated	......	......	......	......	......	......	1	2	4	4
Miscellaneous	51	276	71	457	34	383	31	325	25	204
Total	72	513	151	747	178	773	177	824	145	491

This report makes no mention of the status of the car-coupler or automatic brake, but it is known that there is a rapid increase in the use of these appliances on all roads. The report for 1894 shows thirty-two less killed and three hundred and thirty-three less injured from coupling cars in 1894 than in 1893, yet so different are the reports of the various roads as to what constitutes a coupling casualty, some requiring it shall be the loss of a hand or limb, others the loss of a finger or any injury whatever, that no intelligent conclusion can be drawn as to the relation of the appliances to casualties. The Railroad Commissioners require no report of the number of the cars equipped with these couplers or brakes, hence there are no data upon which to base reliable statistics. The Inter-State Commerce Commissioners' report for 1894 shows that during the year ending June 30, 1893, four hundred and thirty-three persons were killed from coupling cars. That $79\frac{81}{100}$ per cent of locomotives, $21\frac{89}{100}$ per cent of the cars had been fitted with train brakes, and $11\frac{21}{100}$ per cent of locomotives and $24\frac{44}{100}$ per cent of cars with automatic couplers. The Commissioners say the ratio of casualty to railway employés has remained nearly stationary for the three preceding years, and it is not probable it will be materially reduced until, under the operation of the law, greater uniformity, especially in regard to couplers, is attained. The date on which all equipment must be fitted with brakes and couplers is July 1, 1898.

The following table shows the equipment of air brakes and couplers on all the roads of the United States for the years named:

YEAR.	TRAIN BRAKE.			COUPLERS.		
	Locomotives.	Passenger cars.	Freight cars.	Locomotives.	Passenger cars.	Freight cars.
1890	20,247	25,639	8,549	955	25,551	78,809
1891	23,094	27,246	112,999	1,492	26,692	116,382
1892	25,365	28,202	164,668	2,923	27,923	165,619
1893	27,667	30,562	209,437	3,936	30,446	229,289

	1890.	1891.	1892.	1893.
Total number locomotives	29,140	31,139	33,136	34,788
Total number cars	1,169,667	1,185,930	1,215,092	1,273,946

No report is made to the Iowa railroad commissioners of these equipments on engines and cars operated in this State, so that there are no data to show to what extent there is compliance with the law regarding these life-saving appliances. "Why not?" is a pertinent inquiry.

While progress is being made in this direction to lessen the danger from railway transit, it is a pleasure to record an advancement in another and very important direction, affecting as it does the millions who travel. Many human lives are annually sacrificed by the unsanitary condition of passenger coaches. The American Association of Railway Surgeons is making commendable effort to secure a reform in this matter. At the meeting of the American Public Health association held at Montreal, Dr. G. P. Conn, who is an active member of the railway association, as chairman of the Committee on Car Sanitation, made the following report:

In the design of a car for the transportation of people it is important that it be constructed with a view to stability, safety and endurance. It must be constructed with a strength equal to the strain which is expected of it, in order that it may be safe to passenger and employé. This is important, for without strength and capacity for endurance, it would be a veritable trap to every one having anything to do with it. It is virtually and for the time being a house on wheels, in which the varying number of people are expected to make their homes for a longer or shorter period, according to the distance which they may be expected to travel. Therefore, like a house, it should be constructed upon sanitary principles, in which ventilation, heating and such conditions as will allow it to be kept clean, are paramount factors in every case. Unless these sanitary principles can be carried out and are made permanent, then this house on wheels becomes unwholesome and unhealthy, and the conditions become favorable to disease or of

disseminating it, should a contagious or infectious malady find a place within its walls. Theoretically speaking, a room or a car into which a large number of people are to assemble should have left out of its construction everything that is calculated to foster or develop disease germs, therefore the plainer it can be made, the less upholstery, carpets and curtains that are placed within, would seem to be the best calculated for health. Practically, however, the public demands something more than plain walls and plain seats, and forget the conditions necessary for sanitation in their desire for luxury. This is an unfortunate circumstance, but it is necessary to deal with the problem as it exists. Probably cars could be constructed with much less expense on leaving out much of the draperies, etc., that are now considered necessary; but as the public demands the luxurious apartments which we find in all well appointed cars to-day, we shall be obliged to consider the different classes of coaches just as they now exist on most of our long lines of travel.

Referring to ventilation, it is now twenty years since the State Board of Health of Massachusetts instituted an investigation into the condition of passenger coaches. They found that the atmosphere of the ordinary coach contained from one to six times as much carbonic acid gas as other public assembly rooms, such as churches, theaters and public halls. The same year, 1874, at the meeting of the Master Mechanics' Association, the master mechanic of the Boston & Albany, and also of the Old Colony railroad, made a report on that subject. It was taken up by the association, and considerable discussion followed. Some improvements came from this action, but since that period the progress of ventilation in cars has not been rapid; in fact it can scarcely be said that any improvements have been made. Recently, State legislation has placed the obligation upon the management of railroads to use steam heat, therefore the necessity of further improvements in ventilation has become apparent to every one. In ordinary weather during the Winter, the problem of how to heat the car with steam and not have it too warm, is far more difficult in solution than it is to prevent it from becoming too cold. These difficulties are largely due to the fact that the men who have charge of this work are incompetent to carry out the designs of the inventor of steam heat. They have little or no conception of what constitutes good atmosphere in a coach, and they care but little about their work except that the time goes on and they draw their pay. They have no instructor beyond the mechanic who simply shows them how to turn the valves which admit the heat, and to shut it off, and the whole problem, so far as they are concerned, is how to keep heat enough in the car to keep it warm. The changing of the atmosphere of the car is of but little moment to them; they are constantly going in and out of the car at every station, and perhaps may be pardoned for not noticing the atmospheric condition that obtains throughout the train.

Another fact in car sanitation, and to me perhaps the principal one, as it involves every principle of sanitation, is absolute cleanliness. This may be impossible in coaches, yet a near approach to it need not be considered impracticable.

Cleanliness is the first principle in sanitation, whether it be of cars or houses, and seems like a very simple matter. But when we consider that it involves in its principles cleanliness of atmosphere as well as material, then the problem becomes greater, for in keeping the atmosphere of the car clean, as well as its floors and ceilings, you have arrived at what may be called true sanitation. The problem of keeping a car clean is greatly enhanced by the fact that very many good people allow themselves and their children, when riding upon the trains, to become slovenly in their actions, throwing things upon the floor of the car that never would be permitted in an ordinary dwelling house. Why it is that people are so forgetful of good sense and good manners, when riding upon trains, is past comprehension; yet we see it every day, and the coaches become excessively filthy from that cause alone. It may not be easy to break up such habits, yet, if the trainmen formed habits of cleanliness in regard to the coaches which are under their care, it would have a very beneficial effect on the passengers. In the Pullman and Wagner coaches, where porters are employed to wait upon passengers and keep the cars clean, when the occupants so far forget themselves as to cover the floor or carpet with the refuse of oranges, bananas or apples, nutshells and other things which render a car unwholesome or unclean, and the porter goes around with his dust-pan and brush cleaning it up, it does not take a great many miles of travel for such people to see the error of their ways and to discontinue them. The same might be true of the ordinary coaches if the brakeman or person in charge should perform the same acts, for people naturally would become ashamed of throwing things upon the floor for another person to clean up in order to render the apartment comfortable.

Little need be said in regard to heating of cars, as that has become a question of legal importance. The accidents by fire became so numerous that the different State Legislatures took it in hand, passed laws doing away with the ordinary stove, and substituting steam heat. Unfortunately there was no concert of action with different roads in the use of steam heat, as each road experimented for itself, the consequence being many different methods of transmitting steam through the cars. Which of these is the best I am unable to state, but it is to be hoped that some uniform method will be adopted by which all roads will be able to effect interchange of cars, and that the instructions which trainmen should receive upon that particular subject shall be so uniform that there will be no difficulty experienced in keeping cars properly warmed and well ventilated.

To digress a moment, I would add that it has been found necessary to open schools of instruction in the use of the air-brake, and I am told that old and experienced trainmen, after attending these schools, have been surprised to find how little they knew of the practical application of what was supposed to be merely an automatic machine.

Now, this instruction is secured by fitting up a car with all the mechanism of the automatic brake, and having a thorough mechanic for a teacher; and why not combine with that the teaching of car sanitation to the extent that the trainmen may fully understand how to use such devices as are now to be found on most passenger coaches.

In regard to the different systems of ventilation, several experimenters and inventors have gotten up systems of their own, had them patented, and endeavored to put them upon the market. Some of them are very complex and all of them require some knowledge of the subject, or they can not be made useful. All of them involve extra expense in the construction of a car.

The question of how to ventilate a car is one which the mechanic and the sanitarian must bring out together. It seems as though it would be quite impossible to invent any system that will change the air of a car while in motion and at the same time be effective while it is standing still. With electrical power it may be possible to place fans in a car, the same as you do in a house, that will be effective when the car is standing still, but when the car is moving the pressure of the atmosphere upon the outside is so great that considerable change will take place inside the car. Then again, this pressure of the atmosphere is so much different when the car is moving slowly than it is if the car is moving rapidly, that it brings up another point in the problem of ventilation to be solved by the practical mechanic.

Before the use of the power brake, the duties of the train-men were almost constant and imperative, but with the advent of the automatic brake his duties were made much lighter and less exacting.

It is true that with the introduction of the various improvements that have been or may be instituted, a higher order of intelligence may be required than was necessary to assist in stopping or starting a train, yet that does not prevent the average train-man from doing good work, provided he has proper instruction.

The *Railroad Car Journal* publishes the report of the committee of the Master Car Builders' Association, from which I quote at length:

"In all modern systems of ventilation sanitary engineers endeavor to have a plenum instead of a vacuum, or in other words, to have a slight excess pressure inside of the building instead of a slight vacuum. With a plenum there can never be any cold drafts or admission of smoke, dust, or cinders, for the reason that the pressure would always be driving the air outward through every crack and opening. With a vacuum the reverse is the case, and dust, smoke and cold air will find their way in at every crack.

"It is very desirable that the windows of passenger cars be so arranged that they can be locked fast in winter time, to prevent one obstinate passenger interfering with the comfort of the whole carload, but this can only be done when a sufficient supply of fresh air is constantly being furnished to the passengers, comfortably warmed. The opening of the doors at stations is also a great interference with a uniform system of ventilation. This can not be avoided, but the evil effects of it can be largely overcome by building the cars with an inner swinging door. Most of the modern, larger passenger cars having smoking rooms, double saloons, and heating apartments can be very easily fitted up with a swinging door at the end of the passage in between these compartments, which will act as a kind of air lock and prevent a good deal of discomfort otherwise unavoidable.

"A convenient way of arranging the windows, so as to avoid the drafts and interference to the comfort of the passengers in the winter time would be to have the outer sash arranged, as is commonly the case now, with the inner sash arranged so that when lowered they will lock themselves tight and can only be released by a lever at the end of the car, attached to a locking bar running the full length of the car on either side. These windows could be kept raised in summer time, the outer sashes being so that the passengers can raise them or lower them as they please. In the winter time when these sashes are lowered no windows could be raised.

"To summarize, the ideal conditions would be as follows:

"1. The admission of thirty cubic feet per minute per passenger, of fresh air, and the carrying off of an equal amount of foul air, Summer or Winter.

"2. The fresh air so admitted must not be moving at a speed of more than three or four miles per hour in winter time.

"3. Fresh air admitted must be of a temperature in winter time of about seventy degrees Fahrenheit.

"4. Fresh air so admitted in winter time must have added to it a proper degree of moisture for the temperature at which it is admitted, according to the average humidity of the atmosphere when at seventy degrees in the climate in which the cars are running.

"5. No system of winter ventilation can be successful unless means for the fresh air supply are provided independently of and separately from the windows and doors, as well as ventilators for carrying off the foul air.

"6. The fresh warm air should be distributed through as many openings and as low down as it can be conveniently arranged for, and the foul air should be carried off through as many small openings in the roof of the car as can conveniently be arranged for in Winter.

"7. The ventilation should be entirely independent of the speed of the train, and act equally as well whether the car is standing or running.

"8. The ventilation should be so arranged that there will be a plenum or slight excess of pressure inside the car, so that all drafts will be outward instead of inward, and smoke and dust thus excluded.

"9. It is most desirable that double windows should be used, and so arranged that they can be locked fast in winter time, but readily opened in summer time.

"10. It is most desirable that an inside swinging door be used, so as to form an air lock or inside vestibule, to prevent the admission of cold air and dust every time the doors to the platforms are opened."

In arriving at these conclusions, this committee had an investigation made under the supervision of an expert, and incorporated into their report something of his work, and the reasons for summarizing such ideal conditions as they have deemed necessary for perfect ventilation.

The committee add the following:

"It may be argued that there is no use for any such system of ventilation as this, that the present arrangements for the ventilation of passenger cars are good enough, and that nobody is any the worse for the present state of affairs. To show that this an entirely wrong position to take, your committee had a number of tests made to show the degree of foulness of the air in sleeping cars, chair cars, and the day coaches, which tests have been made under the supervision of Mr. William Forsyth, of the Chicago, Burlington & Quincy railroad, through the kindness of Mr. Rhodes. Pure air contains from three to four parts in ten thousand of carbonic acid, and, at 70° Fahrenheit, an average condition of moisture would be from four or five grains of water per cubicfoot.

"Dr. Angus Smith made a series of careful experiments in lead-lined, air-tight rooms for the purpose of seeing how long healthy people could exist in an atmosphere having an excess of carbonic acid and moisture. As a result of his experiments, it was shown that it was very unwholesome to

breathe an atmosphere having more than seven parts in ten thousand of carbonic acid, and that an atmosphere containing ten parts in ten thousand could not be endured by delicate people long without injury, and that as the presence of an excess of carbonic acid is a direct indication of the presence of micro-organisms, commonly called disease germs, the injurious effects are not merely limited to the poisonous influence of carbonic acid, but that the danger of taking organic diseases was very largely increased. It was further shown that the senses are a very unreliable guide in judging of the foulness of the atmosphere, and that people who remain in a room in which the atmosphere had become gradually fouled would hardly notice its foulness, whereas outsiders suddenly coming in would be almost suffocated.

"Micro-organisms, or disease germs, are not given off to any harmful extent in the exhalations of healthy human beings, but they are given off in large numbers in the breath and spittle and evaporation from the skin of unhealthy persons. Especially is this the case with people suffering from tuberculosis, whooping cough, fevers, and so on, and the disease germs grow and multiply very rapidly in a foul, moist atmosphere.

"To quote a prominent naval surgeon: 'The road is short, straight and sure from vomica and mucous patch to the receptive nidus in another's body. Who that has ever had forced on him an aërial feast of cabbage, onions, garlic, alcohol, tobacco and gastric effluvia of an old debauch, can doubt that aqueous vapor can transport microscopic germs by the same route?' "

A. L. Gihon, M. D. Address before the Pan-American Medical Congress, Washington, D. C., 1892.

"Experiments made in Europe on animals which were inoculated with a preparation from the dust beaten out of the cushions of railroad cars in ordinary service, and which cars were not known to have carried sick people, showed that the most of these animals which were inoculated died of violent diseases. Few of them lived long enough to die of tuberculosis—none of them survived. As these micro-organisms are in the air and simply settle on the dust, it goes to show how very necessary indeed it is to carry off the foul air, and that, to quote a southern physician, 'The movement of vast masses of people annually from one section of this broad country in search of those climatic influences modifying the course and progress of disease has become, from a sanitarian's standpoint, a great unsolved problem, namely that of accomplishing the proper ventilation of cars by the introduction of pure air, free from dust, cinders, smoke, and so on, and at the same time the withdrawal of the impure air arising from the natural emanations of the body, as well as the more serious dangers accruing from chronic or contagious influences.'

"All these devices which depend upon the speed of the train for their action, and where the air intakes surround the stovepipe, every time the car stops the ventilating process ceases and may be reversed; at slow speed it will be almost inoperative.

"Great improvement could, however, be made in the condition of the air in our crowded passenger cars if the train-men were compelled to pay proper attention to the ventilators; a regular set of instructions should be furnished for their guidance, and division officers should be instructed to pass through the train at every opportunity and report cases where the ventilators have been neglected and the air overheated or foul, to the division superintendent for discipline. The men would then soon learn to attend to this part of their duty.

"Sleeping-car companies should have a code of rules printed and posted in the cars, and their porters and conductors should be made to observe such rules. One specially important thing is not to open the ventilators on the windward side of the train, otherwise, with drop-sash or trailing-sash ventilators, down drafts and cross drafts are unavoidable.

"The above extract from the report of the committee of the Master Car Builders' Association, has much to commend it to our notice, as it comes from the best and most advanced class of practical mechanics. As a rule such men are not visionary, but reason from cause and effect, therefore their opinions are entitled to our consideration. I understand the report was written by Master Mechanic Sanderson, of the Norfolk & Western railroad, of Virginia; yet when asked his personal opinion of its being practical to carry out such ideas, and use the average train-man to accomplish the work, remarks in rather a sarcastic manner—'I wonder what the A. R U. or any other railroad organization would say if we require our immaculate brakeman to do the chores in the cars.' "*

Another member of this committee, when asked, if he believed it was possible to carry out such an ideal system as the report would allow the public to expect would be in use in a few years, says,—"I would say in answer to your first question, that I do not believe, as a railroad mechanic, that it will be possible to introduce and have accepted by railroad managers, the ideal conditions in a passenger car as expressed in a paper that was read on this subject. I do believe that if our train-men were educated to make better use of our present facilities there would be less complaint. They have been relieved from year to year of their former duties, until they feel that all they need to do is to wear a uniform." †

Undoubtedly this is true, and we are all the more ready to believe its truth after having once asked one of these uniformed "Mikados" to ventilate the coach. That look of pity and condescension makes an impression never to be forgotten.

In support of that part of the report which I have quoted—relating to experiments on animals inoculated with a preparation of dust from passenger coaches—I will give an extract from the report of scientists who have recently concluded a series of experiments under the direction of the Imperial Board of Health of Germany, as to the danger arising from the dust in railroad carriages. Their results show a decided risk involved in traveling under the present sanitary condition of the coaches.

"The dust was collected in each instance from a square metre of surface, and from forty-five compartments, representing twenty-one carriages. The inoculations were made upon guinea pigs. Many of them died of various diseases, and the rest were killed. Three only were found to have tuberculosis. The number of bacteria was largest in the fourth-class cars, and grew less with each rise in grade of the compartments. In the fourth-class

* Mr. Sanderson, Master Mechanic of the Norfolk & Western railroad, Roanoke Virginia.

