

State control of tuberculosis.

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Chapin, Charles V. 1856-1941.
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Publication/Creation

Providence : Snow & Farnham, 1900.

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STATE CONTROL OF
TUBERCULOSIS.

BY

CHARLES V. CHAPIN, M. D.,

SUPERINTENDENT OF HEALTH OF THE CITY OF PROVIDENCE.

PROVIDENCE :
SNOW & FARNHAM, PRINTERS,
1900.

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THE Trustees of the Fiske Fund, at the annual meeting of the Rhode Island Medical Society, held at Providence, Sept. 6, 1900, announced that they had awarded a premium of two hundred dollars to an essay on "State Control of Tuberculosis," bearing the motto :

"Festina lente."

The author was found to be CHARLES V. CHAPIN, M. D., of Providence, R. I.

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THE STATE CONTROL OF TUBERCULOSIS.

To successfully control a disease it is necessary to know how it is caused. For a century or more, many acute observers have been convinced of the contagious character of tuberculosis. Experiments were long ago undertaken to prove its communicability, and some of them, particularly those of Villemin, were successful. The intelligent medical world was not, therefore, unprepared for the discoveries of Koch. By him was discovered the essential factor in the causation of the disease. His experiments were a complete demonstration that the disease we are considering is due to the action upon the tissues of the tubercle bacillus. The bacillus is the cause of the disease. Scores of competent observers at once attempted to prove or disprove Koch's views. This is the proper fate of every important discovery and of every alluring error. Eighteen years have passed, and no person able to judge denies the causative relation of the bacillus to the disease. The definition of the disease is made by the facts. Whatever abnormal condition is produced in the tissues by the bacillus is tuberculosis.

DISTRIBUTION OF THE DISEASE.

There are various forms of tubercular disease occurring among both men and animals. Of the forms occurring in the human species, phthisis is the most common. It is generally said to cause one-seventh of all deaths, but that, at present, is scarcely true, for, owing to the

diminution which has, of recent years, taken place, it does not, under favorable conditions, cause more than one-ninth or even one-tenth of the deaths. It is difficult to determine just what proportion of tubercular deaths is due to other forms. The recent Royal Commission considered that about one-quarter of tubercular diseases are not phthisical. In Providence, however, probably not over 15 per cent. are non-phthisical. It is only in infancy that non-phthisical forms are the most prevalent. In Massachusetts, under one year, the non-phthisical are to the phthisical as 116 to 11, and between the first and fifteenth year, as 61 to 37. The non-phthisical forms of the disease we are considering are returned, sometimes, as "tuberculosis," sometimes as tubercular meningitis, laryngitis, etc.; again, as hydrocephalous or lupus. Diseases of the bones and joints and intestinal diseases, especially in young children, are very commonly due to tubercular infection. In this connection, it must be remembered that the deaths do not by any means represent all the cases. Tuberculosis is not infrequently recovered from, though it leaves its traces in the organism. Marks of tubercular infection are frequently found at the autopsy of persons who have died of other affections. Knopf says that traces of tuberculosis are found in 25 per cent. of all such autopsies. In the New York hospitals it runs as high as 30 per cent., and in Vienna, where the disease is particularly prevalent, the marks of tuberculosis are said to be found in 85 per cent. of all autopsies.

A very large number of species of the lower animals are also subject to tuberculosis, particularly domestic animals or wild animals kept in confinement.

To tuberculosis acquired naturally, the bovine species appears to be more susceptible than are other animals. Next in susceptibility among the domestic animals are swine. Goats and fowls also contract it, and sheep sometimes have it. It is very readily inoculated into rabbits and guinea pigs. Parrots and canaries have been known to have it, but it is very difficult to produce it in sparrows. The carnivorous animals are very slightly susceptible, though wild animals kept in confinement, as lions and tigers, occasionally contract it. As a rule mammalia are more susceptible than the other vertebrate classes. Birds come next, and it has only recently been discovered that fishes sometimes have this disease. Even in the bovine species, tuberculosis is not uniformly distributed. The statistics of the Leipsig slaughter-house for 1895 showed that of oxen 28.14 per cent. had tuberculosis; of heifers, 20.35 per cent.; of cows, 43.51; of bulls, 23.83, and of calves, 0.18.

It would be of very great interest to know just how extensively tuberculosis prevails among the herds of this and other civilized countries, but we have no accurate statistics, at least for this country. It is probably much more common in certain parts of Europe than it is in any part of the United States. It is said that 27 per cent. of all animals slaughtered in Saxony have tuberculosis. No such figures have been obtained in this country, though, in Philadelphia, it is said that a year or two ago 20 per cent. of the slaughtered animals were infected. In the New York slaughter-houses, 7 per cent. have been found infected, and, at the Brighton abattoir, 5 per cent. of Eastern cattle. In Massachusetts, where the tuberculin test is required

for all animals imported into the State, it is said that 10 per cent. of the animals tested prove to be tuberculous. There is almost no tuberculosis among the cattle on the ranges in the West, and the most is found among the dairy herds which supply the Eastern cities. Veterinarians seem to be very generally agreed that tuberculosis among cattle has increased considerably during the last few years, at least until steps began to be taken for its eradication.

It has been suggested that the tuberculosis of man and of the other animals may not be identical. The bacilli which are found in the lesions of the different species are not always exactly the same. There are slight morphological and cultural differences between the bacilli usually found in man and cattle. The bovine bacilli are usually slightly shorter and straighter, and their growth upon artificial media is less luxuriant, and these characters are quite consistent through several generations of artificial cultures. There are some differences, also, in regard to the degree of virulence of the different forms. Theobald Smith, who has given special attention to this subject, has rarely found the bovine type in human subjects. He is, however, far from holding that the different types may not pass from one species to another. Recent bacteriological work seems to show that the morphological and physical characters of most species of bacteria can be considerably changed, usually slowly, sometimes rapidly, by change of environment. Thus, although ordinarily the tubercle bacillus does not grow at a temperature below 98° F., it can be made to do so by careful manipulation, by gradually reducing the temperature for successive generations. The general

opinion seems to be that such slightly different forms as the human and bovine bacillus may readily pass one into the other; moreover, as will be seen, there is considerable evidence to show that the disease is frequently transmitted from animals to man and not rarely, *vice versa*. There are many who go so far as to think the evidence shows that almost all human tuberculosis is derived from the lower animals. One argument for this, which has been elaborately presented, is that the prevalence of the disease in the human and bovine species is co-extensive, and that human tuberculosis is not found where there are no domestic animals affected with this disease. This argument will not, however, bear close investigation, for right in our own section of the country, at Nantucket and on Cape Cod, tuberculosis among cattle is very rare, but is extremely common among human beings.

While the bacillus is the essential cause of this disease, there are, of course, many other factors in its production. There are, probably, differences of individual susceptibility to all infectious diseases, and this difference appears to be very marked as regards tuberculosis. It has long been believed that a poorly nourished body is one of the chief factors in the causation of individual cases of the disease. There are certain physical characteristics which are difficult to define, but not so difficult for the practiced eye of the physician to recognize, which are indicative of a tubercular disposition. It is through the inheritance of such characters that heredity has its share in the spread of this disease. The disease itself is rarely inherited, but the susceptibility to it frequently is. It is always difficult to demonstrate the relative import-

ance of heredity and environment, but most physicians have seen so many cases where the influence of heredity appeared to be very great, that most are convinced that this is a very important factor. Law reports an interesting case where he found eleven cows of a certain herd infected with tuberculosis. These eleven were all of one family, distinct from the rest of the herd. The actual inheritance of tuberculosis does sometimes take place. Calves killed immediately after birth are sometimes found to be tuberculous. In the Munich slaughter-house this is found only once in 100,000 cases, and in Lyons the proportion was not much greater. Most European veterinarians consider it a great rarity. It appears to have been seen more often in the United States. The Maine cattle commissioners report having met with it in sixty cases.

What are called unhygienic surroundings, overcrowding, impure air, especially dust-laden air, lack of sunlight, insufficient clothing, and improper food are all good friends of the tubercle bacillus. The State may do much to improve the conditions of life, and, in this way, indirectly control the spread of tubercular disease, but it is not this indirect form of State control which will be considered in this paper.

METHODS OF EXTENSION.

That tuberculosis is contagious was incontestably demonstrated by Koch. The difficulty of demonstrating the contagiousness of a disease clinically is very great. For years physicians have felt that such evidence was very strong, and, not long since, the committee on collective investigation of the British Medical Association attempted to secure evidence which would

satisfactorily prove or disprove the point at issue, but, although several hundred cases were reported, it was shown in an able paper by Langstaff that they were not much more numerous than the coincident affection of the two persons could be expected to occur, according to the law of chance. It has, however, been proved beyond question that among animals the disease may be and is transmitted from one individual to another. The identity of the lesions in man and animals, and the fact of the universal presence of the bacillus in these lesions renders it certain that tuberculosis in man also is a contagious disease. There can be no question that tuberculosis is only caused by the tubercle bacillus, and that the tubercle bacillus does except under extraordinary conditions, not, grow outside of the human body.

In order to grow the tubercle bacillus, it is necessary to exercise great care in the preparation of the culture medium. Furthermore, growth will very rarely take place except at the temperature of the body. The conditions are such that it can be said to be strictly parasitic in its habits of life. If any animal becomes infected, the germs must have been derived mediately or immediately from some other animal. While the bacilli do not grow outside of the body, they may remain alive for a considerable length of time. They are not, however, so resistant to destructive agencies as are many bacteria. Exposure to sunlight very speedily destroys them, sometimes in a few minutes. Drying, however, does not destroy them. Dried sputum has been shown to retain its virulence for three months, and doubtless, at times, will retain it for a much longer period. The bacillus is readily

killed by heat, exposure to a temperature of 60° C. for 15 minutes proving fatal. It is, however, quite resistant to dry heat. It is killed by disinfectants of ordinary strength, but the action of corrosive sublimate upon sputum requires a strength of 1 to 500, as it forms inert compounds with the albuminous matter of the sputum.

The presence of the tubercle bacillus in the dust of hospitals, churches, theatres, schools, dwellings, and streets has been much discussed. A considerable number of investigations have been made to determine its presence in different localities. Some years since, Webb, in Philadelphia, found it in the air of places of public assembly. Hance found it in the air of Adirondack sanatoria, killing 5 out of 25 Guinea pigs which he inoculated. Gardiner did not find it in 8 tests made at a Colorado Springs hotel. The most careful and complete experiments were made by Cornet. The following table shows the results of his work :

| Nos. | PLACES FROM WHICH SAMPLES OF DUST WERE TAKEN. | Number of Inoculated Animals. | Died of Tuberculosis. | Died of Other Diseases. | Total. | Died of Infectious Dis- eases. Percentage of Inoculated Animals. | Remained Well. |
|------|---|----------------------------------|-----------------------|-------------------------|--------|--|----------------|
| 1. | In the seven hospitals..... | 94 | 20 | 52 | 72 | 76.6 | 22 |
| 2. | In the three insane asylums..... | 33 | 3 | 16 | 19 | 57.5 | 14 |
| 3. | In two prisons..... | 14 | 0 | 6 | 6 | 42.0 | 8 |
| 4. | Inhalation experiment room..... | 4 | 2 | 0 | 2 | 50.0 | 2 |
| 5. | Private patients..... | 170 | 34 | 91 | 125 | 73.5 | 25 |
| 6. | Poliklinik, orphan asylum, etc .. | 28 | 0 | 14 | 14 | 50.0 | 14 |
| 7. | Surgical halls..... | 8 | 0 | 1 | 1 | 12.5 | 7 |
| 8. | Streets and hygienic institute.... | 41 | 0 | 16 | 16 | 39.0 | 25 |
| 9. | Streets alone..... | .. | .. | .. | .. | 55.0 | .. |
| | Totals..... | 392 | 59 | 196 | 255 | 65.05 | 137 |

From this table we can make the deduction that the danger to the inoculated animals of tubercular infection was in the hospitals 47.6 per cent., in the insane asylums 17.6, and in private dwelling houses of consumptive patients 43.6. Cornet's experiments showed that invariably, where the tubercle bacillus was found the patients did not restrict themselves to the use of a spit-cup, but expectorated, also, upon the floor or into a pocket handkerchief. He succeeded only in a single instance in making an animal tuberculous where the patients had surely restricted themselves to the use of the spit-cup. Twenty-nine of his samples of dust were taken from places not especially frequented by tuberculous persons, such as general hospitals, an orphan asylum, the hygienic museum, public stairways, and, in nine instances, from streets. These samples were inoculated upon 873 animals, not one of which became tuberculous. These experiments tend to make it quite certain that the tubercle bacillus is not very widely distributed. There is not much chance of meeting with it except in the close neighborhood of a consumptive or in apartments which have been for some time occupied by a consumptive. Further investigations of the distribution of the tubercle bacillus would be very desirable, but from those already made and from what we know clinically of the spread of this and other communicable diseases, it is entirely likely that the conclusions of Cornet would be fully verified. Strauss examined the saliva of a number of persons who had the care of those sick with phthisis, and found bacilli present in a few of them. It has been demonstrated by very many observers that the expired breath contains no bacteria of any kind. With the conditions

that prevail in coughing, sneezing, and sometimes even in talking, it is otherwise. Under such conditions there appears to be a fine spray thrown out, in the droplets of which bacteria may be found, and tubercle bacilli have thus been shown to be given off from phthisical patients. This spray, however, extends only a few feet from the patient. Experiment, then, seems to show that ordinarily quite close contact is necessary for contagion in this disease. Clinical evidence also supports this view. Of course in the majority of cases of marital contagion which have been recorded, the intimacy was close. Of 213 cases of probable contagion collected by Martin, one-half were marital. Cornet's investigation of the Catholic Nursing Orders in Germany, before precautions were taken to prevent contagion, showed that a very large number succumbed to this disease. Of 2,099 deaths, 1,320 were due to tuberculosis, and of course in all these cases there was close contact between the nurse and the patient.