† Mr. West, Master Mechanic, New York, Ontario & Western railroad, Middletown, New York.

cars the number was estimated at twelve thousand, six hundred and twenty-four per metre; in the third class, five thousand, four hundred and eighty-one; in the second, four thousand, two hundred and forty-seven; and in the first class, two thousand, five hundred and eighty-three. On the seats and upper walls the numbers varied in the four classes from two thousand, six hundred and forty-six to twenty-nine, while the roof was almost free. Though the third and fourth class carriages were the most infected, it was much easier to clean them, as they could be washed with hot water and soap, which could not be so vigorously applied to the better class carriages owing to the carpetings and upholstery." *

The following letter, written on a trip to the Eastern States, says: "In our sleeper were three consumptives returning home to die, and that alone was depressing enough, but when, on getting up in the morning, one sees a considerable amount of dry, yellow sputum on one's vis-a-vis neighbor's bed linen, it is neither dainty nor reassuring. Morning cogitations, usually so pleasant, are apt to turn to the uncomfortable possibility of all the bedding in the car being subjected from time to time to the same infection, and being probably imperfectly washed or simply rinsed Then it is impossible to clean the upholstering and carpeting without taking them out of the car, and an infected sleeper should be dangerous, as the continual vibration keeps the dust and bacteria in the air. The space is also necessarily confined. Moreover, travelers are apt to catch cold from drafts and from sleeping close to the windows, thereby rendering the mucous membranes receptive to germ implantation.

"They order these things better in Europe; on some of the continental lines special coaches are provided for consumptives, and these are constructed with particular reference to ready cleansing and disinfection at the end of every trip, which, it should be noted, are much shorter than the 'runs' in this country, and the need of precautions is, therefore, and for so much, greater here than abroad." †

Dr. S. S. Herrick, of San Francisco, read a paper before the section on State medicine, at the meeting of the American Medical Association the present year, entitled, "Common Carriers as Disseminators of Contagion."

The writer dwelt particularly on the disposal of excretion of the people on inland waters and on railway coaches; believing that certain communicable diseases whose contagious properties are discharged from the alimentary canal are liable to reach the alimentary or respiratory tract of other persons, if not intercepted or destroyed, and cholera, or typhoid fever, dysentery, intestinal tuberculosis and other filth diseases ar notably transmitted in this way.

He says: "Companies who provide meagre accommodation for passengers were properly censured, and should be held justly responsible if inadequate remedies were provided for their patrons."

Discussion by Drs. Ruggles and Cochran, Davisson and Stoner, all of whom were in accord with the opinions advanced by Dr. Herrick.

These men, while enthusiastic supporters of preventive medicine, are gentlemen of sound judgment, and are not carried away by any desire for notoriety. They believe the State and Federal authorities should be ever

* Boston Medical and Surgical Journal.
† Dr. Douglass W. Montgomery's letter to the Pacific Medical Journal.

on the alert to secure health for the individual, and that it is a duty which they owe to the people of the country to have a watchful care over the transportation company, as well as the municipal lines governing health officers.

The *Ohio Medical Journal* says of the prevention of consumption:

"We do not deem it wise or prudent to invade the homes of tuberculous patients for the purpose of securing disinfection or the isolation of the sufferer. The instruction of the patient and his household by the physician, in the necessity of prophylactic measures, is at present sufficient; but we believe that a vast deal of good might be done by the exercise of strict sanitary measures against the contamination of rooms in hospitals and hotels, and the berths in sleeping cars. The most careful cleansing and disinfection of apartments occupied by consumptives should be required before other individuals are permitted to occupy them."

As we have said before in this report, cleanliness is one of the first principles of sanitation; whether it be a car, a house, an office or a workshop, the same principle holds good. In the construction of coaches for passenger use, something should be done to render the cleaning of the car a matter of small expense, for, while in process of construction, little things might be done that would add to their convenience, healthfulness and cleanliness.

All passenger cars at the present time are constructed with water-closets. The floor of such closets and a few inches of the side or mopboard should be covered with sheet copper, as an ordinary wooden floor will soon become filthy, and can never be made clean. Odors will always be given off from an ordinary board floor whenever the temperature rises to that of summer heat; but if the floor be covered with sheet copper, hot water, dry steam and chemicals may be used, leaving it without any absorbing surface to develop odors which may be latent in cold weather, and very active on a hot summer day. If the designer and purchasing agent give attention to this in the first instance, the extra expense will be little or nothing, and will add very much to the efficiency of the car when the rules of sanitation are applied. As cars are now heated with steam direct from the engine, and as these pipes pass through water-closets for the purpose of protecting them against the cold weather, I can see no reason why taps may not be placed in those pipes in water-closets, and used for the purpose of cleaning them with hot steam; and it certainly could be but very little extra expense at the time of the construction of the car.

Dr. S. S. Herrick, of San Francisco, Cal., in commenting upon a statute law of that State relating to maintenance and commitment of a nuisance, remarks:

"Obviously travelers should not be held responsible for committing a nuisance, so long as transportation companies provide no facilities for obviating the same; and legislation should be aimed directly at these companies, holding them responsible and requiring them to provide an adequate remedy.

"It is well understood that the law must not ordain what is impracticable, and equally plain that no serious difficulty and expense would be involved in abating such nuisances. No mechanical difficulty exists for a steamboat or railway coach to have its closet provided with a closed receptacle, having suitable means for deodorizing, disinfecting, and ventilating,

and for discharging the contents into some proper place at short intervals. The details of a contrivance suited to such a purpose need not here be entered into. They belong to the inventor and mechanic, rather than to the sanitarian as such.

"Aside from considerations of health, it seems strange that respect for common decency has not abolished a practice in travel by land which would have brought a blush to common carriers in the good old days of slow coaches. While inventors and builders of palace cars are doing so much for the comfort and convenience of passengers in other respects, they adhere to a form of closet from which travelers must be excluded at the time when it would be most acceptable (halting at large stations) and which scatters filth and disease along the route. It is to be noted that cholera still lingers in Europe, and meanwhile we must not consider ourselves safe here within two weeks' travel by steam; while the other filth diseases, like the poor, are always with us.

"In my judgment the time has come for sanitarians to speak plainly and forcibly on the subject, and to demand of legislators a specific remedy which courts will be bound to apply to this class of offenses against health."

I understand several roads are making use of compressed air for the purpose of cleaning the draperies and plush covering of the seats, and that a plant for that purpose can be arranged to be effective with small expense. If this is true, and I see no reason why it is not, it should be generally used, for thorough cleaning with fresh air would be a most valuable disinfectant.

The vestibule train has become very popular, and no one doubts its efficiency as an easy riding coach, and insures perfect safety in going from car to car; but as an object lesson for the ventilation of cars it becomes a failure, inasmuch as it simply ventilates from one car to the other. Of course some air will pass into the vestibule section, but as that section has less width than the car itself, the pressure of the atmosphere extending to the car is much lessened than what it is upon the sides of the car itself, therefore, but little air is forced in from that section of the construction, as the ventilating property of the vestibule is lost, and aside from that it may be overcome by the extra heat of lighting.

This leads one to consider the lighting of cars. Nearly every large road has been experimenting with the different methods of lighting coaches, and car companies like the Pullman and Wagner have done the same. Whether these experiments have been conducted in the light of sanitation or as a question of expense may be a matter of doubt, although it is probable that the safety of the car from destruction by fire has entered into the range of experiments.

Gas and kerosene lighting while moderately expensive are not only dangerous by reason of their possibility of fire, but the extra heat which they occasion in the car in the summer time proves a very serious obstacle to the comfort of the passengers.

Then, again, the destruction of oxygen by gas or kerosene lighting increases the amount of carbon dioxide in the atmosphere of the car, oftentimes to a dangerous extent, and in that way the health of the passengers is seriously threatened unless there is a large amount of fresh air introduced continously.

That electric lighting is the ideal of the present time perhaps no one will dispute, unless the expense of the same is taken into account. So far as I can learn none of the devices for electric lighting have yet been brought down to the maximum of the manager's idea of expense, and therefore some other method will find favor until the public demand safety in lighting as well as in heating coaches.

It would not seem that it would be necessary in a report like this to make any allusions to the water supply of railway coaches, but the Medical Society of New York has adopted a report calling attention to the danger of drinking water from the average water-tank, as found in railway cars and other public places. Many cases of typhoid fever of mysterious origin, it is said, could be traced to the filthy water-tank, which has been filled with water and ice of doubtful purity, and re-filled from day to day without cleansing. Nevertheless, people must have something to drink in hot weather.

From this we may learn that the public are critical regarding the water supply. Some years since, Dr. Reed, of Ohio, in investigating this matter, found that the water-tanks of ordinary coaches, and sometimes those of palace cars, were notoriously filthy. The water supply must of necessity depend largely on the character of the supply at given points along the line. When cars are cleansed and the water-tanks refilled, the ice supply depends upon the same conditions, but there can be no excuse for filthy tanks any more than in public or private houses. There are enough men employed about the trains to see that every tank is made clean day by day; and not to do so, and thereby endanger the health of the traveling public, becomes criminal.

In conclusion, I have but little to add, as, until the use of such devices for lighting, heating and ventilating as we now have are fully understood and appreciated by the average train-man, who should be held responsible to his superior for the safe condition of his coach from a hygienic as well as a mechanical point of view, it is useless to assume that a more elaborate mechanism will find favor.

Nothing as yet approaching an automatic system in heating, lighting or ventilating a car has been placed before the public, but as it is only a comparatively short period since automatic brakes and couplers have been placed upon the market, we may confidently look forward to the time when the public demand for hygienic improvements will evolve from the mind of man some plan or system to meet the emergencies of the occasion.

In order to do this effectually some one connected with the road would have to instruct the employé in the use of hygienic appliances, the same as is now necessary in the use of automatic brakes; and it would seem quite practical that all roads having a surgical department should extend this work into the domain of hygiene, and give the surgeon-in-chief authority to inspect, instruct and to hold responsible such employés as are in any way concerned in maintaining a healthy condition of our trains. The surgeon more than any other person connected with railroads, appreciates the hygienic condition of coach, stations and grounds of our railroads, for in case of accident, he has much to contend with that is unknown to the physician and surgeon who is called to see those injured in ordinary accidents, and therefore will always be on the alert for all sanitary improvements.

However it may be brought about, the employé should be taught how to make the best use of all the devices in use to promote the sanitation of cars; and should be held responsible for any unsanitary conditions arising by reason of his negligence.

STATE BOARDS OF HEALTH.*

RETROSPECTIVE AND SUGGESTIVE.

The history of the State Boards of Health during the last fifty years reads like a romance.

Created—almost unwillingly—by the different legislatures in slow response to the pleadings of medical men, they have, because of the noble work they have done for humanity, at last achieved secure lodgment in the esteem and respect of the people, who have come finally to rely upon them for helpful guidance in all matters which make for the public health, and the "healing of the nations." They have been the high priests of the sanitary gospel enunciated by the incomparable Mosaic law—a law which was but the amplification of the wisdom of the older civilization—the Egyptian. Under their persistent and scientific administration, we have noted the marked decline in the death-rate and positive increase of the longevity of the race. Per consequence of an inflexibly enforced obedience to the teaching of the old Latin maxim—*Obsta principiis*—on which maxim preventive medicine is founded, as benignant outgrowths of that teaching, the people have become accustomed to seeing epidemics and infectious diseases promptly stamped out. They have seen the wonderful value of proper quarantine and skilled disinfection exemplified by striking object lessons. They have seen reduced to logical sequence the vital problems of house and municipal drainage; the scientific disposal of garbage; the correction of the pollution of waterways; and to their anxious queries as to the best methods of securing pure public water supplies, and the proper sanitation of homes, of public buildings and of thoroughfares, they have received adequate replies.

These results of this general enlightenment have followed, viz: The positive advancement of the public health by the

* By E. A. Guilbert, Dubuque, A. M., M. D., LL. D., President of the State Board.

removal of causes inimical thereto, and the absolute enlargement of the wealth of communities because increased longevity married to firmer health has notably prolonged and enhanced the producing capacity of the individual. These achievements of sanitary organizations have illustrated the truth of the axiom: "Organization is the breath to the life of (sanitary) progress;" and as the earnest hygienist looks backward over the brilliant past and notes its triumphs, his love for the science is intensified by what he sees, the signs of the future seem full of promise, and he is able to become a devotee in whom

> "——— persuasion and belief
> Have ripened into faith, and faith become
> A passionate intuition."

Yet while he glories in the fruitful, educational past, he can not fail to realize that the labors of other days have imposed upon him heavy penalties in the direction of labors in this and the years to come.

Yet there are other worlds for the hygienist to conquer, for the warfare with disease and its causes is unending. The achievements of the past have been won despite the inadequate and grudgingly rendered assistance of legislators and the apathy of a once uneducated constituency. They should be remembered only as incentives to greater achievements in the future. But will State boards, as bodies and as individuals, in view of this retrospect, have reason to "thank God and take courage?" They can not, in justice to their mission, rest from their work. Inaction and decadence are near allies. They should declare even more sonorously than ever before: "Speak unto the Children of Israel that they GO FORWARD" in the divinely appointed faith, and they should speak authoritatively, as they have a right to speak.

Allow me to suggest a few unsettled questions on which we should thus "speak."

1. The pending question is the prevention of the pollution of the navigable rivers of the country. A bill in this behalf was introduced into the last Congress. It is still before the House. It needs, and it should receive, the active and united support of State boards of health. If passed, it would become the parent of similar bills in State legislatures, having in view the maintenance of the purity of the water courses within each commonwealth.

2. The best methods of disposal of the garbage of municipalities. Should it not, as already it has been done abroad, be here transmuted into a valuable fertilizer, or should it be destroyed by fire and thus lost?

3. The momentous question of the cremation of the dead *versus* intramural burial—a question annually becoming more obtrusive because of the wondrous urban development of the land.

4. The intelligent but inexorable restriction of foreign immigration from the non-partisan standpoint of the refusal of the people longer to allow this land to be maintained as a dumping-ground for the refuse of other nations, to the serious menace of the public health, the public morals, peace and interests.

5. The enactment by the general government of stringent laws, whose duty it is to defend with a rigid quarantine the frontiers of the whole country, regardless of State lines.

6. The discussion and elucidation of the grave question as to the influence on the annual rainfall of the land, produced by the wholesale drainage of the smaller lakes, and the pond-like marshes in various States. Is this acre-acquirement greed a cause of latter-day injurious drouths? If so, should it not be prohibited?

7. The inauguration of itinerant schools of instruction in sanitary science for the information of the masses in the form of sanitary conventions, or university extension courses.

These are some of the questions now confronting the hygenist. Should they not receive our careful study, proper solution and courageous advocacy? I commend these random thoughts to the considerate attention of my immediate and remote colleagues.

CONTAGION AND INFECTION*.

Contagion and infection: These words have been used in very diverse senses by good speakers and writers and by equally good authority to mean one and the same thing. A contagious disease is considered to be one which is conveyed from one person to another by contact, by the breath, by bodily effluvia, etc. When the producing material of a contagious disease

* By E. H. Carter, M. D., Des Moines, Member of the State Board of Health. Read before the Iowa Public Health Association, September 6, 1894.

is conveyed from one person to another in clothing, water, food, furniture, etc., the process is called infection, and such articles are said to be infectious.

Contagion also means that which serves as a medium or agency to transmit disease; pestilential influence. Shakespeare says:

> And will he steal out of his wholesome bed
> To dare the vile contagion of the night?

Contagium—the matter derived from a previously existing contagious disease is frequently and probably invariably a micro-organism. Everything is contagious. Diseases ordinarily considered non-contagious may under certain circumstances become highly contagious or infectious. Good health is contagious, but I do not claim that micro-organisms are essential to good health. Yet micro-organisms may be conducive to good health. Micro-organisms may act in the system as scavengers or to destroy other micro-organisms more injurious than themselves. To illustrate—many years ago when I was a small boy my father, after a very abundant corn crop, put on the farm near the barn thousands of bushels of corn in rail pens. The corn, thus cribbed without protection, formed a wonderful attraction for rats, and for a time they swarmed about the premises, prospered and multiplied by the hundreds. The situation was alarming, for these organisms not only destroyed the corn, but they cut the harness, gnawed holes through the bins in the barn, dug beneath the foundation walls and threatened destruction generally. Finally there appeared upon the scene an organism of another kind—a sleek, black mink. He was occasionally seen gracefully gliding along the chinks of the crib or quietly retiring from the bins through holes made by the rats. After this new visitor appeared the rats began to disappear, until finally, after the lapse of a few weeks there was not a rat to be seen. The mink was master of the situation and had reveled riotously on rats. It was a case, indeed, of one organism destroying another. The mink up to this time was conducive to the health of the barnyard.

But lo and behold! On visiting the barnyard one morning after the rats were all gone there lay beneath the roosts the lifeless bodies of a dozen fat chickens with their throats as skillfully cut as could have been done with the surgeon's knife. It was discovered that the organism which had done so much for the health of the place was now striking at its very vitality. The mink was trapped and prosperity prevailed.

Different kinds of micro-organisms may destroy each other, or one kind previously existing in the system may prevent the introduction of others, or only delay for a time their development. If contagion and infection depend upon micro-organisms then the spread of such diseases depends upon the potency of the agency of transmission by which the micro-organisms may be conveyed from one person to another.

A short time ago I entered a barber shop and proposed to have my hair cut and dressed if the gentlemanly barber would be so accommodating as to wash his hands before operating. My request was complied with and the work was begun. "Well," said the barber, "why did you ask me to wash my hands?" "Why," said I, "as I sat in your place waiting for my turn, I saw you vigorously applying your fingers to the scalp of a man whose face was covered with an eruption, and I did not want you to have your fingers

stir up my hair until they had been washed." Said he: "Do you think that disease can be conveyed in that way?" I answered him in the affirmative. "Then," said he, "how is it that we barbers are not all dead?" I asked him if they were all well. "No," he replied, "and I have been wanting to see a doctor for some time. I have some sores on my head and my hair is falling out." He met me by appointment at my office the next day and he was found to be afflicted with the most loathsome disease on earth.

Show me a man who is not diseased! People should not be sick, have eruptions, so-called neuralgic pains, and what is commonly called scrofula and blood disease. A few days ago I asked a prominent barber of this city if he ever disinfected his instruments. He promptly answered me no. He passes his razor over syphilitic sores every day and applies it to the next man's face without cleansing. If a surgeon would do this he would be guilty of mal-practice and subject to arrest. That disease is so conveyed from one person to another does not admit of a doubt.

I quote from the International Encyclopedia of Surgery:

Mediate contagion may occur from the passage of a cigar or pipe from mouth to mouth, from the use of various common utensils, from sleeping in the same bed, or from workmen using such tools as are passed from mouth to mouth, as the blow-pipe employed in glass works. Surgical instruments may convey contagion. Tattooing has sometimes been the means of conveying the poison of syphilis, as in the interesting series of cases, fifteen in all, reported by Maury and Dullis.