The evidence, then, seems to be very strong that the tubercle bacillus is not widely distributed outside of the body, that it is not found in the air except close to the patient, and not then in any quantity if proper precautions are taken. Contagion is found only in the air close to the patient, on the patient himself, and on articles which the patient or his secretions have touched. Probably the same conditions are necessary for contagion from animals.

There are three avenues of infection :

First, through the skin.

There are a number of cases of persons who have been inoculated through the skin. The celebrated

Laennec died of pulmonary tuberculosis which was thought to be contracted through the accidental inoculation of his finger at an autopsy. A more recent case and one concerning which there is little doubt was reported by Pfeiffer, who tells of a veterinarian whose finger was inoculated, whose joints later became involved, and who finally died of the pulmonary form of the disease. Law and Ravenal both report cases of the accidental infection of the hands of veterinarians, and in the case reported by the former, the extension of the disease was only prevented by amputation. Knopf had a similar case in a nurse who became infected while dressing a tuberculous wound. Ernst reported a case of infection of the tongue. Heron, in evidence presented to the Committee on Collective Investigation, in 1890, reported seventy-three articles dealing with this subject. A considerable number are also reported by Senn in his surgery. Lindeman, Jacobi, and Knopf report a number of cases of infection through the rite of circumcision. There are also on record cases due to the common practice of tattooing.

It can thus be seen that the danger of infection through the skin is a real one. Nevertheless, the evidence shows that the danger is very slight, and may be neglected in any measures undertaken for the state control of the disease.

Second, through the respiratory tract.

It is generally believed that this is by far the most common avenue of infection. This view is based chiefly upon the facts that the pulmonary is the most common form of the disease, and that the lungs are, in such cases, involved to a very much greater degree

than are other organs. It is probable that in the main this reasoning is correct. But it does not necessarily follow that because the lungs are chiefly involved that they were the seat of the primary infection. Woodhead has shown that infection through the intestinal wall may leave very few traces there, the most important lesions being subsequently found elsewhere in distant organs, such as the thoracic glands.

From the time of Koch, many experiments have been tried to produce pulmonary tuberculosis by the inhalation of dust containing the living bacilli. Most of these experiments have been unsuccessful. The attempt has also been made to induce it by the inhalation of spray, such as was referred to as given off from consumptive patients during sneezing and coughing. These experiments have been more often successful, but not invariably so. It seems to be quite certain from the experiments of Cornet that have been referred to, and from the observations of many careful investigators, that pulmonary infection is not readily induced. The breathing of a few bacilli by a healthy person is not likely to cause the disease. Chance contact with bacilli in the dust of the street, which has been much dreaded, probably rarely gives rise to the disease. Most of those who have studied the contagion of this disease clinically, as the Committee on Collective Investigation, Heron, Martin, Russell, and Cornet, believe that close and prolonged contact is necessary, in most cases, to produce infection. Infection is not carried far by the air. This accords with the known facts in regard to the transmission of other diseases. Scarlet fever and diphtheria do not pass from one tenement to another in the same house unless there is an actual

passage of infected persons. The carrying of contagion from the sick to the well by a third person is not common. Physicians rarely carry contagious diseases.

It seems most reasonable to believe that the majority of cases of consumption are due to primary infection of the pulmonary tissue, but this is by no means proved. It may be that future investigation may change this view. Even now, there are many who hold to the contrary. Knopf believes that fully as many cases of tuberculosis receive their infection through the alimentary canal as through the respiratory mucous membrane.

Third, through the alimentary tract.

Medical literature contains the record of many cases of tuberculosis which are presumably due to infection through the alimentary canal, usually from the ingestion of milk supposed to be tuberculous. Sometimes, however, as in cases reported by Sherman of San Francisco, the infection was caused by kissing or putting infected articles in the mouth. In many of these reported, the evidence of the source of the infection was by no means certain, and in not a few of them, infection through the alimentary canal was a possibility rather than even a probability. Ernst received 1,013 answers to a circular sent out to physicians and veterinarians, asking for reports of cases of tubercular infection through the medium of milk. Although quite a number of cases were reported, it was not possible in many of them to exclude, with any degree of certainty, other sources of infection. It is thus seen that clinical evidence of infection through the

alimentary canal is not very strong. But such a result might well be expected. It is difficult to trace contagion in any disease, and particularly so in tuberculosis, a disease which is slow in developing, and which is extremely common.

There is certain statistical evidence which indicates that infection frequently takes place through the alimentary canal, probably by the ingestion of milk. Tubercular disease of the digestive organs is much more frequent among young children and particularly infants under the age of one year than at any other age. Such children, of course, live largely on a milk diet, and if tuberculosis is transmitted through the medium of milk, we should expect intestinal and similar forms of the disease to be more prevalent at these ages. Again, statistics show that intestinal forms of tuberculosis have not, of late years, diminished nearly as much as has the pulmonary form. The report of the Royal Commission states that tuberculosis among children under one year of age has actually increased in England and Wales. In most places, however, cases in infants have diminished somewhat in frequency. It is not, of course, to be assumed that all cases of tuberculosis in young children are due to milk infection. Yet as there is good reason to believe that tuberculosis among dairy animals has of late years increased, the fact that tuberculosis retains a stronger hold in infancy than in later life, tends to support the view that, in the young, milk infection is no inconsiderable source of the disease.

The following table illustrating the distribution of the different forms of tuberculosis in Glasgow, also throws some light on this subject :

1890-5. GLASGOW DEATH RATES PER 100,000.

| | All Causes. | Phthisis. | Other Tubercular Diseases. | All Tubercular Diseases. | Percentage not Phthisis. |
|---|-------------|-----------|----------------------------|--------------------------|--------------------------|
| | | | | | |
| City..... | 2,336 | 230 | 91 | 321 | 28.3 |
| Average of three districts with | | | | | |
| (1) Highest death-rate from Phthisis..... | 3,256 | 328 | 125 | 454 | 27.5 |
| (2) Phthisis death rate nearest mean of city..... | 2,197 | 213 | 95 | 309 | 30.9 |
| (3) Lowest Phthisis death-rate..... | 1,692 | 157 | 67 | 225 | 30.2 |

It is seen that all tubercular deaths most prevail where the general death rate is greatest, and there also phthisis is most prevalent, but the other tubercular diseases are relatively less prevalent than in other districts where there is not only less phthisis, but a much better condition generally, as is indicated by the general death rate. It can scarcely be maintained, therefore, that the other forms of tubercular disease occur as a direct result of the frequency of infection afforded by the prevalence of phthisis. Chalmers who prepared the above table states that in the better class districts there is a greater consumption of milk than in the slums, where the other tubercular diseases form a relatively smaller proportion of the tuberculous death rate.

Woodhead states that of 127 cases of tuberculosis in children, in which autopsies were made, the mesenteric glands were involved in 100. He assumes from this

that the source of infection in these 100 cases was, in all probability, through the intestines. In fact, in many cases, he could trace the infection from the intestinal wall up through the mesenteric glands to distant organs of the body. Woodhead also believes, from pathological evidence, that infection not rarely takes place through the tonsils, this often being the source of the tubercular infection of the cervical glands.

A great deal of experimental work has been done upon the production of tuberculosis by way of the alimentary canal. A good many examinations have been made to determine the frequency with which tubercle bacilli may be expected in the milk supply. There has been much discussion as to the occurrence of the bacilli in the milk of tuberculous animals. It has been claimed by some that they will not be found in the milk unless the udder is involved; but it has been shown that this is not true. Milk is much more likely to be tuberculous when the udder is seriously involved, but it does occur when no signs of disease can be detected. Ernst examined microscopically the milk of thirty-six animals, which were tuberculous but had sound udders and found bacilli in the milk of twelve. They were found equally in the milk itself and in the cream. In fifty-six samples of milk and thirty-three samples of cream, taken from the general supply of the City of Boston, no bacilli were found on microscopical examination. The most certain way of detecting the presence of tubercle bacilli in milk or, in fact, in any material is by inoculating the same into animals. Ernst found in twenty-five inoculation experiments performed with milk from the Boston supply,

that three gave positive results. Kanthack, experimenting in Cambridge, England, found infection in nine out of sixteen dairies supplying that town. The milk, however, was not very thoroughly impregnated, as only a very few of the animals inoculated succumbed to the disease. It has been shown experimentally in regard to the tubercle bacillus in milk as, indeed, it has to the cultures of many other bacteria, that the greater the dilution and the smaller the dose, the less the chance of infection.

Kanthack, as well as Ernst, has shown that the bacilli are found in cream as well as in the whole milk, but when milk is put through a centrifugal machine, the larger part of the bacilli are removed in the sediment. Experiments in Germany have shown that butter may contain tubercle bacilli.

A number of other experimentors, as well as Ernst, have found bacilli in milk, when the udders were apparently healthy, and, in fact, when tuberculosis could only be detected by the tuberculin test. It must be admitted, then, that we have pretty strong evidence that if a dairy herd has in it tuberculous animals, the milk from that herd stands a very good chance of being infected. The more disease there is in the herd, and the farther advanced it is, the greater the danger. -

The fact that tubercle bacilli are found in milk and may, by injection into the lower animals, cause tuberculosis, does not prove that milk would cause the disease if taken into the alimentary canal. Of course, many feeding experiments have been undertaken with milk and other products from tuberculous animals. These have not always been successful. Smith, Law, Nocard,

and McFadyean could not infect rabbits and guinea pigs by feeding them with milk which was known to be tuberculous. Peuch, for two months, fed two pigs with milk that, by injection, produced tuberculosis in rabbits, without producing any effect upon the pigs. Gerlach also was sometimes successful and sometimes not. On the other hand, many feeding experiments have been successful. Ernst, using milk from tuberculous animals with apparently healthy udders, produced tuberculosis in two out of forty-eight calves fed with it. He also infected five out of twelve pigs; and, in another series of experiments, eight out of twenty-one calves. Law reports three calves which had milk from sound udders, but became tuberculous. Pearson fed pigs with milk known to be tuberculous, and the animals apparently got fat upon it, but when killed were found to be infected. He says instances are not rare in which calves and swine fed with skim milk from a creamery, have developed tuberculosis on farms that are otherwise free from this disease.

The evidence, then, seems to be that milk of tuberculous animals is quite likely to be infected, and that if infected it frequently produces tuberculosis in other animals, even of a different species, which partake of it. If milk can infect human beings as it does calves and swine, it is certainly dangerous to use in a raw state the milk from tuberculous animals. While we have no incontrovertible evidence that bovine tuberculosis is thus transmitted to man, it is extremely probable that it is so. We certainly have very little evidence that it is not, and it would require pretty strong evidence to show that a disease which can be carried over from cows to swine, rabbits, guinea

pigs and many other species, cannot be transmitted to man.

There has been a great deal of discussion as to the danger from the use of meat from tuberculous animals. As the tubercle bacillus is killed by a moderate degree of moist heat, we can probably safely assume that, in the majority of cases, even if bacilli are present in meat, they will be destroyed by cooking. Experiments, however, to substantiate this view, are much to be desired. In cases where the lungs chiefly are involved and the disease has not progressed too far, there is not much likelihood of the muscles being infected. In fact, it is very unlikely that the muscular tissue itself will be infected at all, but when there is a tendency to generalization of the disease, the small glands between the muscles or their fasciculi may be involved. In such cases, it would be dangerous to eat the meat in a raw state. Feeding experiments have been conducted upon animals with little positive result. Peuch succeeded in infecting two pigs, but only after feeding them for a long time. Nocard was unsuccessful, as also were Touissant, Chaveau, Arloing, Martin, and Vallin.

Perroncito fed eighteen pigs for from three to five months with condemned tuberculous meat, but none of them were infected. It would appear that the danger of infection by meat of tuberculous animals, at least unless the disease has progressed very far and is much generalized, is not very great. This view is held by many leading veterinarians. It is the practice of many not to condemn the flesh of tuberculous animals when the disease is circumscribed. In Saxony, the government inspectors permit the sale of the larger portion

of the flesh of tuberculous animals killed at the abattoirs. This meat, however, is sold on its merits as coming from tuberculous animals. At the Brighton abattoir, a considerable portion of the tuberculous animals there slaughtered are allowed to go upon the market.

METHODS OF CONTROL ALREADY ADOPTED.

Notification.

An important step in the control of other infectious diseases is the report of cases of the disease to the sanitary authority. This is desired, in order that the cases may be studied and more may be learned of the way in which the diseases are spread, and, in order that any necessary methods of restriction may be applied to each individual case. It would appear that notification is as necessary in tuberculosis as in other diseases. In this country, notification has been required in a number of states and cities. Sometimes it applies to phthisis alone, and sometimes to all tubercular diseases. Notification was first required in the City of New York, and, at present, is a requirement of the State law in Maine and Michigan, and of the municipal regulations of Alameda, California; Buffalo, Cincinnati, the City of New York, Salt Lake City, and Yonkers. In these regulations the requirement applies only to phthisis. Tuberculosis is to be reported by the State law of Washington and by the regulations of Asbury Park, Minneapolis, San Francisco, and Syracuse. A recent decision of the Supreme Court of Michigan has affirmed the validity of the law in that state. The following is the rule in the City of New York :

City of New York, Sanitary Code, 1899, Section 53:

Section 153. That pulmonary tuberculosis is hereby declared to be an infectious and communicable disease, dangerous to the public health. It shall be the duty of every physician in this city to report to the Sanitary Bureau in writing the name, age, sex, occupation and address of every person having such disease who has been attended by or who has come under the observation of such physician for the first time, within one week of such time. It shall also be the duty of the commissioners or managers, or the principal, superintendent or physician of each and every public or private institution or dispensary in this city to report to the Sanitary Bureau in writing, or to cause such report to be made by some proper and competent person, the name, age, sex, occupation and last address of every person afflicted with this disease who is in their care or who has come under their observation within one week of such time. It shall be the duty of every person sick with this disease and of every person in attendance upon anyone sick with this disease, and of the authorities of public and private institutions or dispensaries, to observe and enforce all the sanitary rules and regulations of the Board of Health for preventing the spread of pulmonary tuberculosis.