Think of a barber brushing and combing a diseased scalp and within the next three minutes using the same brush and comb in your hair, and that, too, without the slightest attempt at cleansing. This is what happens in the barber shop every hour of the day. Who escapes? Is there a man without disease? Is there a man without some form of one of the two most loathsome diseases?

I quote again from Ashhurst's Surgery:

For reasons to be presently stated, urethritis will be used interchangeably with gonorrhœa, as the term that most precisely and comprehensively describes the most common manifestation of this malady, which, exclusive of the diseases of childhood, have probably affected at some time in thier lives a greater proportion of the males of the community than any other single ailment.

Now you can draw your own conclusion as to the prevalency of this disease. Think of how many persons you know of who have not had sore throat—tonsilitis, for this authority says that no disease of adults is more common than the one referred to. These persons are in the barber shops. They have conveyed the virus from this disease with their hands all over their person. The razors, combs and brushes used on them are never disinfected. A person should patronize as nearly as possible one barber. Select a healthy one and have it distinctly understood that he is at least to wash his hands with soap before he operates. If disinfectants were used it would be still better.

The people are not aware of the amount of specific contagion emanating from barber shops. No one should ever enter a barber shop without taking with him a full supply of combs, brushes and every thing to be used on his person. Suppose you should have a bodily eruption and some sores on your face, would you imagine that it might be an infirmity to be visited upon your "children unto the third and fourth generation?"

BACTERIOLOGY AND MEDICAL SCIENCE.*

ITS IMPORTANCE AND BENEFIT.

In his studies on acetic fermentation, Pasteur says that it is gratifying to make scientific discoveries, but especially gratifying when these discoveries can be applied to practical questions. Nobody has better right to say so than Pasteur, who has extended our knowledge of bacteriology to a greater extent than anybody else, both in scientific and practical direction, and whose work has done so much to the benefit of mankind in general. We shall try to outline, on this occasion, how bacteriology—the very branch of exact science in which Pasteur has done and is doing his life-work—is applied to medical science, and also the nature of the work of the medical bacteriologist.

Until the middle of this century, medical science was in want of an explanation of the nature and origin of infectious diseases. The discoveries of Jenner did not have the background that they have now, and it was not until the year 1856, that the first microscopically controlled inoculations were made by Delafond, namely, with anthrax. In 1848 the typical germ of this disease had been described by the same savant. Muehlhæuser (1845) and Leisering (1860) were the pioneers on the subject of typhoid fever in the same direction.

From 1857, Pasteur published his numerous works on fermentations and bacterial diseases, and from this time the vitalistic theory of infectious diseases, the basis of which was laid previous to this, is to be dated.

What bacteria are, and how widely their importance in our daily life is extended, is well known to everybody, though exaggerations frequently occur. But it is no secret that the most important discoveries in bacteriology fall in the line of medicine.

*By J. C. Ray Des Moines, Bacteriologist of the State Board of Health.

Infectious diseases are manifested by a series of alternate phenomena which distinguish them from all intoxications. They are, as a general rule, caused by specific organisms (bacteria). Tuberculosis, malaria, typhoid fever, recurrens, cholera, yellow fever, and many similar diseases of animals are manifestations of their life and activity. When not attacking man or animal, they live in organic matter of various kinds; it is only when circumstances favor their activities that they attack other organizations. It has been proved that many bacteria produce very poisonous substances. The body must fight the attack made by these, and medicine can do but little to help the patient. Outside of the body, bacteria are found living in almost every place in nature where animals can live, and it is absolutely impossible to avoid coming into contact with them. In all rotten substances, in earth and water, in our clothes and in our food, bacteria live, feed and thrive, and thus we are unable to avoid them.

The work of the bacteriologist consists of ascertaining full evidence in regard to the specific organism connected with a certain disease. In the first stages of many diseases—such as pneumonia and tuberculosis, it is of importance to know whether the typical bacterium of the fatal disease is present or not, and in what quantity. This can not be determined with full evidence by the pathologic diagnosis alone; when this is united with the bacteriological investigation, certainty may be reached, as sufficient morphological, physiological and biological characters of many of the typical forms are known in detail, so that comparing is possible. As the disease proceeds, it is often necessary to follow the development of the cause, therefore the bacteriologist should work hand in hand with the physician.

Bacteriological investigations of air and water in towns or smaller localities (wells, sewers, etc.) are important, and should be carried out at regular intervals, so that the danger of contamination might always be known. A great many pathogenic forms will keep alive or actually live in water for a long time; they will come into the wells from the rottening or otherwise contaminated substances in the ground, etc., and attack the organism, either by direct introduction into the body or transmitted through the air from the surface of the water. It is always important to have an estimate of the bacteria living or able to develop in the water from which we are supplied.

Of almost equal importance are researches on bacteria in the atmosphere. The latter is in very many cases the way of transmission, and important results have been derived from such investigations.

Bacteriological analyses of the ground in certain districts are of importance in and after epidemics; such places as are exposed to infection or already infected should always be examined. The results of such analyses have often given good information with regard to disinfection, and the life history of many pathogenic forms have been made known.

In many cases, milk and other victuals will be subjects of investigation. Experience often showed that milk can transfer many infectious diseases, and that many pathogenic forms of bacteria keep alive in milk. Meat should be subject of constant control, as is, in fact, the case in some countries. Many other articles of our daily food should likewise be examined. It is not untimely precaution or falling into the "bacteria rage" of our age to urge the necessity of controlling grocery stores as well as meat markets. Another place where bacteriological control is necessary is in the treatment of many drugs.

The question of disinfection is based entirely on bacteriology.

It is evident that, though no doubt the importance of bacteriology has been and still often is over estimated, it can not be lost sight of when we know how public health must depend upon its many important results. Almost every day discloses new facts or theories, and there is hardly any department of science in which it is so difficult to follow the progress as just here. But the medical bacteriologist can not work alone; if his work shall bring out hygienic results; he must work hand in hand with the chemist. The combined results of the chemical and the bacteriological water-analysis form the complete hygienic investigation of the water. But, more than this, everybody should receive such information as this, and learn the necessity of disinfective hygiene in public and private life.

CORPSES.

DISINTERMENT AND TRANSPORTATION.

In order that the people of the State may be better informed respecting the conditions upon which dead human bodies may be disinterred and transported, the Secretary was directed to publish the rules and regulations of the Board relating thereto. They are as follows:

TO WHOM IT MAY CONCERN.

In accordance with the Rules and Regulations adopted by the National Association of Railroad General Baggage Agents, and the Iowa State Board of Health, whenever it is desired to disinter the dead body of a human being, for removal or transportation, application for permission so to do must be made to the State Board of Health for each body to be disinterred.

The application must state the full name of the deceased, also the age, cause of death, date of death, name of physician who made certificate of death, place of burial and where to be reinterred.

No disinterred body will be received for transportation by any railroad, unless accompanied by a Special Disinterment Permit from the State Board of Health, which is additional to the regular Transportation Permit.

The Disinterment Permit must also be approved by the Local Board of Health of the jurisdiction where the body lies buried.

Depositing bodies in a Receiving Vault is deemed a burial, and a Disinterment Permit will be required for removal of a body therefrom

A body dead from diphtheria (membranous croup), scarlet fever (scarlatina, scarlet rash), small pox, Asiatic cholera, leprosy or typhus fever must not be deposited in a receiving vault.

A receiving vault in which is deposited the dead body from Asiatic cholera, small pox, diphtheria (membranous croup), leprosy, scarlet fever (scarlatina, scarlet rash), typhus fever, must not be opened for the removal of such bodies, nor the deposit of bodies dead from non-contagious diseases, nor for the entrance of living persons, and no permit will be granted for the removal of such bodies from such vault.

Where the disinterment is for the removal of bodies to another part of the same cemetery, or to a contiguous cemetery, the removal must not be by any public conveyance. In such cases, it is not required that the bodies shall be prepared as for transportation by railroad or other public conveyance. But a separate Disinterment Permit from the State Board, approved by the local board, must be obtained for each body disinterred.

Children must not be permitted to be present at disinterments.

No permit will be granted for the disinterment of bodies dead from small pox, Asiatic cholera, leprosy, typhus fever, diphtheria or scarlet fever (scarlatina, scarlet rash), and, for sanitary purposes, membranous croup will be deemed to be diphtheria.

Blank forms for application for permits will be furnished on request to this office for Form 24 E.

Undertakers and others will save possible delay and trouble in the removal of corpses, by strictly conforming to these instructions.

These regulations apply equally to all express companies.

The following is the form for an application for a disinterment permit:

STATE OF IOWA: }
HEALTH DEPARTMENT. }

APPLICATION FOR DISINTERMENT PERMIT.

To the State Board of Health:

Application is hereby made for a permit for the disinterment of the body of.....now lying at
(Give full name here, whether one, two or three; use no initials.)
.....cemetery in the.....of.....
(City, town or township)
county of.....State of Iowa, and who died on the.....day of
.....18..aged....years....months....days, the cause of death being
.....and not the sequela of diphtheria, membranous croup, scarlet
fever (scarlatina, scarlet rash) or other contagious disease, and.....
contagious as shown by the certificate of.....
(Give full name of physician here.)
attending physician.

The body is to be removed by.....
(State whether by railroad or by private conveyance.)
to.....cemetery in the.....of.....
(City, town or township)
county of.....State of.....for reinterment.

.....Applicant.

Post office address.....county of.....Iowa.

Send permit to.....post office.....
county of.....Iowa.

NOTE.—A body deposited in a receiving vault is deemed a burial, and requires a disinterment permit.

To all Railroad Companies, General Baggage Agents, Train Men, Station Agents, Express Companies and Undertakers:

Transportation of persons dead from diphtheria, Asiatic cholera, small pox, leprosy, typhus fever, yellow fever, or from any sequelæ of, or any complications with said diseases, is positively prohibited within this State under any conditions. For the protection not the only of public, but of railroad companies and train men, and for all sanitary purposes, membranous croup is to be deemed and treated as diphtheria.

As a matter, therefore, of protection, justice, economy and obedience to law, it is imperative that these regulations be rigidly observed on all railroads operated in this State.

It having come to the knowledge of the State Board that physicians, through ignorance or design, in many instances, give the cause of death as "*heart failure, nervous prostration,*" *etc.*, which are sequelæ of diphtheria, when the real cause was diphtheria.

Railroad trainmen, station agents, and express agents would therefore be fully justified in deeming as suspicious, if not in absolutely rejecting a corpse accompanied with a permit in which the cause of death is given as "heart failure" where the age of deceased is under thirty years, unless there is positive statement in the physician's certificate that the "heart failure" was not the result of diphtheria or membranous croup. The State Board of Health has ordered that physician's certificate giving "heart failure" as a cause of death, must not be accepted by a county clerk for record, and must be returned to the physician who made it for proper specification. It is known that serious results, and the loss of many lives, have followed the shipment of a corpse under false return of the cause of death.

Every transportation permit where the cause of death was a contagious disease, or any complication thereof, must, in addition to approval by the local board of health, be approved and countersigned by the health officer of such local board as a protection against improper shipment.

In accordance with the Rules and Regulations adopted by the National Association of Railroad General Baggage Agents, and the Iowa State Board of Health, whenever it is desired to disinter the dead body of a human being, for removal or transportation, application for permission so to do, must be made to the State Board of Health, blanks for which will be furnished by the secretary.

No disinterred body must be received for transportation by any railroad, express company, or other public conveyance, unless accompanied by a Special Disinterment Permit from the State Board of Health for each body, which is additional to the regular transportation permit, and the date of death of decedent, as given in the physician's or coroner's certificate, must be taken as evidence of disinterment.

The disinterment permit must be approved by the local board of health of the jurisdiction where the body was disinterred.

Depositing bodies in a receiving vault is deemed a burial, and a disinterment permit is required for removal.

BURIAL OF THE DEAD.

The body of a person who has died from Asiatic cholera, small pox, typhus fever, typhoid fever, diphtheria, membranous croup, scarlet fever (scarlatina or scarlet rash) or measles; must not be removed from the sick room until it has been wrapped in a cloth saturated with a solution of corrosive sublimate (one ounce to six gallons of water) and then tightly enclosed in a coffin. The body shall then be buried immediately without the attendance of any person other than is necessary for the interment thereof.

No public funeral* shall be held of any person who has died from either of said diseases, and no public funeral shall be held in a house, nor on any premises where there is a case of, nor where a death has recently occurred from either of said diseases.

No person, company, corporation or association having charge of, or control of, any school-house or church, or of any building, room or place used for school or church purposes, or for any public assembly, shall permit the body of any person dead from any of the contagious or infectious diseases named in these regulations, or any other dangerous contagious disease to be taken into such school-house, church, building, room or place, for the purpose of holding funeral services over such body; and no sexton, undertaker, or other person having charge of, or direction of, the burial of any body dead from any of the said diseases, shall permit the coffin or casket containing such body to be opened in the presence of any child, nor shall any child be permitted to act as pall-bearer, or carrier at any such funeral.

No hack, omnibus, street car or other closed vehicle used for the conveyance of the living, shall be permitted to carry the body of any person dead from an infectious or contagious disease; nor with the knowledge of the owner, driver or person in charge thereof, to carry any person or article liable to communicate the infection or contagion of such disease. And any railroad car, street car, omnibus, cab, hack, or other vehicle, in which a person has been carried affected with any of the diseases named herein, shall be forthwith removed from service and be disinfected before being used again.

* A "public funeral" is deemed to be the indiscriminate attendance of persons not immediately connected with the family of the deceased person, *especially children*; the carrying of a dead body to a church or other public building; or exposure thereof to the public at any place, preceding or during the funeral service. In other words, there must be none present except those absolutely necessary to prepare the body for interment or inter it.

No dead body of a human being shall be buried within a city or incorporated town; nor in any burial place used or controlled by any city or incorporated town within the State, without a burial permit issued and signed by the clerk or recorder of such city or town. A burial begins when the body is prepared for burial.

CIGARETTE SMOKING.*

HISTORY.

Cigarette smoking is comparatively a recent habit in the United States, being introduced in the early seventies. There were very few cigarettes manufactured until 1875. Like many other crimes and filthy habits, it originated among the lower classes of Russia, Poland and France, and for a long time was confined to the same classes in this country, but it finally, by a process of evolution, made its way until it has been adopted by the better class of persons. After being transplanted to this country, like many other unsavory exotics, it flourished luxuriantly, until to-day it is recognized by students of social problems to be one of the most dangerous, degrading and demoralizing evils, and demands the early attention of our legislators toward its arrest. I believe the only way to accomplish this is for the National government to pass a law prohibiting the manufacture and sale of cigarettes within the United States. If this can not be done, then the States should protect their young men and boys by enacting prohibitory laws. This is easier said than done, for there is an immense amount of money and influence that will be used freely to cripple or arrest any effort in the line I have suggested. Whenever a bill has been introduced into a State legislature or municipal council to interfere with the sale of cigarettes, the Cigarette Trust has had its lobbyists in swarms to buy, threaten and browbeat every officer who dared to raise a voice against their nefarious business. Very few have any conception of the amount of money invested, and the number of persons engaged in the manufacture and carrying on of the business. The Cigarette Trust represents twenty-five million dollars. The firms of Goodland & Company, Kinney Brothers, Kimball & Company,

* By J. M. Emmert, M. D., Atlantic, Member of the State Board of Health.

Lorillard, Dukes & Sons, and Stratton & Strong employ five thousand people in their factories. The output of cigarettes is numbered by the hundreds of millions, beside the large quantities which are imported from foreign countries. Some idea of the immense profit made can be had by the large amount of money expended in advertising, which is usually of the costliest kind. One method of advertising should be suppressed by every decent community—that of pictures of but partially clad, or nude, women, which are given away or hung in the show windows of tobacco stores, and plastered upon show boards and dead walls. These pictures appeal to and arouse the baser passions of boys, young men and girls, and many times no doubt are among the leading factors that cause their downfall. These pictures can serve no other purpose, and are intended to serve no other purpose, than that of pandering to morbid curiosity, and arousing those passions which create such a demand for their goods.

THE COMPOSITION OF CIGARETTES.

One would suppose by reading the papers and journals devoted to the advancement of the business that the cigarette is made of the most healthful and healthgiving material. They claim that nothing but the purest tobacco, and nothing but tobacco, is used. If you have been lulled into that belief, and know anything about the fumes of pure tobacco, go with me into a close room or smoking car where a number of dudes are smoking cigarettes, and you will believe with me that a cigarette contains something that has the odor of rotten fish, cabbage and other garbage, that has lain in the sun for some time and then is mixed with the material of slaughter-houses and out-houses. Its odor is abominable, even to old smokers, who use nothing but pure tobacco. If my information is correct, many cigarettes are made from old cigar stumps and quids of tobacco culled from the gutters and sidewalks and cuspidors of large cities. This business is carried on in the slums and saloons and most degraded neighborhoods where people who make it a business live, and who are of the lowest strata of society; dirty, filthy, besotted and diseased. Every large city has an army of scavengers who make their living in this way. After a cigar is partly smoked and allowed to lay for some time it undergoes some kind of change, chemical or otherwise, which will produce nausea in the oldest smoker, showing that this change has a powerful effect on the nervous system, and must be detrimental to health. If this was all, it would not be so dangerous, but at least seventy-five per cent of the manufactured cigarettes on the market are impregnated with opium, arsenic, cocaine or some other enslaving drug.

THE YOUNG MAN'S AND BOY'S CIGAR.

One of the most unfortunate things about the cigarette is that it is the young man's and boy's cigar, and sometimes, I am sorry to say, the girl's as well. The adolescent, we know, are much more susceptible to any kind of poison, and the effects are more injurious, permanent, and more liable to interfere with normal functions. It is therefore upon the young man we find the most baneful effects of smoking, and especially of cigarette smoking. It is a question whether the present pernicious habit of cigarette smoking by boys is not equally of importance with the use of alcoholic liquors upon the rising generation. The habit is growing so rapidly in this country that ere long it will be more important, because of the vastly greater numbers indulging in the vice. The boy of to-day seems to turn to the cigarette instead of to the cup to satisfy that peculiar want for some narcotic which is apparently almost universal in the human race.

METHOD OF SMOKING AND ITS RESULTS.