These laws and regulations are not well enforced. The Secretary of the State Board of Health of Michigan informed the writer that probably not one-quarter of all the cases appearing in that state are reported, and the board of health of Buffalo report that notice is rarely received of a case except when a physician sends in sputum for examination. In Michigan, whenever a case of consumption is reported from a town, the health officer is required to fill out a blank, stating a large number of facts in regard to the history of the case, possible sources of infection, and methods taken to restrict the disease. On the death of the patient, or recovery, if recovery takes place, another and final report

is to be made, giving facts of intermediate history and whether or not disinfection was done. No very valuable results have, as yet, been obtained from these investigations, as only a few of the rural health officers can be expected to be skilled enough to investigate the cases properly. In New York City, careful record is kept of all cases reported, and, owing to the active interest taken by the health department of that city, more cases are reported there than elsewhere, so that, of late, the number of cases reported has exceeded the number of deaths. A careful record is kept of all cases, and their location is also noted on a map. A study of this map has shown that phthisis prevails to a much greater extent in some districts, and in some houses, than it does in others.

Notification presupposes correct diagnosis. It is generally admitted that the examination of the sputum for tubercle bacilli is a great aid to diagnosis, though it is to be feared that many physicians place too much dependence upon a single negative finding. To assist physicians, many states and cities offer laboratory facilities for the examination of the sputum.

Education.

A great deal has been done, during the past ten years, to educate the public to a knowledge of the contagiousness of tuberculosis. Probably a large proportion of intelligent people now understand that tuberculosis is contagious. A large part of this work of education has been carried on by public health officials, particularly those engaged in laboratory work. It is to be feared, however, that some of the teaching has gone farther than the facts would warrant.

It is certain that tuberculosis is contagious, but, as we have seen, the exact path of infection is not perfectly known. Nevertheless, dogmatic statements have been very common as to the great danger of breathing tuberculous dust, of drinking tuberculous milk, and of eating the flesh of tuberculous cattle. It is true, however, that most of the extravagant statements in regard to these matters have not emanated directly from the bacteriologists. The public press, and pseudo-scientists generally, have sometimes misunderstood the meaning of the work of scientific investigators, and have made too much of what are, perhaps, the least important paths of contagion in this disease. The daily press is of great assistance in sanitary education, but its powers should be called into play with considerable care. One of the most common and useful means of education in such matters is the distribution of circulars of information. Such circulars, explaining the nature and methods of the spread of tuberculosis, have been issued by many health officials and by the societies for the suppression of tuberculosis. One of the first and best of these circulars was that issued by the Board of Health of New York City. At present, such circulars are issued by the State Board of Health of California, Colorado, Connecticut, Delaware, Indiana, Iowa, Kentucky, Maine, Massachusetts, Michigan, New Hampshire, New Jersey, New Mexico, New York, Ohio, Rhode Island, South Carolina, Tennessee, Texas, Virginia, West Virginia, and Wisconsin. They are distributed by many local boards of health in these states and have been issued by cities outside of the states mentioned, as St. Paul, Minneapolis, Chicago, St. Louis, and Philadelphia. In New York City they are sent to

the physicians for distribution to their patients, and this method is probably followed in most cities. In Buffalo they are sent to all cases reported, or to the friends of the patient. In New York City the summer corps of physicians who visit among the poor, distribute some 30,000 annually. In Brookline, Mass., one is sent to every family in the town. In Minneapolis one form of the circular is printed upon a card which is to be hung in the room occupied by the patient. It must be confessed that many of these circulars are not very well prepared, exaggerate very much some of the means by which the disease is spread, pass lightly over others, and suggest many unnecessary and impossible things.

Control of expectoration.

At one time more importance was attached to the spread of tuberculosis by the inhalation of the dust of the streets and public places than is at the present time. As a result of the view that tuberculosis is chiefly spread in this way, various ordinances have been adopted to prevent indiscriminate expectoration. The first rule of this kind was that adopted by the Board of Health of New York City, May 12, 1896. By this rule it was forbidden to spit upon the floor of the public buildings, of railroad cars and ferry-boats. Rules covering this subject have since been adopted by a large number of cities and towns and by the State Board of Health of Indiana, but have not yet been incorporated into statute laws. Many of the rules go much further than that of New York, and forbid spitting in omnibusses, hacks, carriages, vehicles, steam-cars, or any public conveyance, also in public halls, assembly

rooms, shops, stores, halls, railway stations, churches, schoolhouses, and other public places. Some of the rules go further still, and forbid the spitting upon the sidewalk, as in Cincinnati, Cambridge, Colorado Springs, Brookline, Providence, Springfield, and Rochester. The following is the rule in Cambridge, and perhaps is as explicit as any :

Cambridge ; Rules of the Board of Health, April 12, 1899 :

The Board of Health hereby adjudges that spitting upon the floor, platform, or any other part of a public conveyance ; upon the floor, steps, or stairs of any public building, hall, church, railway station, or shop ; upon the sidewalk of any street, court or passageway ; or upon the pathway of any park, square, or common is a nuisance, source of filth and cause of sickness, and prohibits spitting in any and all such places.

Many of the rules require that copies of the rule shall be conspicuously hung in public conveyances and other public places. Most of the transportation companies are very ready to do this, and have welcomed the law, and have tried to enforce it.

Cases have been brought for violation of these rules, and it is said that the courts have sustained them. It requires a good deal of effort, however, on the part of the police, to secure any permanency in this reform. It is, perhaps, questionable whether rules of this kind can be enacted as necessary for the preservation of public health, but, fortunately, it is not necessary to prove the exact role played by promiscuous spitting in the production of tuberculosis to enact such legislation. Promiscuous spitting is a nuisance and may be suppressed on that score alone, thus enabling us to try a very practical experiment as to the importance of one alleged means of spreading tuberculosis.

The surest way to prevent expectoration in places where it may be dangerous is to keep consumptives out of such places. It is doubtless for this reason that Pennsylvania has passed a law forbidding the employment by bakers of persons having consumption, and the sanitary code of Yonkers makes it a misdemeanor for bakers or market-men to pursue their occupation if they have this disease.

Very little has been done by any municipality to control expectoration by regulating the conduct of the individual. In New York City, when a case of consumption is reported to the board of health, unless the attendant physician requests otherwise, an inspector is sent to the home of the patient and gives verbal directions how to dispose of the sputum without danger to others. Subsequent visits are made to see that these directions are carried out, and it is claimed that they are in about one-half of the cases. Doubtless, all over the land, educated physicians in private practice and in charge of institutions, have done much to teach patients in regard to this matter, and probably have accomplished far more than have the health officials.

Disinfection.

Experiments have shown that it is quite possible that the apartment occupied by a consumptive patient may become infected with the germs of the disease. Scrapings have been taken from the walls and furniture of such apartments, and have been found to contain bacilli. There is not, however, much clinical evidence that such apartments may be the cause of spreading the disease. The investigations of Flick, in Philadelphia, and of the board of health in New York

City, show that certain houses appear to be the homes of tuberculosis. Certain houses have had cases in them for a long series of years. A minority of the houses furnish a majority of the cases. There are few cases on record, however, where a tubercular family has removed from a house and a non-tubercular family entered it and become infected. A case of this kind has recently been reported in the bulletin of the Ohio State Board of Health. But such cases are not more numerous than could reasonably be explained as coincidences.