If the cigarette was smoked like a cigar the damage would be but little greater than the smoking of a cigar; for we know that many cigars contain drugs, yet do not produce the effect the cigarette does; but cigarette smokers are not satisfied to use the weed that way. They draw long whiffs into the mouth, and then by a reverse action of the muscles of the mouth and fauces fill their lungs with the result of combustion and carry the smoke into contact with the great absorbing surfaces of the lungs, where the noxious element passes at once into the circulation, traverses the entire system and exerts its morbid effects. The anatomical structure and physiological function of the mucous membrane of the lungs are such that the poison enters directly into the arterial circulation, exerting almost immediately its action upon any and all the organs, but more especially the nervous system. If there was no poison in the cigarette except that of nicotine it would take but a short time to produce nicotine poisoning with its well known painful results. Beside the poison absorbed we have a foreign material deposited upon the membrane that is not absorbed, but

remains there to interfere with the normal functions of the lungs, to absorb oxygen and exhale carbonic acid gas. The interference with this function soon locks up within the system an amount of this gas which interferes with and finally arrests the functionating of the different organs, beside starving the tissues because there is not a normal supply of oxygen.

EFFECTS UPON DIFFERENT ORGANS.

The cigarette habit has peculiar effects upon different organs. It first causes hyperæmic condition of the mucous membranes of the mouth, fauces trachea, bronchial tubes down into the smaller bronchioles and air cells—in fact the entire respiratory system. This constant irritated condition soon extends into the sub-mucous tissues and becomes chronic, and in a few months, or years at farthest, the victim has a chronic catarrhal condition throughout the entire respiratory tracts with all its distress and evil results. Every physician understands what is meant by a "tobacco heart." It becomes weak and irregular. The heart muscle is changed in its minute structure. A degeneration of the muscular fibres ensues that interferes with its functions and renders it liable to rupture if a little extra work is suddenly thrown upon it. Consequently the cigarette smoker is in constant danger of sudden death.

Cigarette smoking, viewed in the light of its moral and physical effects upon the nervous system, and borne out by clinical results, appears to have a peculiar affinity for the nervous system. We find boys who are "cigarette fiends," although they be models of honesty, trustfulness and integrity prior to the beginning of their smoking, soon become dishonest, untruthful and irresponsible. The boy's whole moral nature undergoes a change for the worse. I believe all educators are agreed upon the fact that the boy who smokes soon falls behind his fellows in his studies; his memory becomes impaired; his brain dull and sluggish. His listless and absent-minded condition soon causes his grading to be low, which discourages him, and he soon drops out of school to become a street loafer or, what is worse, a criminal, pauper or idiot, and thereby a menace to society and a burden to the State.

The effect of the poison upon the nervous system may develop any of the neuroses; one case developing a tendency to suicide, another to idiocy, another to insanity, another to epilepsy and so on throughout the entire line of nervous diseases. Its baneful effect is soon read in the boy's face; he becomes emaciated

cadaveric, and gives the appearance of malignancy. If the above is a true statement of cigarette smoking (and clinical demonstrations and the appearance of the victim confirm it), is it not time for us to arouse the public mind to the fact that something must be done to arrest and overthrow this dire evil that is eating out the very heart's core of our national existence?

BOARDS OF HEALTH.

A very few years ago to find a State having a health department would have been a very rare thing indeed. To-day scarcely a State can be found that has not such a department. Every State and territory in the United States has a State health service with the exception of Georgia, Idaho, Montana, Oregon and Wyoming.

Of those having health departments all have special State Health Boards except Alabama, which has a *State Health Officer*—the State Medical Association constituting the State Board of health; South Dakota, which simply has a health officer designated "*President*," and Texas, which has a *State Health Officer*. Idaho has no State Board, but provision is made by her laws for the appointment of health officers by the various boards of county commissioners, who are answerable to the local authorities only. Every Province in the Dominion of Canada has a well-equipped health board and every State in the Republic of Mexico. Every State and Province in Canada, the United States and Mexico has also provisions for the organization and maintenance of local boards in cities, towns or townships.

In Iowa every city, incorporated town and district township is by statute a local health board, receiving largely its instructions in the shape of rules and regulations from the State Board of Health, and invested with almost absolute power to carry out these rules and regulations.

The law leaves no option with the civil bodies named as to the performance of their duties as health boards—it is mandatory, and a failure for them to discharge their duty in this capacity would render them liable to impeachment.

Thus our State in city, town and rural district, is a vast net work of independent health departments, yet all having the same duty to perform, and all substantially the same rules and regulations to work by. There are no counties, towns or townships in the State that can not be depended on to do efficient and prompt service in case of the incidence of an infectious disease, in the way of not only preventing its spread, but in speedily stamping it out.

Such a condition is the safe-guard of the people. It is better than bars and bolts to doors, for these could not keep out pestilence, nor even robbers always. It guards and preserves the health and lives of our people, and enables them to lie down and sleep in peace and health.

When the General Assembly in 1880, enacted the law creating the State and local boards of health it builded wiser than it knew, and all the money expended to maintain the health service of the State for these fifteen years is nothing compared with the saving even in money to the State for any one year, to say nothing of the loss of loved ones, and of the pain and anguish of body and mind resulting from such loss.

What has been done in the past is but a foretaste of the reasonable possibilities of the future. Every State Board of Health and many of the highly efficient municipal boards, backed by ample means, are pursuing lines of research and investigation in the chemical and microscopic laboratories and at the various experiment stations that will lead to most magnificent results in the way of demonstrating incontestably the causes and best method of preventing the infectious diseases that sweep off annually more than half our people.

The health service of any State is deserving of the best awards that can be given in the way of funds to prosecute its work, as well as of the gratitude of its people.

DANGER FROM MATCHES.

Few people realize, or even consider, the danger, common in every dwelling house, from matches. They are kept in every room, scattered here and there, on tables, shelves and mantels; in closets; in sleeping rooms where they will be handy; in cupboards infested with mice; are carried in the pocket; are scattered about the floor in handling and, being "only a match,"

are deemed not worth picking up. And yet in this little splinter of wood lies the latent power to reduce a city to ruins, or the most stately mansion to ashes, to which may be added the incineration of human beings. Nobody knows how many conflagrations can be traced to this little trifle; for the fire fiend usually covers his tracks so that none can tell from whence he came.

Every match carelessly dropped, or left lying loosely about, becomes a dangerous thing. A slight pressure of the foot as it lays on the floor or carpet will ignite it. It is dark; it is behind you and you do not see it; you pass out of the room and close the door—perhaps go away and leave the house alone. In a moment the house is on fire, and is burned up. A woman's foot may start a flame which will ignite her clothing and she be burned to death.

Chemists have labored hard and long to produce a match without the use of phosphorus, but have failed to meet the universal demand. The so-called "safety matches" composed of a fulminating composition which it is claimed can be ignited only on the boxes in which they are packed, are not safe, as can be demonstrated by allowing a package to fall upon the floor when extremely dry. They are also more expensive, and the average man wants a match he can put in his pocket and ignite on the leg of his trousers, while the average woman wants one that can be conveniently scattered about the house, and will ignite anywhere.

The most dangerous of all the friction match kind is what is called the "parlor match." It is exceedingly sensitive to friction; a slight touch will ignite it, and it throws off a large, vigorous flame. It will ignite even in the pocket of a person's clothing. It leaves a dirty stain wherever it is drawn. For the protection of human life and property, keep matches in few places in the house or office, and only in covered metal boxes, in which they can be reduced to ashes without danger, out of the reach of little children, and invulnerable to mice, who are especially fond of phosphorus. A tight-fitting cover will prevent rapid combustion, as a certain amount of air is necessary thereto.

POISON IN THE POT.

The markets are flooded with nickel-plated copper cooking utensils. They are attractive to the eye, and cheap, which, unfortunately, is too often the prime consideration with the average housekeeper. They are a dangerous article for household use, especially for coffee and tea, or any acid food. The plating is usually lead, combined with tin, which, by the action of the acid of the fruit, or the coffee and tea, becomes corroded and develops a rank poison.

Professor Silliman, of Yale college, says: "It is well known to chemists that vegetable infusions, like tea and coffee, act upon metals and metallic alloys, such as are used for culinary purposes, corroding them, and imparting to the liquids thus prepared a disagreeable, metallic flavor, which in the case of lead or copper alloys is positively poisonous."

This can be shown by allowing one of these alloy vessels to stand a few days, when the verdigris formed will be plainly seen, but which has not been observed, because from constant use it is taken up and forms a part of the daily food or drink.

The effect of chemical action upon metals is easily demonstrated with the tomato, so universally used as food. When cooked in an iron vessel, it has a bitter metallic taste, which is not present when cooked in a porcelain-lined vessel. For tea and coffee, all metallic vessels should be avoided, and especially those with copper bottoms.

It is pertinent here, also, to say that all canned fruit or meat should be at once removed from the can when opened, and placed in an earthen vessel.

Water may be safely boiled in metallic vessels, and when boiling poured over tea or coffee in earthen or porcelain vessels, rendering both less dangerous and more palatable.

KEROSENE.

During the biennial period there has been a marked diminution of accidents from kerosene. The rigid enforcement of the statutes against the purchasers from non-resident dealers has largely checked the sale and use of non-inspected oil in Iowa. Retail dealers are generally satisfied with a single payment of fines and penalties as the result of such surreptitious and unlawful traffic, and it may be safely asserted that very little kerosene is now sold in the State that has not been inspected; and further, that no other State has greater immunity from danger than is secured under the inspection service.

Marked improvement is being made in the lighting of railroad cars. The kerosene lamp is rapidly being substituted with the gas burner and electric light.

Accidents, loss of human life, destruction of homes, still continue from the use of gasoline, and there is no protection against them whatever. The causes can invariably be traced to carelessness and negligence. Several lives have been lost through the gross carelessness of dealers in substituting gasoline for kerosene, whereby the house lamp is filled with the dangerous fluid with disastrous results. The regulations made by the State Board requiring the branding of every vessel by the dealer in which he places gasoline is largely ignored, as no penalty is incurred therefor. The legislature should, by statute, fix the responsibility and liability of those who engage in this dangerous traffic.

For the benefit of persons who use gasoline the following suggestions are given with the distinct understanding that it is always dangerous and unsafe. A leaking can, a defect in the stove, the stop-cocks may become worn and leak, permitting a flow of gasoline faster than it is consumed, the generating burner may be extinguished by wind, when the gasoline will continue to flow, and explode on relighting the burner. The stove has not yet been made that renders it "perfectly safe" to

use gasoline. The danger lies in the gasoline itself, which is not safe to have about a house.

Certain precautionary measures may be adopted to render it less dangerous if rigidly observed, to-wit;

First. Keep it in a well ventilated, cool place, inaccessible to children; never in any part of a dwelling.

Second. No unclosed vessel, as a pitcher, basin, or cup containing gasoline should be carried or placed within ten feet of a burning stove, lamp, gas or flame of any kind, nor left standing in any room within a dwelling house.

Third. Gasoline should never be poured from one vessel to another in any room in which there is a lighted lamp or a burning gas jet, an open grate burning, nor within ten feet of a stove in which is a fire, as the current of air in a room is always toward a fire or burning lamp, and the vapor of gasoline will be carried in that direction and will ignite at a long distance.

Fourth. Never fill the reservoir of a stove when the burner is lighted, nor near another stove in which a fire is burning. To do so, an explosion is inevitable. Remove the can, after filling the reservoir, entirely from the room before lighting the burner, otherwise it may ignite the surrounding vapor, and explode the can. Two women burned to death, and two houses destroyed during the year, from neglect to observe this precaution.

When not in use, close the cut-off between the reservoir and burner. This will prevent overflow from defect or leakage at the burner. If there be an overflow of gasoline, when filling the reservoir, or from the burner, wipe it carefully up before lighting the burner. If the overflow should become ignited, smother it with a blanket or cloths. Do not throw water on it, as that spreads the gasoline and increases the danger. Flour will squelch the flames quickly. This is true of the accidental ignition of any quantity of gasoline or kerosene. Keep the reservoir continually closed air tight.

Fifth. If, from leakage of a stove, or vessel, there is discovered an odor of gasoline in a room that has been closed, throw open the doors and windows until the air is changed before a match is struck, or a flame of any kind is permitted therein.

Sixth. It seems absurd to give warning against kindling a fire with gasoline, but the record of self-murder from this cause is evidence that this superlative folly is perpetrated to an alarming extent. A more certain and horrible method of self-destruction can not be easily conceived.

Seventh. Keep gasoline in a tight vessel, and after drawing therefrom place the cap over the spout and close the neck and vent tube, if there be one. This will prevent evaporation of the fluid. It is from evaporation, filling the air with an explosive vapor, comes the danger. To test this, pour a tablespoonful of gasoline on a plate, wait a minute, and see how near a lighted match can be brought to it, being careful to have your hand below the bottom of the plate.

Eighth. Never attempt to clean gloves on the hand nor dresses with gasoline, near a flame or stove. The fire in the stove will draw the vapor from the gasoline through the crevices, and ignite it like a lightning flash. If gasoline is spilled upon your clothing, remove the garment at once, keeping entirely away from flame of any kind. The deodorizing of gasoline for toilet use does not change its explosive nature.

A change has been make by the Board respecting inspection service. All disputes arising between a deputy inspector and a dealer must be settled by an appeal to the State inspector, and not to the State Board of Health as heretofore; and only such as arise between a deputy inspector and the State inspector, or between the State inspector and a dealer, can be referred to the State Board of Health.

The State Inspector, instead of the office of the State Board of Health, will hereafter supply the deputies and such dealers as desire, the proper apparatus for making the tests. These changes relieve the Board of a good deal of work and responsibility, and seem to be in entire accord with the statute relating to the statute regulating the inspection of oil.

CARE OF PERSONS FOUND UNCONSCIOUS ON THE STREET.

It is not unfrequent that persons are found unconscious on the streets, who are immediately carried away and thrust into the cell of a jail as a "drunk" to "sleep it off," which in very many cases proves to be the "sleep that knows no waking," from causes entirely distinct from alcoholism.

To avoid such errors and secure the humane treatment of such persons, the health department of New York has adopted

the following regulations which are commended to the boards of health of all cities and towns in Iowa. Regulations and methods can be devised adapted to their localities by such boards as will carry out the object and purpose here defined:

1. Whenever a person is found in an unconscious or semi-conscious state on the street or elsewhere, away from his own home, the police, when notified of such case, shall immediately summon medical aid, sending for the ambulance surgeon or for the police surgeon, or in towns where there are no such officials then for the nearest physician, who should be compensated for his services by the authorities.

2. The police shall not decide as to the disposition of such a case, but must await the decision of the ambulance surgeon, the police surgeon, or of the physician called, and must act in accordance with such decision.

3. A police officer who acts in opposition to such decision should be by the ambulance surgeon, police surgeon, or the physician reported to the police commissioner, who should subject such officer to discipline, rules governing such cases having previously been made and promulgated.

4. Ambulance surgeons should give prompt and immediate aid to patients found in the condition hitherto described and remove them to the nearest hospital, or to their homes when ascertainable, according as their judgment dictates is the best course to pursue in the interest of the patients. The existence of an alcoholic complication in the case should in no wise adversely influence the surgeon or physician called as to the disposition of the case, as such complication often renders skillful medical treatment the more imperative.

Ambulance surgeons and other medical men brought in contact with cases in which alcoholism is a frequent complication, should be reminded that this condition often renders an immediate diagnosis impossible in the most serious and oftentimes fatal forms of cerebral disease and injury, as well as in other diseased conditions.

6. The examination of ambulance surgeons should include the differential diagnosis of alcoholic coma from other forms of coma, and the various diseases or injuries that may produce a condition simulating alcoholic intoxication.

7. Hospital authorities receiving financial aid from the city should not refuse admittance to patients suffering from supposed alcoholism, for in so doing they are liable to be contributory

to the death of such patients. They should know that if the condition be one of uncomplicated alcoholism this fact will, in a short time, be revealed, and other disposition may be subsequently made of the case; while, if the patient is so affected as to need immediate and skillful treatment, his rejection by the hospital authorities may conduce to a fatal result. If they refuse to receive such cases because complicated with alcoholism they should be held legally responsible for the results. And, further, if such refusal is persistent after their attention has been called to the matter, the city authorities should strike the name of such hospital from its list of beneficiaries.

LEGISLATIVE SUGGESTIONS.

Fifteen years' observation and application of the statute regulating the health service of the State—chapter 151, laws 1880—and defining the duties and powers of the State Board and of local boards of health have demonstrated several defects that limit the efficiency and to that extent defeat some of the beneficent designs of the law.

Inasmuch as the honorable gentlemen and eminent jurists who compose the Code Revision Commission have had the matter under consideration, it would perhaps be presumptuous, until their report is properly presented, to make any specific suggestions.

The State Board of Health, through its efficient local boards, because of the promptness with which outbreaks of infectious diseases have been restricted and stamped out, deserves generous treatment at the hands of the General Assembly.

VITAL STATISTICS.

When the State Board of Health was created by the General Assembly, in 1880, one of the important duties entrusted to it was the supervision of a registration of marriages, births and deaths, and specific provisions were made for its execution, trusting to the intelligent and hearty cooperation of the medical profession of the State, and to the midwives, for reports of births and deaths. It is now fifteen years since this law was

enacted, and there has never been received at the office of the secretary data respecting births and deaths that would justify their publication. For the purposes for which they are intended they are utterly worthless, because unreliable. There are just two causes for this: Physicians and midwives will not report births and deaths, and clerks of the district courts, whose duty it is under the law to prosecute such delinquencies, fail to do their duty in this respect. The latter hesitate to commence prosecutions, and our physicians do not seem to realize the importance of such reports, or else do not have sufficient professional and civic pride to do a professional as well as legal duty. The law not only makes it the duty of physicians and midwives to make such reports, but imposes a fine of ten dollars for a failure to do so. The principal objection urged by physicians is that it requires a specific work and makes no provision for compensation.

A physician a few years ago was prosecuted for refusing to make such report and a judgment was rendered for defendant. It was carried to the supreme court and the decision of the lower court was reversed. The defendant claimed that the statute requiring him "to report the information demanded of him is in conflict with the constitution of the United States and of this State, and is unjust and oppressive, and contains requirements which were impossible for defendant to perform."

The supreme court, in concluding its decision, says:

II. The statute requires the collecting of statistics pertaining to the population of the State, and the health of the people, which may impart information useful in the enactment of laws and valuable to science and the medical profession, to whom the people will look for remedies for disease, and for means tending to preserve health. The objects of the statute are within the authority of the State and may be attained in the exercise of its police power. Similar objects are contemplated by States requiring a census to be periodically taken, the constitutionality of which we have never heard questioned

III. We need not inquire whether the provisions of the statute are unjust or oppressive. These are matters for the consideration of the legislative part of the government. We may observe that it is difficult to discover oppression or injustice in requiring the medical profession to make known to the world statistics which may promote and are promoting the public health.

IV. One ground of the demurrer is, that defendant, under the statute, is required to do that which it is impossible for him to perform. The law requires of no man impossibilities. If the information sought from defendant could not have been obtained by him in the *bona fide* exercise of reasonable diligence, the law will not punish him for not imparting it. A physician should honestly endeavor to obtain and report all information required by the regulations of the statute and the Board of Health.