Still, it must be admitted that there is some chance of the disease being spread in this manner, so that it is advisable to disinfect premises that have been occupied by consumptives before they are occupied by others. This is commonly done by municipal boards of health, when requested by the family, and such requests are becoming quite common. Doubtless, also, many persons thoroughly cleanse the premises, practically disinfecting them, without calling upon the health officers. A few cities, notably New York, require the disinfection of such premises; but the method prescribed is cleansing, rather than disinfection. It is required that all walls and woodwork shall be washed with washing soda, one-half pound to a pailful of hot water, and then the room is repapered, whitewashed or kalsomined. Occasionally goods are taken away and steamed.

Hospitals.

It is considered that isolation hospitals are a necessity for the control of communicable diseases. If they are needed in scarlet fever, diphtheria and small-pox, they are needed still more in tuberculosis. In tuber-

culosis, far more than in any other disease, does the welfare of the patient depend upon hospital treatment. By going to a hospital, not only does a patient avoid all danger of giving the disease to others, but he stands a much better chance of getting well. There are not many hospitals for consumptives in the United States, and some of these are designed more as homes of refuge for the incurable poor than as true sanatoria. In Germany the use of hospitals for the cure of consumptives has been known for a long time. There are many such hospitals, and many patients are cured in them. Knopf says that cures can be obtained in from 25 to 50 per cent. of the cases. Of 5,032 patients at Goerbersdorf, in Germany, from 1876 to 1886, 11 per cent. were reported as cured, and 15 per cent. as almost cured. Of 1,390 received during the first stage of the disease, 27 per cent. were cured, and 31 per cent. almost cured. The other German sanatoria report cures of from 14 to 27 per cent. Several French sanatoria report cures of from 21 to 50 per cent. The Loomis sanitarium in New York reports 25 per cent. of cures and 50 per cent. of ameliorations. The Saranac sanitarium reports 20 to 25 per cent. of cures. At Chestnut Hill, Philadelphia, where patients in all stages are received, there are 8 per cent. of cures and 11 per cent. of ameliorations. Perhaps the most striking proof of the value of hospital treatment is shown by the action of the state-aided insurance companies of Germany. These companies find it for their advantage to send their policy holders who become phthisical, to sanatoria, and to pay their board while there. During 1898, between three and four million marks were expended for that purpose. It has been shown

that it is not necessary to go into deep forests or high mountain regions to secure a good location for a consumptive hospital. Dry and somewhat isolated situations can be found, suitable for these hospitals, within a few hours' journey of nearly all our cities. Considerable difficulty has, at times, been found in securing a site for such hospitals, the people of the locality fearing it may be the means of introducing contagion. This fear is unfounded. The care which is exercised in hospitals to prevent the spread of contagion is effectual. It is shown that at Goerbersdorf and Falkenstein, the death rate from phthisis has diminished from 18 to 11 per cent. since the sanatoria were established.

Hospitals not only help to cure a patient and keep him from infecting others, but they teach him habits of care in regard to the disposal of sputum, and in other ways instruct him in the principles of hygiene, so that when he leaves the hospital he is much more likely than before to lead a healthful life and to avoid infecting others.

The cost of treatment in hospitals designed for the care of consumptives is not far from the cost in general hospitals. The cost in the German hospitals is 60 to 80 cents per day; the cost in St. Joseph's Hospital, New York City, is 50 cents; and of the Chestnut Hill Hospital in Philadelphia, 40 cents. These hospitals, however, do not offer the best facilities. The cost at Saranac Lake is from \$1 to \$1.25; at the Loomis Sanitarium, \$1.43; at the Cincinnati Hospital, about \$1.25. The exact figures for the hospital in Massachusetts are not given, but are apparently considerably greater. Knopf says it is more economical for the

municipality to care for its phthisical poor in special sanitarium than it is in general hospitals. The initial cost may be somewhat greater, but the length of stay is pretty certain to be less, and, in the aggregate, many years of useful life will be preserved to the community.

Considering the advantages which are secured by hospital treatment, it is rather remarkable that in this country so little has been done by the state to furnish it. The first and only municipal hospital for the care of consumption, with which the writer is acquainted, was that at Cincinnati. This is a substantial brick building in the suburbs, built for a smallpox hospital, but devoted to the care of consumptives since July 8, 1897. The hospital and other buildings, exclusive of land, cost about \$50,000.

During the first two years that the building was occupied, 330 patients were treated. The visiting physician, Doctor Lyle, reports some cures and many improvements, but he has not been able to follow the cases very carefully after their discharge. This hospital, however, is not intended so much as a curative institution as an isolation hospital to which patients may go instead of entering the general hospitals of the city.

Massachusetts has set the example for the establishment of State hospitals. The Massachusetts Hospital is at Rutland, in that State, and was opened for the reception of patients on Oct. 1, 1898. It is intended to accommodate 200 patients, and cost over \$150,000. It is intended for patients in the early stages of the disease. There is a uniform charge made of 50 cents per day, but poor patients may be admitted without

charge on application of the poor department of the town to which they belong. Of course, this board does not begin to pay the running expenses, and these are met by State appropriation.

Control of Milk Supply.

It is, of course, useless to attempt to secure a milk supply which shall be free from tuberculous taint, except by inspection and control of the dairies from which the milk is derived. As yet, not very much has been done along this line, in the United States. In New Jersey and Wisconsin the laws permit of the inspection and licensing of dairies. In Minnesota a somewhat recent law confers upon cities the authority to license milk producers, and inspect and test dairy cows. This law has been tested and its validity upheld by the Supreme Court. Notwithstanding the dearth of specific legislative authority, a considerable number of cities have taken more or less energetic action, looking to the supervision of the sources of their milk supply. In some, the action taken is merely one of inspection, advice and publicity; in others, control is exercised over dairies within the jurisdiction of the municipality. In others, the attempt is made to control all the sources of milk supply of the city.

It is necessary, first, to obtain a knowledge of all the dairy cattle supplying the city. To accomplish this, every dealer must be licensed and must keep the authorities informed of the location of every herd from which he obtains milk. This method is followed in New York, Minneapolis, St. Paul, the District of

Columbia, St. Louis, Buffalo, Lynn, Nashua, Portland, and other cities.

The second step is to provide for an inspection of the herds and dairies from which the milk is derived. Sometimes this inspection is confined to the limits of the city, as it is in New York, Baltimore, Cincinnati, and the District of Columbia. Of course, such local inspection cannot accomplish much. Every herd supplying the city should be controlled. Among cities which have attempted to inspect every herd supplying the city may be mentioned Portland, Lynn, Nashua, Rochester, the District of Columbia, Minneapolis, St. Paul, St. Louis and San Francisco.

Lastly, it is necessary to test with tuberculin every animal from which the municipal supply is derived. By licensing dealers, by registering producers, by inspecting their herds, by testing the cattle with tuberculin, and condemning all infected animals, by tagging the animals so that they may be identified, and by re-inspecting, at intervals, the milk supply may be kept free from tuberculosis. This method has, at present, been successfully adopted only in Portland and Westbrook, Me.; in Lynn, in Minneapolis, and St. Paul. Such drastic methods are sure to meet with great opposition, and permissive legislation is difficult to obtain. The attempt was made in the District of Columbia, and San Francisco, but was a failure. In Massachusetts, also, the authority was sought by which local boards of health could, in this manner, control the milk supply, but it was successfully opposed by the milk dealers and producers.

The attempt has been made in New Orleans, St. Paul, Indianapolis, and, doubtless, in other cities, to improve the milk supply by moral agencies. The

municipal authorities offered to test the dairyman's herd and certify to those which were found healthy. Few, however, took advantage of the offer, for they did not find that the expense and trouble were compensated by increased custom. This method, however, was successful in Indianapolis, where nearly all the dairymen have voluntarily subjected their animals to inspection. In St. Paul, on the other hand, the city was obliged to resort to compulsory methods. The limited demand for "certified milk" shows that the public is hardly ready to ask for clean milk, or willing to pay for it.

The Eradication of Tuberculosis in Cattle.

If it is true, as is not improbable and as many would have us believe, that a large part, perhaps even half, of human tuberculosis is derived from cattle, an important step in controlling the disease in man is to get rid of it in animals. It may, perhaps, be admitted that the evidence is not strong enough to warrant our taking the radical steps necessary to get rid of tuberculosis, on account of its danger to human beings, but there are other and ample reasons why the State should seek to free its herds from tuberculosis, as it has from pleuro-pneumonia and other infectious diseases. In this work, however, the co-operation of the dairyman and farmer cannot be expected, as it may be in the acute diseases. Tuberculosis is a chronic affection. The cattle owner can detect it long before death, make use of the milk for a considerable period of time, and finally sell the animal for slaughter, at a small loss, or perhaps no loss at all. The trouble and expense incurred in entirely freeing a herd from

tuberculosis are considerable, and the average man who hesitates to incur a momentary loss for the sake of future gain, had rather take the chances of losing a little money now and then on a cow, than of going to the trouble of getting rid of the disease altogether. Nevertheless, the aggregate loss from tuberculosis is enormous, and the State would be justified in making large expenditures to exterminate it.

Various plans have been suggested and tried for getting rid of tuberculosis in cattle. The most radical measures were those adopted in Massachusetts, where the plan was adopted of inspecting every animal in the State, and killing and destroying all which reacted with tuberculin. Large sums of money were expended, great opposition was aroused, and the plan had to be abandoned. A somewhat similar, but less rigorous method, was adopted in Belgium, in 1896, but it also has been modified. In Baden, herds from which tuberculous cattle are reported by the meat inspectors are examined and measures taken for the suppression of the disease at the expense of the state. In Baden, as in Saxony and other parts of Germany, a part of tuberculous meat is used as food. In France, also, the flesh of tuberculous animals is not always condemned, though animals that are discovered to be tuberculous are always killed. In Denmark, the state offers to test herds for their owners, and tuberculous cattle are killed if the disease is far advanced, and their flesh is then destroyed. In the early stages of the disease the animals may be kept in quarantine, or they may be slaughtered and are largely used for food; but the milk and cream of quarantined animals cannot be used without pasteurization. A similar plan has been adopted in Norway.

It is of special interest to us to know what is being done in the United States.

The importation of tuberculous cattle into the United States is guarded against by the inspectors of the Bureau of Animal Industry. While this bureau might under the laws attempt to prevent the passage of tuberculosis from one state to another, it has not yet had the means for doing so. This is at present controlled by the states, and eighteen of them have laws respecting it, among which are Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, New Jersey, Pennsylvania, Iowa, Montana, and Texas. A common form of the law is that requiring that no animal shall be imported without a certificate that it has been inspected and tested with negative results. In Texas cattle must not be imported for breeding or dairy purposes, and an exception is made in favor of animals certified to as natives of Colorado or Nebraska. In New Hampshire animals may be brought in for pasturage only, without the tuberculin test, provided they are sound on physical examination. In Connecticut, when any one imports cattle from an adjoining State he must, within six days, notify the commissioner on domestic animals.

Very little work has been done in eradicating bovine tuberculosis by municipal health officers except in connection with the protection of the milk supply. Nearly all the active work, except in a few cities as New York, Minneapolis, St. Paul, Indianapolis, Rochester and Lynn, has been done by state boards. Some of this work is done by boards of cattle commissioners and some by state boards of health. Much of the following summary is taken from the seventh annual report of the state veterinarian of Maryland.

Massachusetts. Under Chapter 491, acts of 1894, some 465 inspectors were appointed, whose duty it was to inspect cattle and stables, and report the occurrence of any contagious disease. All cattle visibly affected with tuberculosis were killed and paid for, while many were tested at State expense at a cost of \$240,737.84. This does not include the cost of testing many more cattle, which was made at the expense of individual owners.

Condemned cattle were paid for upon written application for the test to be applied, and upon the provision to thoroughly disinfect their premises, and to introduce none but cattle tested (at owner's expense) in future. This led to an order that cattle to be paid for must be tested by the cattle commissioners or their authorized agent. The large amount of money spent and the number of animals destroyed caused great opposition and resulted in a change of policy. It is now required by law that each town and city shall appoint an inspector who will act in conjunction with the state board.

This work may be considered under three heads:

1. The supervision of the traffic in live cattle brought into the State.

2. A general inspection, the examination of cattle quarantined as diseased by the local inspectors in the various cities and towns, and the payment for those found to be infected with tuberculosis.

3. Testing entire herds for the purpose of permanently eradicating tuberculosis from the premises.

In 1899, \$75,000 was appropriated and only \$50,000 was to be asked for the next year; 785 tuberculous animals were killed, for which \$17,277.69 was paid; 565 animals were tested for owners who were trying to free their herds, and of these 63 were condemned.

Maine. Maine was the first of the New England States to adopt the system of placing quarantine on the admission of out-of-state cattle. The law was first enforced in 1892 against Massachusetts, because of the large per cent of Massachusetts cattle that were found diseased. Later it was placed on all out-of-state territory, except on such animals as were provided with certificates of the tuberculin test. The authorities in Maine test herds only on the voluntary application of the owner. The owner to receive one-half the value, as determined on the basis of health before infection, the limit of compensation being \$100 for pedigreed animals and \$50 for others. The commission have power to investigate as to the existence of disease and to condemn and destroy such as show physical evidence of disease. During the year 1898, 415 head of cattle were destroyed at an appraisal of \$18,122.

Vermont. Vermont, with its small percentage of diseased animals, has probably been more successful than any other State in its attempts to control tuberculosis. Since Feb. 1, 1897, 60,000 have been tested, and 2,360 have been found diseased and killed, a percentage of disease of nearly four per cent. In Vermont no animals are tested unless the owners allow the entire herd to be tested, and thereafter every animal admitted to the herd must be tested and the stables thoroughly disinfected. The commission test only where application is made by the owner. In their annual report a list of seventy-eight retested herds is given, in which tuberculous animals were found. Twenty-three herds were found free on the second test, and twenty-three had only one case each on the second test. Eight of the remaining herds that

were found diseased on the second test were free on the third test. The report states that "the proper disinfection is a more difficult matter than is the discovery of the diseased animal."