This is his duty as a citizen, and is imposed as an obligation by the ethics of the useful and honorable profession of which he is a member.

As claimed by demurrer in section IV above, is it really under any circumstances *impossible* to comply with the law? It may be inconvenient at times, but not often even inconvenient.

An argument as to the value of vital statistics seems hardly needed by intelligent readers, and yet a brief statement of the advantages may not be amiss.

Births, marriages and deaths constitute the chief events of human existence. The record of these phenomena and of the causes leading to the last named, constitute vital statistics. A faithful registration of births and deaths—the alpha and omega of life—is surely of vital importance to every individual of the State, especially to all physicians and students of sanitary science. Such statistics facilitate the identification of individuals and thereby aid in the settlement of estates; assist in the detection of criminals; afford data for the estimation of life expectancies; furnish to medical and sanitary science important and invaluable information regarding the state of the public health; throw light upon the casual conditions upon which prevailing diseases occur, thus leading to intelligent methods for prevention, and afford reliable information as to climatic influences in the production of sickness and death.

Iowa enjoys an enviable position as to salubrity of climate, physical vigor, high birth rate, proportionately low death rate and longevity; and the figures could be produced to verify this statement if only the physicians of Iowa could be induced to report the casualties required by law. A laudable and patriotic ambition to do justice to our noble State should alone overcome any reluctance or hesitation because of inconvenience.

If the profession in Iowa in the face of the statute and its expressed penalities; in view of the decision of the supreme court; in view of the incalculable benefits of these statistics to the profession and to science; and in view of their material advantages to Iowa, can not be induced to furnish these reports *the next General Assembly should remove from our statutes every section and syllable relating to the registration of vital statistics.*

This should be done in the interest of economy if for no other reason. The expense to the State Board of Health for postage, blanks and binding these reports is by no means inconsiderable, and further, each county has to pay the clerk of the

district court in addition to the regular compensation allowed by law ten cents for each marriage, birth or death recorded, and the further sum of ten cents for each one hundred words of written matter contained in said report to the State Board of Health.

As a matter of course, there should be in the clerk's office a record of marriages for obvious reasons, but there is no reason why births or deaths should be reported to the clerk and these and marriages reported by him to the office of the State Board of Health unless they are at least approximately correct. The reputation of the State, economy and truth alike require the repeal of the provisions of chapter 141, laws of 1880, relating to vital statistics, or the enactment of such additional provisions as will make it operative.

QUARANTINE.

The law should more clearly point out the sources by which the indigent who are quarantined shall be provided with medcal attendance, nurses, medicines, food, clothing, fuel, etc., needed to keep them comfortable, contribute to their recovery and prevent the spread of the infection. These expenses should primarily be paid by the county, through the board of supervisors, to be subsequently refunded by the respective townships, by special levy. As it is, there is in every county in the State a conflict between the township trustees and the county supervisors relative to the payment of such expenses. Because of this, quarantine is often neglected and, as a consequence, infectious diseases spread, and often valuable lives are sacrificed, besides the waste of money and time that sickness entails. The law should be so explicit on this point that there could be no question as to its meaning and so mandatory in its construction that there would be no temptation to evasion.

In view of the presence of tuberculosis in cattle in several parts of the State, and of the practically infallible methods known for its detection, it is fair to presume that liberal and progressive measures will be provided by the General Assembly for its extermination, because of its menace to the commercial as well as sanitary interests of the State. Shall any less interest be manifested in the lives and health of the *people*—in the extermination of those infectious diseases that exist only by tolerance? The two most important factors in the restriction and extermination of infectious diseases are quarantine

and disinfection, and the greater of these is quarantine, since without quarantine disinfection is impracticable. Hence every legal measure that will encourage quarantine, that will make it more tolerable by reducing its discomforts, that will make it more general by applying it impartially, is for the benefit of the people, and should be enacted by the legislature.

ITINERANT VENDERS OF MEDICINE.

Though not strictly relating to the public health, the attention of the General Assembly is respectfully called to certain itinerant venders of medicine who receive authority from the Pharmacy Commission to vend and sell proprietary medicines. Vested with this authority, they assume the duties of physicians; they hold professional consultations; they call themselves "doctors"; they diagnose diseases; prescribe their proprietary remedies, and apply them, and make contracts, written or verbal, to cure or heal for a specified, often an exorbitant, fee. In many cases, they are grossly ignorant, from any standpoint—knowing nothing whatever about anatomy, physiology or the nature and application of drugs. When complaints are filed against them and they are tried by a jury in a justice court, they produce a pharmacy license for which they have paid one hundred dollars for a year's permit. In that document they are authorized to sell proprietary medicines in Iowa for one year.

The citation of one such case, of which many could be given, will suffice as an illustration. One of these men some time since visited Atlantic. He is a man who is specially ignorant on all subjects pertaining to medicine and surgery—unless it be the particular proprietary medicine he sells. He gave performances to attract the crowds to sell his remedies; he advertised himself as Dr. ————; he solicited private interviews; he examined the sick that called; diagnosed, or pretended to diagnose their diseases, and made contracts to cure them; he visited the sick at their homes, when called, examined them, informed them that they had certain diseases, prescribed for them, and in several instances applied and administered his remedies, and guaranteed a cure at a stipulated sum, part of which was to be paid down and the balance at stipulated times. In one case, he visited a woman, made a private examination, declared she had some uterine or "female" trouble, prescribed for her, and contracted to cure her. All this was in evidence before the jury, and yet he was acquitted on the ground that it

was not assuming the duties or offices of a physician, but that he was simply selling his proprietary medicines as he had been authorized to do by his pharmacy permit.

The danger to life and health, as well as the exorbitant and criminal fraud practiced upon an honest but too confiding people by such ignorant pretenders, not only suggest, but demand, such a change of the statutes relating to the practice of medicine or pharmacy as will effectually cure the evil. Unless they are physicians, holding a permit from the State Board of Medical Examiners, their pharmacy permits should be cancelled in addition to their having inflicted upon them the penalties provided for a violation of the Medical Practice Act, in case they pretend to be physicians; and the text of the law should be so plain and explicit, in defining a physician, that no juror nor justice could mistake its meaning.

SUPERINTENDENT OF PUBLIC INSTRUCTION.

The duties of the various boards of health and school boards touch and overlap at so many points that it would seem eminently fitting that the State Superintendent of Public Instruction should be a member *ex-officio* of the State Board of Health. His relation to all the schools of the State, and his intimate acquaintance with hygiene, physiology and sanitary science would not only render him specially qualified to act as such, but the Board would be benefited by his counsels, and he in turn would be greatly strengthened for his work along the lines of sanitation in the public schools.

At a meeting of the Board, held some time since, a resolution was passed unanimously asking the General Assembly to so modify the law relating to the public health (Chapter 151, Laws of 1880) as to make the State superintendent a member of the State Board of Health *ex-officio*.

DISEASED MEAT.

The use of diseased meats for human food is a menace to the public health and has long since been so recognized by the law making power of the State.

Section 4035 (Code 1873) declares: If any person knowingly sell any kind of diseased, corrupted or unwholesome provisions, whether for meat or drink, without making the same fully known to the buyer, he shall be imprisoned in the county jail not more than thirty days or by fine not exceeding one hundred dollars.

This section of the Code seems very clear and explicit and the penalty, though very mild, well defined. The attempt to apply it, however, shows that it is very defective in that it fails entirely to define diseased, corrupted or unwholesome provisions.

Some time since the State Veterinary Surgeon found a lot of cattle which he condemned as tuberculoses—placing them under quarantine and expecting in a day or two to slaughter them. Upon his return he found that the cattle had been sold to be shipped out of the State for food. When confronted with the above section of the Code and made acquainted with its penalties the offender replied that he had fully made known to the buyer the fact that they had been condemned as tuberculous, and that the buyer took them fully aware of their condition.

Under such circumstances cattle and other condemned food-animals may be sold and shipped out of the State or butchered and sold within the State and no one but the consumer suffers therefor.

In view of the great danger to the consumers of diseased meat products, that has been demonstrated time and again, to say nothing of the repulsiveness of eating such meat, it would seem that no penalties could be too severe against the traffic in such food, and no ambiguity should defeat the practical and universal application of the law to such sordid offenders.

EMERGENCY FUND.

During the history of the Board there have arisen conditions that demonstrated the necessity for a contingency fund to meet unforseen emergencies. If even a small amount, not to exceed two thousand dollars, were placed at the disposal of the Board to be used upon the order of the Executive Council with such limitations and safe-guards as would secure its judicious and appropriate expenditure it might be the means of saving many valuable lives beside much sickness, loss of time and expenditure of money. An extensive and serious epidemic of sickness from food or water posioning, or from some occult infection that would require prompt and exhaustive investigation with a view of ascertaining the cause and preventing its spread. Under these circumstances an appeal is always made to the State Board of Health or to the Governor for help and none can be given for lack of funds. Should no such emergency arise, of course there would be no occasion for the expenditure of any part of this fund.

FOOD ADULTERATION.

Nothing can be more conducive to the proper preservation of the lives and health of the people than protecting them against adulteration, fictitious labels and imperfect preparation. Investigations now being made in several States, under statutes provided therefor, disclose the adulteration of nearly every article of food to a greater or less degree. The people have no conception of the extent to which this imposition and fraud is practiced. Articles purchased in the regular way at retail stores gave the following results by chemical analysis:

Coffee.—Adulterated with chicory, burnt starch and chefus—a small nut. Some of the mixtures contained no coffee at all.

Ginger.—Wheat, rice, corn, cayenne pepper and tumeric.

Honey.—Adulterated with glucose.

Lard.—Adulterated with cotton-seed oil, tallow, alum and lime water.

Mustard.—Yellow lakes, flour, tumeric, cayenne pepper.

Fruit Jellies.—Gelatine and apple jelly.

Apple Butter.—Stewed pumpkin and molasses cooked in cider.

Maple Syrup.—Of all samples fifty-eight per cent was glucose. It is safe to say a larger part of maple syrup sold in the markets is a fabrication of other sweets, mostly glucose, to which a little maple syrup is added for flavoring. A syrup is adulterated when it contains glucose or any substance which would not be the natural product of sorghum, sugar cane or the maple.

Glucose is used in nearly every thing in which saccharine is required. It is given to the public as sugar, never as glucose. The commercial syrup known as No. 8, of which thousands of carloads are sold in Iowa annually, is nearly all glucose, which is much cheaper than sugar, hence the substitution, for profit.

Baking Powder.—Forty per cent adulterated, the principal adulterant being alum, which is an injurious mineral. Some samples contained no cream of tartar at all.

Canned Goods.—Dried peas, beans, apples and peaches soaked and packed in glucose syrup. The cost is forty-five per cent less than fresh fruit.

Confectionery.—No article of food which is so extensively eaten by children and women is so liable to adulteration as candy. Flour, starch and glucose are used. This gives light weight which is equalized with terra alba, a white clay. Poisonous flavoring extracts and coloring matter are used.

Pure sugar is a staple article at a fixed value. Candy made from it must have a relative fixed value. By the addition of glucose, starch and flour this value may be depreciated seventy per cent.

Butter.—Forty-six per cent were adulterated with foreign substances.

Of three hundred and seventy-six articles of food in use in every household, two hundred and fifty-five were found by the chemist of the New York State Board of Health to be adulterated.

While it is true most of the adulterants are non-poisonous they are all fraudulent. When the adulterant manufacturer omits to place on his package of pepper the words: "Compounded with burnt meal, mustard, cayenne, buckwheat hulls, pepper dust, etc.," or on his prepared coffee the words: "Compounded with chicory, peas, wheat, wood, molasses and burnt leather," or on his vessel of lard: "Compounded with cotton-seed oil and tallow," or on his syrup: "Compounded with fifty per cent glucose," or on his mustard: "Compounded with twenty-seven per cent of wheat, corn, cayenne pepper, mustard, tapioca and tumeric," he not only perpetrates a fraud but he becomes a rascal. It is some consolation, however, to know that while he practices this lacency he has conscience enough to avoid actual poisoning, and yet even this is uncertain.

The sole purpose of this adulteration is to increase weight or bulk and profit, lessen cost and rob the consumer. It is an outrage against the public health and honest traffic.

There have been increased instances of food poisoning, due, unquestionably, to increased consumption of preserved food. When it is considered that much of the preparation of this food is done by those wholly ignorant of bacteriological possibilities involved in every case or package, the marvel is that more injury does not ensue, and more frequently than it does. Damaged and diseased articles which could not be otherwise disposed of, may be, and are, worked into preserved preparations and thrown into market under labels without means of identification of the maker.

It is estimated the annual value of the food supply of the United States is four billion, five hundred million dollars, of which nine million is adulterated with poisonous substances and eighty one million with non-poisonous substances. This immense sum, realized from sophistication, is simply stolen

from the people to make millionaires of the robbers, and the loss falls largely upon the poor man, the laborer, and the artisan, impelled by limited means to purchase in small quantities and at lowest prices.

This state of facts becomes a premium on dishonesty. The honest manufacturer and dealer is forced into competition with fraud.

The farmer of Iowa is directly interested in this matter. His market for beef, pork and dairy products is seriously menaced by the fraudulent practices of those who stand between him and the consumer.

Legislation is forcibly demanded upon this subject:

First.—For the protection of the public health.

Second.—To prevent fraud, deceit, and obtaining money by false pretense.

Third.—To protect the consumer, the honest manufacturer and dealer.

Fourth.—Legislation and investigation in other States are driving fraudulent goods into Iowa. The markets are full of them.

There should be required that with each and every package of food product there shall be given the guaranty and designation of the quality, and where and by whom prepared.

But no law will suppress adulteration which does not provide officers whose duty it shall be to enforce it, as against any other criminal offense. An individual has no authority to demand articles for inspection, or the means to pay for such inspection. He may be thoroughly convinced of an adulteration and fraud, but must succumb to the necessity of poverty, and want of means to prove it.

RAILWAY CAR SANITATION.

While railway managers are making commendable progress in devising means for the comfort and convenience of passengers in railway coaches, they have omitted the water-closet, which, as a rule, is filthy, and always, as at present constructed, a menace to public health. No good reason can be given why these closets should not be provided with closed receptacles, and suitable arrangements for discharging the contents at frequent intervals, and cleansing, deodorizing and disinfecting them, instead of spreading their contents, filth and the germs of disease, through the country. Travelers will not

cease to commit nuisances, and they should not be held responsible therefor, so long as the railway companies provide no means to obviate it. Common decency, if not a proper respect for public health, should long ago have suggested the abolishment of the open railway water-closet. It should be required by legislative enactment in such terms as courts and railway companies will respect.

CREMATION OF THE DEAD.

Relative to this subject, Dr. E. A. Guilbert, the honored president of this Board, says in an able paper found on page 280 of this Report:

"The statutes of the various commonwealths of this country do not prescribe methods of interment, therefore cremation is not an unlawful method of disposing of the dead, as some 'pelting, petty cavillers' have proclaimed. Hence, no appeals to State legislatures on this behalf are necessary. But organized and persistent petition endeavors should be brought to bear upon these bodies, with reference to influencing the enactment of laws making it obligatory upon boards of health to incinerate the bodies of those dead from infectious diseases."

This opinion was forcibly maintained and adopted at a notable gathering of scientists in London some time since. Sir William Thompson offered the following resolution, which was adopted by only four dissenting votes:

Resolved, That cremation of the dead is a rational hygienic measure which is especially called for where the death occurs from contagious disease.

COMPENSATION OF MEMBERS.

It may be surprising to the members of the legislature to know that the members of the State Board of Health under the statutes are required to perform their duties as such without any compensation, except "traveling and other necessary expenses incurred in the performance of official duties." The law requires the Board to meet twice annually, in May and November, "and at such other times as the Board shall deem expedient." The Board in order to meet the pressing demands of the health service of the State in a proper manner has deemed it expedient to meet intermediate between the May and November meetings, to-wit, in August and February, making four meetings annually. They come from various and some from remote parts of the State, and for their faithful and efficient services they receive barely their railroad fare and hotel expenses, not any per diem whatever.

While the position is an honorable one it is a responsible one, and to meet the requirements of the health service efficiently and as was intended by the law requires a high grade of professional ability, as well as of mature judgment and careful thought. These men, the physicians especially, are in the active practice of their profession and to abandon their practice at least four times each year and come to Des Moines and remain at least two days at each meeting, and simply have their expenses borne is amomalous to say the least. They should have their expenses paid and a per diem at least of ten (10) dollars, which should include one day for coming and returning. That would make about one hundred and sixty dollars per annum for each member in addition to their traveling and other necessary expenses.

Inasmuch as the appropriation made fifteen years ago has become inadequate to meet the growing demands of the service because of the greatly increased population, to meet this extra expense the appropriation should be increased at least one thousand per year. With that increase the expenditures of the Board, if every cent were used, would be far less than any similar Board in this country.

COMPENSATION OF SECRETARY.

The compensation paid the secretary of the Iowa State Board of Health is beggarly, indeed, compared with that of other State Boards—especially when it is considered that he is expected to, and does, give all his time to the discharge of the duties of the office—more especially when the service required is of a high professional and literary character. It will not be regarded as odious to compare the salary paid by Iowa with that paid by contiguous States. Illinois pays the secretary of its Board annually three thousand dollars; Minnesota, two thousand five hundred dollars; Michigan, two thousand five hundred dollars; Wisconsin (secretary and clerical, 1892), six thousand two hundred dollars; Iowa, one thousand two hundred dollars. The Pharmacy Board of this State pays its secretary one thousand five hundred dollars, and there is scarcely, if, indeed, any deputy or chief clerk in any State office paid less than one thousand five hundred dollars. There is no complaint that these salaries are too high. The contention is that the salary of the secretary of the Iowa State Board of Health is too low.

On this point Hon. ex-Governor Wm. Larrabee, in his biennial message to the Twenty-third General Assembly, said, speaking of the Board of Health: "I consider the compensation of the secretary inadequate for the work and responsibility of the position, and recommend that it be increased to one thousand five hundred dollars per annum."

METEOROLOGICAL TABLES—COMPARATIVE STATEMENTS.

1839—IOWA CITY*—1859.

Elevation above sea level, 645 feet.

YEAR.	Comparative mean temperature (degrees). June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Average mean for year.
1839	70.6	75.7	73.1	61.1	60.7	35.1	23.9	32.2	31.8	40.5	62.7	68.9	53.03
1840	72.4	73.9	72.1	61.1	52.6	41.9	29.6	19.5	28.2	38.3	52.9	63.1	50.64
1841	71.1	70.4	65.5	58.5	55.0	38.2	28.8	29.9	26.1	37.1	51.0	58.1	48.68
1842	65.6	68.4	68.7	64.5	55.5	30.2	21.6	26.3	28.1	45.8	53.3	57.9	48.82
1843	67.8	70.4	70.6	64.6	42.2	34.1	31.9	25.0	13.4	15.5	47.7	58.2	45.11
1844	65.8	74.9	70.0	61.4	46.1	36.1	25.4	22.7	30.3	38.3	60.8	55.9	48.81
1845	64.3	76.0	70.8	62.9	48.5	33.3	18.2	30.0	20.9	40.4	51.1	55.5	48.29
1846	66.1	73.0	72.0	65.9	43.0	39.1	28.9	31.2	24.2	40.6	52.7	64.1	50.00
1847	62.5	69.5	65.3	59.8	47.8	33.5	25.4	12.3	25.3	29.4	49.1	55.8	44.64
1848	64.3	64.0	66.7	56.3	43.9	30.8	19.1	28.0	28.4	35.2	45.1	62.0	45.31
1849	67.6	66.5	65.3	61.7	49.0	42.9	18.4	14.3	18.1	37.6	44.3	54.8	45.00
1850	70.2	74.2	72.2	58.8	44.2	37.6	19.8	24.4	28.9	32.6	41.2	51.3	44.76
1851	46.6	71.6	69.1	68.3	50.4	34.5	31.4	24.0	27.7	38.2	41.5	58.2	46.12
1852	66.8	72.4	69.0	59.8	53.2	30.0	22.2	19.6	29.0	30.2	32.2	60.0	45.86
1853	71.2	68.8	71.1	62.9	45.5	39.7	26.7	27.1	21.4	33.2	47.8	55.7	47.76
1854	69.0	76.2	73.0	68.2	44.4	36.8	27.8	16.2	28.5	39.9	51.1	60.0	41.00
1855	67.0	73.0	70.4	67.9	47.2	37.8	21.7	24.8	15.6	30.3	54.0	60.4	47.50
1856	[illegible]	[illegible]	[illegible]	[illegible]	52.4	32.8	15.6	7.5	15.0	25.8	49.5	61.4	44.14
1857	65.1	71.2	70.9	63.8	47.9	31.2	31.4	6.2	28.8	29.9	38.3	53.9	44.90
1858	70.6	78.8	79.9	66.0	32.0	32.6	25.5	30.0	16.0	38.7	46.1	54.3	49.20
1859	69.0	72.3	68.2	60.3	37.5	39.6	15.1	24.1	25.8	40.1	43.3	62.1	46.45

YEAR.	Comparative precipitation (inches). June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Total for year.
1839	......	......	......	......	......	......	......	......	......	......	......	......	......
1840	......	......	......	......	......	......	......	......	......	......	......	......	......
1841	......	......	......	......	......	......	......	......	......	......	......	......	......
1842	......	......	......	......	......	......	......	......	......	......	......	......	......
1843	......	......	......	......	......	......	......	......	......	......	......	......	......
1844	......	......	......	......	......	......	......	......	......	......	......	......	......
1845	......	......	......	......	......	......	......	......	......	......	......	......	......
1846	......	......	......	......	......	......	......	......	......	......	......	......	......
1847	......	......	......	......	......	......	......	......	......	......	......	......	......
1848	2.50	5.70	9.10	3.00	4.30	1.40	1.20	1.20	1.00	2.10	0.70	4.40	36.29
1849	12.20	1.40	12.20	5.00	4.80	6.60	1.14	2.82	1.30	2.41	4.70	4.70	59.27
1850	3.50	5.00	13.00	3.90	2.70	3.59	2.87	4.62	0.80	2.08	3.30	3.70	38.66
1851	14.30	8.60	14.00	3.50	1.40	3.63	2.95	1.55	5.34	3.00	3.60	12.60	74.50
1852	2.30	3.70	2.80	8.20	7.60	5.70	5.11	2.52	1.00	8.60	5.30	6.50	50.39
1853	6.40	6.60	1.70	6.20	0.21	4.92	0.32	0.43	0.90	0.75	11.80	4.60	45.08
1854	0.66	2.22	3.33	1.13	4.22	0.19	0.51	0.40	1.80	1.22	1.76	6.21	24.15
1855	4.73	[illegible]	3.51	1.84	2.86	2.18	2.15	1.68	0.70	1.87	2.55	1.94	28.68
1856	2.86	2.74	1.36	2.45	5.21	4.35	6.25	0.12	4.46	0.57	3.44	4.39	38.20
1857	0.90	4.67	6.00	1.80	1.95	4.77	1.85	0.61	5.80	3.33	5.09	2.75	39.52
1858	6.70	7.30	4.12	6.10	4.90	4.54	1.82	1.60	2.00	2.20	2.00	8.40	51.68
1859	5.82	2.93	1.70	1.80	0.85	1.33	1.81	0.94	1.72	5.01	1.05	7.49	32.70

*Observations were made by Prof. T. S. Parvin.

METEOROLOGICAL TABLES—CONTINUED.

1859—MUSCATINE*—1874.

Elevation above sea level, 520 feet.

YEARS.	Comparative mean temperature (degrees). June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Average mean for year.
1860	69.3	71.7	68.06	54.3	61.3	35.7	17.5	21.5	26.6	42.7	49.6	64.3	47.90
1861	68.3	69.0	70.1	62.6	50.1	37.0	26.0	13.9	27.1	34.0	47.6	58.7	46.28
1862	71.8	73.4	69.3	63.4	48.6	35.2	29.3	13.5	13.2	29.0	42.9	59.4	45.91
1863	62.5	71.5	70.4	61.2	40.0	33.8	77.0	26.0	23.4	31.9	41.3	58.7	41.63
1864	70.6	76.0	73.0	66.9	47.8	45.8	19.3	15.9	27.4	32.6	46.1	66.2	46.95
1865	74.9	69.3	72.4	72.6	53.9	42.6	21.0	20.5	31.5	34.3	48.1	61.4	50.20
1866	67.9	77.1	68.8	59.1	53.1	40.2	21.6	20.7	19.6	31.8	51.2	59.2	47.65
1867	70.5	74.3	74.7	66.8	54.5	31.6	24.3	17.9	26.3	25.7	47.1	51.9	47.00
1868	70.8	80.8	69.1	58.8	49.8	28.0	21.7	13.4	25.3	42.7	41.7	61.7	48.11
1869	66.0	70.9	74.4	63.2	42.7	32.1	25.5	26.0	27.0	30.4	47.1	60.0	47.11
1870	71.8	78.3	70.9	67.8	53.2	39.3	24.4	22.1	24.9	30.8	53.5	65.5	50.20
1871	70.5	71.3	73.8	60.1	52.8	29.0	15.6	22.1	26.2	42.3	......	65.9	......
1872	70.5	74.0	73.8	62.9	48.1	27.3	12.6	16.9	23.2	28.3	48.8	58.6	43.75
1873	73.5	73.5	74.8	61.1	44.9	31.4	25.1	10.4	16.4	31.5	44.2	56.2	45.25
1874	......	......	......	......	......	......	......	......	......	42.3	52.1	......	......

YEARS.	Comparative precipitation (inches). June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Total for year.
1860	3.66	4.03	2.30	2.76	1.00	2.09	4.02	1.17	0.43	0.55	1.67	1.42	25.10
1861	0.40	2.70	1.07	9.92	9.16	2.93	2.87	0.28	3.91	2.30	4.40	2.98	46.09
1862	6.07	3.10	7.30	6.10	2.49	3.29	2.75	0.29	0.28	4.06	5.39	3.65	47.78
1863	0.21	0.80	2.44	4.44	4.10	4.11	3.55	3.40	3.02	2.58	0.55	4.56	33.76
1864	5.70	5.00	7.60	2.12	4.55	4.82	1.60	2.39	0.67	5.64	3.97	3.60	47.47
1865	6.99	7.30	1.55	3.75	6.35	0.25	0.33	0.30	3.15	3.57	9.31	2.72	45.34
1866	4.76	6.55	6.85	6.53	4.61	1.41	2.34	4.19	0.79	0.83	2.92	1.59	43.37
1867	3.94	3.94	4.45	4.62	3.06	1.97	0.73	1.26	4.76	1.90	0.95	10.60	42.18
1868	1.28	6.15	4.67	5.17	0.33	4.38	0.81	0.17	1.51	6.31	4.92	6.20	43.90
1869	7.42	7.42	11.43	3.09	2.07	3.52	2.40	1.54	2.65	0.43	3.16	4.06	49.11
1870	1.30	1.85	5.83	6.67	3.16	0.44	0.25	2.30	0.25	2.30	0.25	3.00	29.10
1871	9.16	5.56	5.23	0.09	5.51	3.77	2.13	1.51	3.10	5.36	3.30	2.00	66.63
1872	7.39	5.85	9.55	6.29	0.80	1.21	0.71	......	0.24	......	......	7.82	......
1873	4.44	3.24	0.65	2.97	2.96	0.82	4.22	......	0.10	......	......	5.55	......
1874	......	......	......	......	......	......	......	......	......	......	......	......	......

*Observations were made by Prof. T. S. Parvin.

METEOROLOGICAL TABLES—CONTINUED.

1885—CEDAR RAPIDS—1895.

Elevation above sea level, 736 feet.

YEAR	COMPARATIVE MEAN TEMPERATURE (DEGREES.)													COMPARATIVE PRECIPITATION (INCHES.)											
	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Average mean for year.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Total for year.
1885..	67.56	93.92	66 15	58 29	45.04	33.75	22 67	7.41	10 06	28.07	43.21	55 58	44 68	3.45	6.43	6.38	2 81	2 50	0.65	2.48	1.65	1 85	0 61	7.82	5 65	42.28
1886..	71.11	77 23	78.53	64 10	53.58	33.55	16 50	10 80	21.66	28 70	51.54	62 50	47 48	1.25	0 57	1 70	2.86	4.92	1 50	0 40	2 61	1 57	4.47	2 16	2.69	26.30
1887..	74.08	77 80	72 40	65.30	45.51	34.25	22.70	14 52	15.01	31.75	49.52	66 27	45.58	2.53	4 58	1.40	4 93	2.47	0 79	2.72	2 05	4.67	3.50	0 98	1.20	31.41
1888..	69 80	75.96	68.10	58 67	47 80	36 50	28 80	9 18	20 60	37.80	48 55	52.83	45.56	2.24	6.03	2 42	1 07	2.35	4.12	2 16	1.39	1.37	5.52	1 74	8 10	36.56
1889..	74.33	75.83	67 83	59 56	46 18	39 30	29 10	23.32	28.72	39.04	52 25	60.62	48.21	4.11	5.79	1.65	3 76	1.49	1.03	1 62	1 44	1 87	0 42	2.91	5.15	31 18
1890..	69 27	70 42	69 82	67 63	49.13	35.51	32.75	26.00	23.27	38.08	51.82	71.51	48.79	9.54	1.97	4.27	2 90	5.30	1.87	0 40	2 11	1.04	2.04	2.42	2 06	45 92
1891..	71 03	73 07	75 04	67 04	55.06	53 06	19 67	15.02	30 03	32.05	46.06	75 03	48 10	3 21	3.20	5.44	1 81	2 41	2 98	1 77	1 89	1 13	3 74	1.63	4.11	33.25
1892..	72 02	76.03	70 02	64.09	52 07	34 03	22.09	9.62	17.94	33.01	45 09	57.02	48 04	7 48	4.45	2 17	2.34	1.03	1.00	2.02	2.82	2 76	2 38	4.15	10 19	42 63
1893..	74 04	76.01	74.07	65 03	52 02	34.90	32 06	21.69	20.09	42.05	53.01	61.08	50.38	4 89	1.98	2.47	2.85	2 63	1 24	2 40	0.72	1 82	2.99	3 89	2.79	30.67
1895..	72.6	.....	.....	.....	.....	.....	.....	14.08	16.08	36.00	53 08	63.00	.....	2.43	0.18	2 51	1.48	2.23	1 53	1.39	1 51	1.58	4.52	1 65	3.8	23.60
														2.93							1.56	0 38	0 66	1.26	2.84	.....

METEOROLOGICAL TABLES—CONTINUED.

1874—DAVENPORT—1895.

Lat., 41° 30' N.; Long., 90° 30' W. Elevation above sea level, 615 feet.

YEARS.	COMPARATIVE MEAN TEMPERATURE (DEGREES).													COMPARATIVE PRECIPITATION (INCHES).											
	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Average mean for year.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Total for year.
1874.....	72 6	77.5	74.3	65.1	52 3	36.3	27 9	23.8	25.8	34 3	41.2	64.3	49.63	5.37	3.10	3.68	7.86	1 30	2.47	0.50	4.34	0.74	1 31	2 64	3.45	36 79
1875.....	68 4	73.6	69.3	61.7	48 6	33.4	34.5	9.4	10.4	30 1	45.7	60 5	44 06	4.01	9.31	1 73	4.05	1.61	0.57	2 08	0.38	1 09	0.88	2.50	7.01	37 99
1876.....	69.0	75.4	74 6	62.3	49.2	35 2	14.4	25.9	30 1	32 1	56 0	62 1	49 20	4 25	4.82	4.27	5.50	1.54	2 54	0 36	3.47	3 63	4 34	5 30	6.70	46 89
1877.....	69 1	75 0	72 5	67 1	53.5	37.1	42.5	16 8	36 3	28 7	49 4	61.6	50.80	5 80	3.47	3 21	1 45	4.88	2 53	2.32	1 41	0 70	3 91	3 28	2.82	35 09
1878.....	68.0	78.0	74.0	65 1	51 8	42 3	30 3	30.1	36 7	48 2	56.7	57.5	5 . 22	4.36	2.19	5.07	1.82	4 21	0 99	0 98	0 36	1 00	2.21	2 19	5.14	31.12
1879.....	69 5	76.9	71.7	60.5	50 8	39 9	30 8	18 4	25.5	39 5	50.5	63.8	50 56	4.57	5.87	4.35	1 43	0.92	4.70	1.62	0 79	1 00	1 80	1.54	5.83	33 80
1880.....	74 2	64.5	74.3	62.8	50 7	39.7	21.7	37.6	33.7	37.0	49 7	67.2	51.03	7.21	4 31	5 93	4 87	0 94	1.23	1 15	3 18	1 72	2 68	4 50	5.49	42 73
1881.....	69 7	77 6	77.2	69.7	56 8	39.7	38.2	13 8	19 9	28.8	44 6	69.0	50 29	7.91	0.91	0.74	5 59	6 85	2.19	1 71	1 34	4 14	4.33	1.51	1.54	37 68
1882.....	68 6	70 5	72.2	64 4	57 7	42.2	28 2	28.9	40.3	40 8	51.3	55.6	51 76	8 53	4 41	2 29	1.30	3 75	1.49	1 78	0.90	0 62	2 80	3.15	5.49	38 50
1883.....	68.3	73.7	69.8	60 9	50 9	41.7	31 3	18.5	24.4	34 7	51 7	57.0	48.31	4.38	3.66	1 04	0 72	5 13	3.58	6 79	1.16	4.42	0 73	3.33	5.46	35 33
1884.....	70.3	71 8	70 0	69.5	57.2	40.3	25 1	18 8	26 9	36 4	50 4	61.2	48.72	3.07	4.51	3.84	4 79	7.17	1 49	3 68	0 75	0 93	3.97	0 77	3.79	38 11
1885.....	68.2	75.5	67.9	61 1	48.1	38 1	25.6	15 9	17.3	34.1	49.4	57.8	45 97	2.08	1 86	12.64	4.19	2 71	1.39	1 95	2 10	1 39	0 17	2.47	1.96	34.35
1886.....	70 2	76.3	74.4	65 4	55.7	35.1	17.5	13 8	23.1	33 0	52 0	62.4	47.90	0 49	0.43	2 67	2.43	3.47	0.74	0 55	2.62	1.52	3.08	1.84	3.73	22 62
1887.....	73 0	78 0	72.2	64 4	47.5	37.0	24.0	13.2	21 8	34 3	52 3	67.1	48 90	1.43	4 87	3.23	5 45	3 41	1.15	3.26	1.43	4 81	0 77	1.17	1.76	32 78
1888.....	69 8	74 4	69 6	58.0	46 9	38.1	30 5	9.7	20 8	30.1	49.5	55 2	46 29	5.83	7 31	2 79	1 98	2 81	3.54	2.80	1.54	1 17	2.70	1.57	9.25	40.46
1889.....	66.7	73 8	71.1	63.8	49.0	36.6	39.6	25 2	19 0	39 3	49.7	59 3	48 67	5.19	8 29	1.11	3.27	1.26	2.17	1 60	0.95	1.44	1 74	3.89	6.34	37.61
1890.....	74.0	76 0	70 0	61.8	52.0	42.0	30.4	27.0	31.0	30.0	53.0	58 0	49 64	4 51	0 83	1.66	2 34	3.63	1.37	0 62	2 49	1.10	2 34	0.86	4.31	34 50
1891.....	71 0	69.0	70.0	69.7	51 0	32 0	35 0	28 0	26 0	29.0	52 0	58.0	49.60	3.56	3.29	5 54	1.50	1.37	3.56	1.64	2.38	0.89	1.68	3.30	2.74	30 95
1892.....	70 0	74.0	73.0	66 0	56 0	33.0	29 4	17.0	31.0	34.0	47 0	56.0	48.10	10 79	4.16	1.53	2 09	0 55	2.01	2.73	1.60	1 38	3.06	5.41	8.84	44 15
1893.....	72.0	77.0	72 0	66 0	55.0	36 0	24 0	9.0	17.0	34.0	47.0	58.0	47 04	3.84	1.73	1 17	3.35	0.30	2.56	1 67	1.14	1.69	2.25	4 50	2.67	27.33
1894.....	75.0	77.0	75.0	67.0	54.0	34.0	32.0	28.0	22.0	43.0	53.0	61.0	51.03	2 16	0.44	2 02	1.02	3.02	1.26	0.61	1.33	4.48	1 88	1.37	1.93	18.52
1895.....	73.0	.....	.....	.....	.....	.....	.....	15.0	15 6	35.0	53 0	63.0	.....	1.22	.....	.....	.....	.....	.....	.....	1.27	0.58	1.57	0.32	2.25	.....

METEOROLOGICAL TABLES—CONTINUED.

1874—DES MOINES—1895.

Lat. 41° 35′ N. Long. 93° 46′ W. Elevation above sea level, 849 feet.

YEARS.	COMPARATIVE MEAN TEMPERATURE (DEGREES.)													COMPARATIVE PRECIPITATION (INCHES.)											
	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Average mean for year.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Total for year.
1878			78.0	68.1	59.4	42.2	19.9																		
1879	70.1	77.7	75.4	69.4	59.7	39.3	21.4	18.7	19.9	34.9	51.2	64.2	51.32	6.63	6.29	3.21	2.00	2.84	0.34	1.75					
1880	71.8	74.4	73.1	62.2	49.2	38.2	20.1	38.2	38.5	38.0	50.5	68.5	54.01	4.11	3.82	6.69	5.34	4.30	1.97	0.86	0.73	0.70	0.70	1.50	31.22
1881	70.6	76.2	77.9	66.1	54.7	38.8	35.0	14.0	28.9	28.9	41.4	66.8	49.86	15.79	5.57	5.29	4.70	6.45	3.97	1.85	1.55	1.78	1.78	3.36	3.82	57.26
1882	67.9	68.4	71.1	64.2	52.4	39.5	23.9	26.7	37.8	37.8	51.1	54.8	51.36	12.16	4.78	5.14	0.15	5.91	2.81	2.59	0.63	2.28	2.28	3.47	3.53	55.24
1883	67.5	73.6	70.7	59.8	48.7	48.7	27.3	8.8	19.1	32.9	51.8	55.8	48.94	7.75	2.37	2.81	1.88	4.42	4.42	1.04	1.72	2.51	0.37	3.48	9.76	48.67
1884	70.0	71.8	68.7	67.9	55.6	37.6	18.4	16.0	15.4	33.8	41.7	59.8	46.90	3.84	2.16	5.84	5.46	5.33	1.26	1.93	0.85	0.04	3.24	2.97	3.31	41.79
1885	69.0	75.9	68.7	63.5	48.8	39.2	28.4	11.5	14.6	35.6	49.0	60.1	46.63	3.03	6.35	5.10	4.82	4.17	0.61	1.95	1.04	0.42	0.04	3.62	1.70	34.25
1886	71.3	78.4	76.8	68.1	57.5	35.8	19.2	10.9	24.8	34.9	52.7	64.4	49.67	1.21	0.27	1.10	7.30	2.62	1.86	0.81	3.44	0.52	1.41	4.83	3.71	33.03
1887	71.9	77.5	75.4	64.8	48.4	37.3	22.9	11.5	19.4	35.7	52.5	65.7	48.25	2.25	1.97	2.66	5.36	1.49	0.52	1.41	0.83	1.65	1.79	2.48	2.31	29.17
1888	68.6	75.6	69.2	58.3	48.8	35.8	29.1	6.9	22.6	29.0	51.0	54.5	45.61	2.32	3.42	4.51	0.48	0.84	2.09	2.44	1.15	1.51	2.02	1.45	7.84	24.63
1889	67.4	73.8	72.0	62.8	49.2	34.4	30.5	21.8	19.6	39.2	50.1	60.5	49.22	3.02	4.37	2.23	3.41	0.52	1.24	0.57	1.42	0.37	0.11	3.61	4.84	31.15
1890	69.3	68.6	69.8	68.2	52.2	32.0	31.6	28.3	23.2	34.8	52.6	57.8	48.73	4.91	1.19	5.95	1.67	4.46	0.74	0.11	2.62	1.17	0.91	0.78	3.00	34.13
1891	69.0	73.8	72.0	65.8	55.2	39.7	19.6	17.8	29.0	35.6	47.0	54.8	47.85	5.60	2.78	4.24	1.64	2.41	1.34	1.58	1.82	1.13	2.25	2.12	3.29	23.12
1892	71.0	76.0	76.0	66.0	55.0	38.0	24.0	10.2	17.0	33.0	46.0	57.0	47.50	3.41	8.04	2.45	1.12	2.24	1.58	1.05	1.69	1.35	2.47	2.32	1.77	30.14
1893	74.0	78.0	76.0	67.0	54.0	34.0	31.0	21.0	29.0	43.0	53.0	62.0	51.00	1.67	0.29	1.89	4.46	2.24	0.99	1.15	1.09	1.39	1.78	1.41	20.56
1894														5.26							1.80	0.60	0.50	3.41	2.86	
1895	70.0							17.0	19.6	36.0	55.0	63.0													

METEOROLOGICAL TABLES—CONTINUED.

1874—DUBUQUE—1895.

Lat., 42° 30′ N., Long. 90° 35′ W. Elevation above sea level, 665 feet.

YEARS.	COMPARATIVE MEAN TEMPERATURE (DEGREES.)													COMPARATIVE PRECIPITATION (INCHES.)											
	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Average mean for year.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Total for year.
1874	72.5	78.3	74.3	65.2	52.0	34.4	29.6	21.2	23.2	33.2	41.3	65.2	49.86	3.30	3.34	2.13	7.68	2.14	4.17	0.65	2.45	0.36	1.28	1.54	1.08	30.12
1875	67.5	73.3	69.7	61.7	52.1	33.7	33.9	6.6	6.1	27.5	45.0	60.7	44.85	4.75	5.39	1.07	6.11	2.71	0.48	2.71	1.00	2.12	1.45	2.71	3.62	35.12
1876	69.1	74.9	73.8	61.4	47.6	34.1	13.7	27.8	27.8	31.0	48.6	61.6	47.61	7.88	8.15	5.92	5.00	1.10	2.49	0.82	3.20	1.53	4.00	3.61	5.91	50.29
1877	67.4	74.7	73.0	66.2	51.7	35.0	46.0	15.2	34.8	27.1	48.2	62.2	50.15	6.75	2.90	3.96	0.67	5.35	3.31	2.70	0.98	0.26	4.53	3.74	3.84	38.07
1878	66.8	76.8	7.7	63.8	49.9	39.7	19.5	27.7	30.3	45.4	53.6	56.0	50.69	4.35	6.71	1.72	6.94	2.85	0.78	1.12	0.49	0.93	2.44	4.34	4.61	38.28
1879	68.9	76.6	71.6	59.4	48.7	37.4	20.3	17.4	22.8	37.2	50.7	62.6	48.61	4.99	6.78	2.43	2.98	0.93	5.41	1.28	0.44	1.00	1.20	1.02	2.94	32.51
1880	71.1	74.2	72.8	61.2	48.7	21.8	19.1	34.4	29.1	35.6	48.8	67.4	49.76	6.02	3.55	7.15	6.84	0.66	2.11	1.25	1.95	1.01	2.55	3.52	3.72	34.54
1881	67.6	75.2	74.5	66.3	53.3	36.2	34.7	12.5	20.1	30.4	43.9	67.7	48.83	7.56	10.53	2.46	10.26	6.70	3.19	1.55	1.87	2.70	5.70	1.39	2.30	42.40
1882	67.2	69.6	71.6	62.6	55.3	39.2	23.4	24.1	35.7	37.0	48.5	54.4	49.00	6.24	1.48	2.29	2.69	5.29	1.55	1.79	0.84	0.59	1.49	4.47	4.16	41.13
1883	66.7	72.5	68.5	58.8	53.3	38.5	27.0	10.2	18.8	30.9	49.7	54.6	46.62	5.34	7.90	2.70	2.09	4.44	1.65	1.88	1.59	2.60	0.32	1.93	7.10	34.65
1884	68.6	80.6	68.4	67.8	53.6	36.3	21.3	14.1	22.2	31.2	48.4	60.6	46.06	4.89	5.30	4.25	4.07	4.16	1.43	4.08	0.99	2.19	3.85	2.77	4.88	31.98
1885	69.0	75.9	68.8	63.5	55.1	39.2	28.4	12.3	13.3	30.3	47.2	56.7	46.09	6.16	6.16	8.07	4.58	2.30	0.64	3.14	1.80	0.72	0.41	3.69	2.62	34.41
1886	71.3	78.4	76.8	68.1	48.8	35.8	19.2	10.9	24.8	34.9	51.0	61.1	48.70	0.71	0.89	0.67	2.10	4.08	1.82	1.03	3.17	1.36	4.32	2.12	4.17	29.56
1887	71.9	77.5	78.2	71.0	44.3	25.0	22.9	11.5	20.7	32.4	50.7	65.6	49.59	1.32	2.44	4.49	7.72	2.22	0.74	3.67	3.33	3.56	1.80	1.27	2.55	32.50
1888	69.0	74.1	69.0	57.0	46.0	37.0	29.0	7.9	18.0	26.7	48.0	53.9	44.55	5.28	3.89	1.73	2.01	1.62	2.75	1.16	1.20	1.31	3.44	2.51	5.84	32.91
1889	66.0	73.0	72.0	63.0	48.0	35.0	37.0	22.0	16.0	39.0	49.0	59.0	49.08	3.87	4.21	0.25	1.54	0.66	1.51	1.38	1.55	1.34	0.30	3.56	4.00	24.18
1890	74.0	75.0	68.8	60.0	51.0	39.9	37.0	23.0	28.6	28.0	51.0	56.0	48.42	9.59	1.21	6.90	3.73	0.43	1.85	0.82	2.31	1.25	1.68	2.94	5.26	40.56
1891	70.0	69.0	70.2	69.0	51.1	36.5	33.0	26.8	23.1	27.7	50.8	58.3	48.10	2.24	45.9	3.81	0.68	2.20	3.34	2.08	1.27	0.98	2.69	1.63	2.54	26.55
1892	68.0	74.2	72.6	64.2	54.6	31.4	17.9	14.6	28.6	31.0	45.7	55.0	46.40	14.16	5.08	2.51	3.79	0.44	1.89	2.08	2.34	1.62	1.91	4.57	9.18	40.60
1893	72.0	76.0	71.0	64.0	53.0	34.6	22.0	6.6	15.0	32.0	45.0	57.0	45.68	5.49	5.57	0.58	3.31	1.66	2.03	1.33	1.60	1.30	2.52	4.32	3.06	32.77
1894	75.0	76.0	73.0	66.0	52.0	32.0	32.0	22.0	20.0	41.0	52.0	62.0	50.30	2.25	0.01	1.38	2.93	1.29	1.53	0.35	1.11	1.32	5.06	2.26	1.75	19 28
1895	72.7							14.0	16.9	35.5	53.9	62.1		2.23							1.44	0.66	0.99	0.49	2.63	

METEOROLOGICAL TABLES.—CONTINUED.

1839—MUSCATINE AND IOWA CITY.—1870.

Maximum and Minimum Temperature for the Years Named.*

YEAR.	JAN. Max.	JAN. Min.	FEB. Max.	FEB. Min.	MARCH Max.	MARCH Min.	APRIL. Max.	APRIL. Min.	MAY. Max.	MAY. Min.	JUNE. Max.	JUNE. Min.	JULY. Max	JULY. Min.	AUG. Max.	AUG. Min.	SEPT. Max.	SEPT. Min.	OCT. Max.	OCT. Min.	NOV. Max.	NOV. Min.	DEC. Max.	DEC. Min.	ANNUAL. Max.	ANNUAL. Min.
1839	60	0	63	-4	80	4	96	38	84	38	89	48	95	58	92	49	84	38	80	31	60	-2	48	-5	95	-5
1840	39	-17	71	-25	63	12	86	37	85	37	88	57	87	58	86	54	76	44	77	25	66	19	55	-2	88	-25
1841	52	-23	62	-14	68	18	77	27	90	31	96	49	96	56	96	48	96	36	72	18	60	-4	47	-8	96	-23
1842	52	-19	56	-13	84	13	84	28	86	33	92	43	94	50	96	42	92	35	80	23	69	-11	48	-21	96	-21
1843	50	-15	45	-19	38	10	78	5	88	27	90	40	95	55	94	46	92	45	84	12	56	10	44	8	95	-15
1844	41	-6	56	0	66	6	72	30	85	35	90	48	94	56	92	46	93	33	74	16	61	7	38	-6	94	-6
1845	58	6	66	6	77	8	86	16	82	31	88	54	98	50	93	48	92	30	72	16	60	-17	42	12	98	-17
1846	56	12	50	-8	72	20	82	28	86	38	82	54	94	44	91	54	92	42	80	16	62	2	54	8	94	-8
1847	40	-23	56	-10	66	0	86	13	87	30	86	40	92	42	86	42	84	36	86	8	74	7	63	-10	92	-21
1848	50	-8	50	4	70	8	80	22	84	35	88	31	85	48	86	48	84	33	72	27	50	5	44	-6	88	-8
1849	46	-24	48	-22	68	10	74	22	86	30	86	44	89	42	86	38	84	37	70	28	72	20	44	-12	89	-24
1850	46	-10	55	-14	64	10	78	18	86	24	88	40	94	50	94	50	84	30	80	22	66	16	44	-6	94	-10
1851	46	-16	52	0	78	12	70	24	82	22	85	44	97	44	85	52	91	30	79	18	51	14	56	-18	97	-16
1852	53	-23	52	0	80	3	64	20	82	29	90	40	94	45	92	44	84	35	76	30	58	7	52	0	94	-21
1853	54	-9	55	-11	66	5	71	27	81	34	91	49	87	46	92	41	89	37	75	10	60	15	48	-1	92	-9
1854	55	-14	60	-13	70	4	88	12	76	25	92	49	98	46	99	46	96	37	82	27	60	7	50	-4	99	-14
1855	64	-21	40	11	63	-2	87	24	86	27	91	35	95	55	96	53	92	35	84	15	67	10	60	-19	96	-23
1856	32	-26	42	-29	56	-17	77	27	90	40	97	50	93	55	91	40	91	28	82	25	54	4	42	-13	97	-26
1857	41	-30	57	-12	58	-5	65	13	83	29	89	38	97	45	93	47	88	36	74	[illegible]	[illegible]	0	52	-13	97	-30
1858	52	8	46	-17	70	1	78	24	81	39	96	52	89	52	99	46	87	42	85	30	52	4	48	15	96	8
1859	50	-13	51	-13	61	13	72	22	82	45	85	40	97	46	92	42	87	34	82	15	75	12	46	-22	97	-22
1860	48	-26	58	-20	72	16	84	18	89	28	92	48	94	50	95	45	89	40	87	24	69	-8	43	-22	95	-26
1861	39	-18	56	-15	64	8	73	28	78	35	89	51	97	47	99	47	88	40	74	28	65	5	62	-5	99	-18
1862	38	-23	42	-25	64	5	67	25	84	39	89	42	95	56	99	55	82	41	86	17	[illegible]	-15	52	-3	99	-23
1863	59	0	44	-17	57	12	82	38	80	36	93	42	94	49	91	36	93	36	66	18	61	-8	53	-24	94	-8
1864	55	-26	56	-15	60	0	74	32	90	32	92	47	94	55	91	50	92	36	68	23	59	0	54	-14	94	-26
1865	46	-10	48	10	70	-5	75	20	86	37	88	54	91	55	90	55	90	44	82	30	66	20	50	-17	91	-17
1866	47	-14	55	-20	60	4	76	22	84	35	90	48	94	60	85	43	85	31	82	30	72	-16	58	-2	94	-14
1867	45	-18	52	-18	47	-13	70	27	79	31	90	52	92	55	85	50	87	43	80	32	72	0	42	-2	92	-18
1868	50	-16	55	-26	75	3	78	18	84	46	92	47	96	53	92	48	81	32	73	30	63	18	50	-18	96	-18
1869	48	-14	62	-8	72	12	80	20	82	40	85	44	86	52	93	57	80	33	78	16	70	5	.....	-2	93	-14
1870	45	-5	57	-10	56	4	90	24	89	44	99	50	100	55	96	50	90	36	75	25	66	20	54	-11	100	-11

*Observations made by T. S. Parvin, at Muscatine, 1839 to 1860, and at Iowa City, 1860 to 1870.

METEOROLOGICAL TABLES—CONTINUED.

1880—DES MOINES—1895.

Maximum and Minimum Temperature for the Years Named.*

YEAR.	JAN. Max.	JAN. Min.	FEB. Max.	FEB. Min.	MAR. Max.	MAR. Min.	APRIL. Max.	APRIL. Min.	MAY. Max.	MAY. Min.	JUNE. Max.	JUNE. Min.	JULY. Max.	JULY. Min.	AUG. Max	AUG. Min.	SEPT. Max.	SEPT. Min.	OCT. Max.	OCT. Min.	NOV. Max.	NOV. Min.	DEC. Max.	DEC. Min.	ANNUAL. Max.	ANNUAL. Min.
1880	63	10	68	1	80	-3	84	26	93	44	93	48	94	53	96	51	87	41	77	26	62	0	49	17	96	-3
1881	42	-19	45	-8	52	6	81	11	88	40	96	54	98	56	103	57	93	40	83	32	60	6	36	10	103	-19
1882	51	-1	65	1	74	10	81	31	81	33	92	44	92	52	91	51	92	37	8	33	71	15	50	17	92	-1
1883	29	-26	50	-23	67	5	89	29	83	35	93	50	97	54	91	48	90	37	80	28	67	6	57	10	97	-26
1884	49	-30	54	-8	70	-6	74	26	80	35	95	47	95	55	91	49	92	43	[illegible]	28	64	2	50	18	95	-30
1885	47	-20	50	-20	63	7	76	26	92	28	93	44	100	54	90	46	87	45	77	29	66	21	55	-3	100	-20
1886	38	-24	51	-20	69	8	83	20	93	37	101	44	104	56	101	46	93	38	84	27	68	9	54	-19	104	-24
1887	41	-24	53	-15	72	9	86	18	93	39	93	45	101	52	100	45	92	40	82	13	73	-9	50	-12	101	-24
1888	43	-27	57	-20	72	-4	79	21	81	34	88	41	99	56	96	46	90	32	79	27	75	19	60	11	99	-27
1889	50	-1	52	-13	69	16	82	24	85	31	88	37	90	51	93	47	86	31	85	26	63	4	69	8	93	-13
1890	50	-18	59	-5	66	-8	83	25	89	32	96	49	101	55	97	48	89	33	79	22	67	19	36	3	101	-18
1891	47	6	55	-10	60	-5	81	20	83	34	90	49	88	49	93	40	90	39	81	28	67	-10	60	0	93	-10
1892	50	-26	50	-1	73	6	72	25	75	35	92	48	95	50	95	47	92	29	87	25	64	12	54	-16	95	-26
1893	42	-14	45	-16	74	1	80	22	83	33	90	47	95	56	94	42	98	30	83	19	65	-8	52	-10	95	-16
1894	55	-27	54	-8	74	4	87	28	90	36	99	43	104	52	100	47	93	37	82	30	66	4	65	-8	104	-8
1895	64	-14	64	-18	88	3	85	28	94	35	89	50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	94	-18

* Figures preceded by a dash (-) indicates below zero.

METEOROLOGICAL TABLES.—CONTINUED.

1874–KEOKUK–1895.

COMPARATIVE MEAN TEMPERATURE (DEGREES).

YEARS.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Average mean per year.
1874	75.5	80.4	76.7	67.0	55.4	36.7	31.2	27.7	29.4	38.0	44.0	66.7	51.30
1875	71.0	75.5	70.3	63.8	50.6	35.1	6.5	16.3	18.1	43.8	48.9	61.8	48.50
1876	69.7	76.4	75.8	64.4	51.8	38.2	18.8	33.8	34.2	31.6	52.6	63.5	59.31
1877	71.4	76.9	74.3	69.8	55.3	38.9	42.9	22.0	38.0	32.5	50.7	52.1	52.90
1878	70.6	81.5	77.7	67.3	51.3	44.0	23.8	34.9	38.4	50.4	58.8	66.2	55.17
1879	72.1	80.6	75.0	62.9	61.4	42.7	26.9	22.6	29.8	42.8	54.2	66.8	52.99
1880	73.9	77.7	77.5	65.4	51.2	31.5	21.1	41.3	36.3	40.0	53.8	68.9	53.46
1881	72.7	79.9	79.2	72.4	57.0	39.6	37.6	18.8	24.9	33.7	46.8	69.8	51.93
1882	71.1	72.4	73.4	66.1	58.6	42.8	27.7	28.1	33.5	41.7	53.7	56.8	52.64
1883	69.7	76.0	71.2	62.7	51.5	42.8	31.8	15.5	24.9	35.3	54.0	59.8	49.60
1884	71.5	75.0	72.0	71.1	58.4	40.6	23.0	18.7	27.5	37.3	50.6	62.3	50.65
1885	70.4	78.5	70.0	64.6	49.4	40.6	28.7	16.3	16.4	34.7	49.7	60.6	48.81
1886	76.7	77.5	77.1	68.2	57.6	38.5	21.3	14.7	26.2	26.5	53.6	64.1	49.61
1887	72.8	79.1	74.1	65.9	50.0	40.5	27.3	19.1	29.5	38.4	53.6	66.5	51.40
1888	70.3	75.7	70.8	60.0	48.6	39.2	32.2	13.6	25.7	34.2	53.2	58.0	48.29
1889	70.3	74.4	73.2	64.0	50.3	37.6	42.6	27.0	22.5	41.2	52.1	60.7	51.32
1890	76.4	[illegible]	71.2	62.7	54.0	44.0	31.8	28.9	32.8	32.6	54.9	60.1	52.45
1891	71.5	70.6	71.1	70.9	51.5	35.5	37.9	31.6	29.7	31.1	54.0	60.5	51.74
1892	73.0	74.6	74.8	67.2	57.2	36.4	25.9	19.6	33.6	36.2	49.2	58.1	50.48
1893	73.0	78.0	72.0	69.0	57.0	39.0	29.0	14.2	21.3	36.6	49.9	59.8	49.90
1894	76.0	78.0	77.0	68.0	56.0	37.0	35.0	28.0	26.0	45.0	54.0	63.0	53.80
1895	73.0	.....	.....	.....	.....	.....	.....	20.0	19.0	38.0	55.0	64.0	......

COMPARATIVE PRECIPITATION (INCHES).

YEARS.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Total for year.
1874	4.01	4.61	3.87	7.92	1.84	2.17	1.26	3.82	0.88	0.14	2.40	1.65	34.77
1875	8.33	12.70	3.83	5.30	2.71	0.59	3.93	0.61	1.84	1.07	0.89	6.70	48.10
1876	6.61	6.79	4.14	11.08	2.12	2.82	0.23	3.68	1.45	3.45	4.07	5.28	31.71
1877	7.82	6.90	2.52	3.61	7.01	3.05	3.50	0.51	0.15	3.76	4.21	5.55	49.19
1878	3.93	2.37	5.27	1.35	2.31	1.91	1.95	0.18	2.95	3.78	2.31	3.47	31.78
1879	2.41	1.98	4.57	1.12	0.28	3.91	1.45	[illegible]	0.53	1.72	1.55	1.46	22.51
1880	3.06	2.25	3.81	3.21	2.02	1.13	0.67	3.91	1.94	1.83	4.79	5.92	34.84
1881	8.70	3.08	0.86	4.10	8.01	2.59	1.70	0.50	2.58	2.42	3.12	6.65	42.40
1882	9.44	4.53	3.99	2.52	2.71	2.25	1.75	1.07	1.54	3.33	3.22	7.11	41.53
1883	5.88	3.15	1.34	1.76	6.95	2.09	1.20	1.24	6.13	1.07	2.97	4.87	38.65
1884	4.03	2.30	2.74	4.25	3.35	1.73	3.91	0.85	1.88	3.37	1.31	3.16	31.98
1885	6.97	2.29	5.98	3.77	2.59	0.88	1.96	2.44	1.14	0.17	2.33	2.59	34.11
1886	2.86	0.65	5.90	3.94	2.38	1.15	1.03	2.08	1.40	2.25	1.52	4.49	29.66
1887	1.14	1.57	2.38	3.13	1.98	1.18	2.73	1.48	5.19	0.76	1.84	2.54	26.92
1888	5.42	6.00	2.07	2.13	1.62	2.83	1.61	1.57	2.17	2.43	1.85	5.06	34.80
1889	2.97	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.08	1.89	0.90	1.04	3.60	5.72	34.75
1890	8.41	2.49	1.77	4.46	2.44	1.87	0.63	1.81	1.09	2.43	1.79	3.34	24.97
1891	3.66	2.77	6.10	0.49	1.49	3.69	1.33	2.59	1.32	2.27	5.06	2.56	33.15
1892	2.65	6.18	1.07	3.21	0.71	3.16	1.50	1.96	1.61	2.91	6.15	6.34	37.45
1893	2.37	2.00	1.16	3.18	0.33	2.29	0.90	0.92	1.76	2.65	5.41	4.36	24.91
1894	2.85	0.37	0.51	4.86	1.28	2.24	1.16	2.24	1.46	2.52	2.75	3.06	25.10
1895	2.61	.....	.....	.....	.....	.....	.....	1.44	0.19	1.05	3.38	3.05	......

METEOROLOGICAL TABLES.—CONTINUED.

1874–OMAHA–1895.

Latitude, 41° 0' N.; longitude, 96° 0' W. Elevation above sea level, 1,113 feet. Observations represent Western Iowa.

COMPARATIVE MEAN TEMPERATURE (DEGREES).

YEARS.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Average mean for year.
1874	73.1	79.6	77.2	61.7	53.6	36.0	28.2	22.2	24.0	33.1	44.7	66.1	49.12
1875	70.9	74.2	70.0	62.5	47.6	32.6	32.9	10.8	25.7	30.2	44.9	62.9	47.18
1876	68.2	75.2	74.9	62.2	49.9	33.1	19.0	26.7	30.4	29.2	51.1	63.0	48.51
1877	69.1	75.6	72.6	66.4	51.2	36.0	38.9	30.2	37.3	33.9	50.1	60.3	50.96
1878	69.7	79.0	76.8	64.1	52.0	43.8	21.5	28.8	36.7	47.9	54.6	58.1	52.00
1879	72.7	78.5	75.0	62.5	61.5	40.3	17.3	21.7	26.8	41.0	53.6	60.8	50.06
1880	73.0	76.7	74.2	62.9	40.2	26.4	18.4	34.5	30.9	35.9	51.2	69.4	50.22
1881	74.9	78.9	70.2	66.0	54.4	38.9	36.0	11.8	17.0	37.6	44.4	67.8	50.56
1882	71.0	71.7	73.1	67.5	57.2	39.7	24.6	27.5	36.3	40.2	52.0	56.6	51.11
1883	69.1	75.7	71.3	0.8	44.4	39.2	[illegible]	11.9	21.7	34.6	53.6	57.3	47.76
1884	72.3	74.5	70.3	68.6	57.3	39.3	17.3	17.0	19.4	35.3	47.5	61.6	48.36
1885	71.2	77.0	69.9	64.5	49.8	39.9	28.6	12.2	16.6	36.1	50.1	59.8	47.47
1886	70.2	77.3	75.6	65.1	48.3	34.3	17.9	11.9	24.4	31.9	60.9	65.1	48.52
1887	72.4	76.3	72.0	65.3	50.7	39.6	23.6	11.8	18.2	38.0	54.5	66.1	48.95
1888	70.0	77.6	70.3	61.3	48.4	36.7	30.4	8.0	25.9	28.8	52.5	55.9	47.15
1889	68.7	74.8	74.0	63.6	52.2	35.3	30.4	22.8	21.1	40.2	52.4	61.6	50.50
1890	74.0	78.8	70.5	63.7	52.0	42.0	35.0	18.0	25.0	33.0	55.0	60.0	50.58
1891	69.0	71.0	74.0	70.0	53.0	34.0	35.0	20.0	20.0	29.0	54.0	59.0	48.16
1892	71.0	76.0	73.9	68.0	57.0	38.0	22.0	18.0	30.0	34.0	48.0	54.0	49.08
1893	73.0	77.0	76.0	68.0	55.0	27.0	37.0	16.0	20.0	34.0	48.0	59.0	47.01
1894	74.0	77.0	75.0	67.0	55.0	37.0	33.0	21.0	22.0	43.0	51.0	65.0	50.22
1895	70.0	.....	.....	.....	.....	.....	.....	19.0	21.8	37.4	58.0	64.0	......

COMPARATIVE PRECIPITATION (INCHES).

YEARS.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Total for year.
1874	6.93	0.54	2.08	7.18	1.45	1.05	0.54	0.32	0.92	1.49	2.01	1.24	25.75
1875	10.95	10.01	7.77	2.55	1.16	0.13	1.03	0.20	0.51	1.24	3.06	4.25	19.89
1876	8.47	7.30	6.27	4.93	0.69	1.15	0.16	0.23	0.40	3.18	2.65	2.07	32.51
1877	8.30	0.96	3.13	2.05	5.86	1.39	2.14	0.53	0.44	1.26	6.24	8.62	40.92
1878	8.48	7.66	2.48	3.22	0.55	0.29	0.27	1.33	0.14	3.04	3.97	5.77	37.05
1879	4.09	3.17	1.51	1.43	3.64	4.25	1.75	0.07	0.93	2.17	1.77	5.53	30.41
1880	3.14	5.36	7.10	2.91	3.54	1.70	0.28	0.90	0.14	0.50	0.55	3.40	29.52
1881	5.56	5.89	1.65	8.36	4.84	1.29	1.56	0.61	3.09	0.82	4.23	7.94	45.75
1882	12.05	6.76	0.95	0.51	5.09	1.42	0.92	0.74	6.60	0.79	5.91	4.91	45.59
1883	12.70	4.79	3.39	4.53	5.63	0.64	0.73	1.01	1.00	0.52	3.20	11.29	48.83
1884	6.11	10.35	7.07	4.91	5.81	0.42	0.72	0.73	1.42	4.91	3.88	1.45	47.68
1885	2.67	9.24	6.99	2.50	3.86	0.73	1.17	0.41	0.47	0.33	0.31	4.43	33.14
1886	1.50	0.69	4.53	4.45	1.33	1.54	1.46	1.15	0.36	1.31	7.77	4.58	24.67
1887	4.56	2.02	3.94	2.14	0.72	0.89	1.11	0.49	1.00	3.48	0.88	1.39	19.92
1888	3.86	2.55	3.41	0.24	1.19	0.12	0.96	0.58	0.74	4.25	2.95	4.36	20.88
1889	5.44	4.94	2.90	1.74	0.34	0.87	0.58	1.62	0.23	0.53	1.19	2.67	22.57
1890	5.04	3.74	1.02	2.50	1.09	1.01	0.08	1.44	0.54	1.35	1.55	2.72	22.08
1891	6.66	3.54	2.02	1.76	5.37	0.37	2.07	2.11	1.02	2.26	2.80	4.94	39.92
1892	1.51	3.64	2.50	1.63	1.28	0.14	1.79	0.42	0.54	2.74	4.82	8.43	29.44
1893	7.11	3.03	3.62	1.72	0.12	0.43	1.13	0.28	0.97	1.29	3.12	3.84	26.66
1894	4.74	0.61	0.36	2.48	2.94	0.11	0.94	0.51	1.30	0.91	2.31	0.61	17.82
1895	4.31	.....	.....	.....	.....	.....	.....	0.35	0.62	0.99	3.56	1.11	......

METEOROLOGICAL TABLES—CONTINUED.

1889—SIOUX CITY—1895.

Elevation above sea level, 337 feet.

Year.	Comparative mean temperature (degrees). June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Average mean for year.
1889	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1890	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1891	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1892	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1893	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1894	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1895	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Year.	Comparative precipitation (inches). June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Total for the year.
1889	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1890	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1891	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1892	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1893	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1894	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1895	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

NORMALS OF TEMPERATURE FOR TWENTY YEARS.

The following table is compiled from observations of Prof. T. S. Parvin, from 1861 to 1871, and from those of Prof. G. Hinrichs, of the Iowa Weather Service, from 1871 to 1880, and are the result of nearly thirty thousand observations, which were made at Iowa City. The values given are for each decade of each month:

Months.	Mean temperature, degrees F. I.	II.	III.	Month.	Rainfall in inches. I.	II.	III.	Month.
January	.52	.60	.60	1.72	18.7	19.1	20.3	19.4
February	.55	.55	.70	1.80	22.0	24.4	27.1	24.4
March	.80	.95	1.10	2.85	29.6	32.2	37.3	33.1
April	1.20	1.20	1.10	3.50	42.3	47.9	51.6	47.6
May	1.20	1.20	1.35	3.75	55.5	60.0	63.8	59.9
June	1.65	1.65	1.55	4.85	66.3	68.8	71.9	69.0
July	1.65	1.27	1.20	4.12	73.7	74.1	73.8	72.9
August	1.42	1.65	1.85	4.92	73.1	71.8	69.6	71.2
September	1.80	1.55	1.25	4.60	66.4	62.9	59.4	62.9
October	1.10	.85	.90	2.85	55.0	50.3	45.1	49.9
November	.95	.82	.70	2.47	40.7	35.8	29.2	35.3
December	.60	.50	.50	1.60	26.3	23.2	20.2	23.1
Total for the year (mean)	......	......	......	39.14	......	......	......	47.47

AVERAGE TEMPERATURE.

FOR A SERIES OF YEARS, BY MONTHS.

Station.	Number of years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Algona	11	10.7	17.3	25.5	43.6	59.3	67.7	73.3	70.2	59.9	46.8	31.1	17.8	43.6
Davenport	20	20.8	26.1	34.5	49.8	61.0	70.4	75.0	72.5	64.2	52.1	37.3	28.0	49.8
Des Moines	13	17.9	23.6	34.2	50.6	60.6	69.9	74.4	72.1	63.6	52.0	36.9	26.5	48.3
Dubuque	19	18.1	24.3	31.4	48.6	60.2	68.9	74.2	71.5	62.7	50.8	35.4	26.1	47.7
Iowa City	16	18.9	23.9	32.3	48.1	60.1	68.8	74.1	71.3	63.0	50.2	35.3	27.6	47.4
Keokuk	20	28.6	29.1	47.2	51.9	62.8	72.1	77.1	74.4	66.1	54.1	40.0	29.8	49.0
Muscatine	52	20.2	24.7	35.0	46.9	59.8	66.1	73.6	70.5	62.4	50.3	35.1	24.3	43.9
Omaha	19	18.8	25.6	45.4	50.5	62.3	71.1	76.3	74.0	63.9	52.7	34.4	25.4	49.4

Average annual for the State, 45.5.

Average for the six growing months, 63.8.

RAINFALL FOR FORTY-FIVE YEARS.

The following is a record of the rainfall in Iowa for a period of forty-five years as observed at Muscatine, Iowa, by J. P. Walton, Rev. J. Ufford, S. Foster and Prof. T. S. Parvin, voluntary and Smithsonian observers:

Year.	Inches.	Year.	Inches.	Year.	Inches.	Year.	Inches.	Year.	Inches.	Year.	Inches.	Year.	Inches.	Year.	Inches.	Year.	Inches.
1846	34.55	1851	74.50	1856	41.94	1861	44.25	1866	32.86	1871	36.11	1876	58.37	1881	45.66	1886	34.22
1847	28.50	1852	79.98	1857	34.85	1862	55.16	1867	32.24	1872	35.44	1877	44.78	1882	46.67	1887	28.30
1848	30.62	1853	41.32	1858	58.45	1863	26.83	1868	40.91	1873	28.42	1878	39.30	1883	41.12	1888	28.89
1849	59.16	1854	23.66	1859	25.96	1864	33.77	1869	48.59	1874	24.79	1879	33.82	1884	45.49	1889	33.47
1850	40.98	1855	[illegible]	1860	25.10	1865	34.21	1870	24.61	1875	37.59	1880	35.78	1885	29.14	1890	32.87

MEAN FOR EACH MONTH DURING THE FORTY-FIVE YEARS.

January	1.52	March	2.71	May	4.80	July	3.95	Sept	3.90	Nov	2.54
February	2.08	April	3.37	June	4.78	August	4.41	October	3.01	Dec	2.35

AVERAGE PRECIPITATION.

BY MONTHS FOR A SERIES OF YEARS—IN INCHES.

STATIONS.	Number of years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Algona	16	0.92	1.57	1.52	2.20	3.46	4.62	3.04	3.82	3.25	2.21	1.50	0.99	277.77
Davenport	20	1.74	1.63	2.16	2.75	4.49	4.39	4.81	3.82	3.17	2.16	2.06	1.33	34.79
Des Moines	13	1.40	1.31	1.45	2.56	4.62	5.85	3.19	3.11	3.40	3.58	1.99	1.49	35.06
Dubuque	18	1.69	1.56	2.31	2.77	3.96	5.09	4.37	3.49	4.31	3.65	2.14	1.85	37.09
Iowa City	23	1.74	1.55	2.54	3.13	4.21	5.02	4.35	4.57	4.24	3.11	2.64	1.74	39.77
Keokuk	20	1.79	1.80	2.16	2.96	4.64	4.92	4.19	3.12	3.53	3.15	2.03	1.96	35.87
Muscatine	43	1.81	2.08	2.79	3.41	4.39	4.86	3.91	4.58	3.12	3.04	2.90	2.29	33.22
Omaha	19	0.67	0.73	1.46	3.11	4.51	5.84	5.15	3.42	3.26	2.77	1.23	1.01	33.02

Average for the State, 34.88 inches.

Average per month of crop season, 3.10.

Total for six growing months, 23.25.

FINANCIAL STATEMENT.

RECEIPTS

Warrants on State Treasurer June 30, 1893, to June 30, 1894		$ 4,816.18	
Warrants on State Treasurer June 30, 1894, to June 30, 1895		5,468.94	
			$ 10,285.12

EXPENDITURES.

Secretary's salary June 30, 1893, to June 30, 1894	$ 1,200.00		
Board meetings June 30, 1893, to June 30, 1894	571.51		
Contingent expenses June 30, 1893, to June 30, 1894	3,044.68		
		$ 4,816.18	
Secretary's salary June 30, 1894, to June 30, 1895	$ 1,200.00		
Board meetings June 30, 1894, to June 30, 1895	329.50		
Contingent expenses June 30, 1894, to June 30, 1895	3,939.44		
		$ 5,468.94	
			$ 10,285.12

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