The commissioners have found that cattle buyers from States where no quarantine was enforced have purchased many suspected animals at a price a little less than would have been paid if not suspected.

New Hampshire. Diseased animals are reported to the commission through the selectmen, and are released or condemned on physical examination.

When the owner applies for inspection of his herd, and where there is reason to believe the disease exists, the board may treat the entire herd, the owner receiving half compensation. In 1898, 225 herds were tested and 148 animals killed for which \$2,894 was paid.

Rhode Island. Rhode Island has a commissioner in each county, appointed by the board of agriculture, whose duty it is to inquire into the condition of any animal in their county whenever there is any reason to suspect tuberculosis. When any animal is thought to be tuberculous by a commissioner, he shall immediately quarantine and examine. In 1898, 496 animals were killed for which \$9,014.50 was paid.

New York. In New York state, tuberculosis in cattle is handled by a tuberculosis committee of the state board of health. No appropriation has been made by the legislature for the use of this committee and no cattle have been ordered killed, except where the owners have waived all right to compensation. The committee, however, have received many requests from owners asking to have their herds tested; and also test the animals belonging to public institutions.

New Jersey. New Jersey has a commission of seven members. The commission, on application from the owner, the state board of health or the state dairy commission, will make an examination of suspected herds, the reacting animals to be condemned and killed. They are appraised at their market value, not exceeding forty dollars, the owner receiving compensation at the rate of three-fourths of their valuation. In 1898 there were tested 1,438 cows, of which 245 were condemned. The cost of inspection was \$1,179, and the amount paid for the cows was \$5,098.20.

Pennsylvania. It has been the practice in Pennsylvania to test herds only on the application of the owner, and then only where the disease was suspected to exist. The application is made on a printed form, and in making the application the owner promises to observe every direction recommended that tends to the purification of his premises. If he has to tear down half his barn, or cut windows through his stables, or put in new floors, he agrees to do that before the examination is made, and he agrees also to procure his animals for restocking from as healthy a source as possible. It has been impossible, however, to comply with all the requests sent in, and, as far as possible, the worst herds have been picked out for testing. Reacting animals are all condemned and compensation given the owner.

At the time of publication of the last annual report the average appraisement for cattle condemned was twenty-four dollars and fifty cents. Since the beginning of the last fiscal year the total payments for tuberculous cattle to date (January 1, 1898,) amount to \$57,191.16 for 2,510 animals, an average of \$22.78 per head.

In Pennsylvania the number of cattle tested up to the 1st of June, 1897, was 9,108; the number condemned as tuberculous was 1,839, a percentage of 20.39. Since the 1st of June, 4,887 cattle have been tested; of these 671 were found to be tuberculous and were killed; a percentage of 13.73. All parts of the state are represented among these herds, as only herds suspected as diseased are tested. The state officials believe that many of the worst herds have been discovered, and that the percentage of tuberculosis among cattle at large is being steadily and rapidly reduced.

Illinois. The live stock commission has been conducting tests on herds where the owners apply for it. All animals are slaughtered without compensation, the owners having whatever there may be from the sale of the hide and carcass; where the disease is slight the beef may be sold, if fit, for food.

During the year 1897, 36 herds were tested, including 851 animals; of these 77 were found diseased, or about 9 per cent. (This percentage includes a herd of 251 that had previously been tested.) Of the 77 diseased animals, 41 carcasses were condemned and 36 passed as fit for food.

During the year the board has made tuberculin tests on all dairy herds for which applications were made. There were fewer tests made in 1898 than during the previous year, not because the disease was any less prevalent among the untested herds of the state, but simply because a less number of owners of herds appeared to be willing to bear all the loss to be sustained through the members of their herds that would respond to the test.

Michigan. Cattle found to be tuberculous are quarantined and killed. The law does not provide compensation, however, and, as a result, the commission has met with a good deal of opposition. The commission has followed the plan of inspecting animals brought to their attention as suspicious, and killing such as react, without compensation.

During 1897 and 1898 the commission has applied the tuberculin test to nearly 1,000 head of cattle, a goodly proportion being milch cows. In fact, a larger number of cattle have been tested for tuberculosis during the last two years than had previously been tested since the tuberculin test was adopted by the commission.

The tuberculin test is applied only when suspicion is directed toward, or complaint made of, either a single animal or an entire herd. The records of tests made show but a small per cent. of infected animals, and when it is considered that only suspicious herds are tested, it is felt to be a safe estimate that less than two per cent. of the cattle in Michigan are affected with tuberculosis.

Minnesota. All cattle which show symptoms of tuberculosis must be quarantined at once and the entire herd tested with tuberculin. When cattle have once reacted the owner has his option of having them killed or continued in quarantine for a period not to exceed three months, when they are again tested. If they react on the second test, they must be killed within one month. The owner has no compensation for cattle killed, but he is allowed to have them killed under inspection, and, if they pass, he can dispose of the flesh like any other beef. In 1898, 2,975 cows mostly

furnishing milk to St. Paul were tested and 6.37 per cent. were condemned.

Wisconsin. The state board of health are applying the tuberculin test to infected herds reported, as far as their means will allow and condemning the animals that react to the test, the state paying two-thirds of the appraised value.

It has not seemed necessary in this discussion to consider the value of the tuberculin test any more than the causative relation of the tubercle bacillus to the disease. All competent persons seem agreed that in tuberculin we have the best means possible for making a diagnosis of this disease. It is not infallible, but permits a very much surer diagnosis than can be obtained by any other means. Without it, the eradication of tuberculosis would be much more difficult and expensive than with it.

With tuberculin the recognition of the disease is the most certain part of the work. Perhaps the most difficult part is the disinfection of infected premises. The following directions which the Massachusetts Board of Cattle Commissioners insist on being carried out on all premises that they attempt to free from the disease are perhaps as good as any:

REGULATIONS OF MASSACHUSETTS BOARD OF CATTLE
COMMISSIONERS FOR CLEANSING AND DISINFECTING
BARNs.

*These Must be Complied With by Owners of Cattle, Which the State
Pays For.*

In attempting to get rid of tuberculosis in a herd of cattle, it should be remembered that not only is it necessary that all the diseased animals be picked out and either isolated or destroyed,

but that no new animals should be introduced unless they have been tested and are known to be free from disease.

The barns should also undergo a thorough renovation and be properly cleansed and disinfected before they are again occupied.

In renovating or remodelling barns the great importance of sunlight, thorough ventilation and good drainage should always be borne in mind.

Disinfection of the barns is always necessary to destroy any infectious material that may have been left after the removal of diseased cattle. The best disinfectant we know is sunlight. Germs of disease will live but a short time when exposed to the direct rays of the sun, and for this reason, if for no other, a southerly exposure and plenty of windows in the barn are to be desired.

In proceeding to disinfect a barn the first, and perhaps the most important step to be taken is to collect all rubbish, have the walls, ceilings and floors thoroughly swept and cleansed of all litter, dust, cobwebs, and the like. The floors, mangers, feeding troughs and stanchions should be carefully scraped and cleaned, special care being taken with the corners, and all of the rubbish collected and burned.

All odds and ends of boards and old and broken mangers and partitions should also be removed and burned, and when occasion requires it, new plank floors should be laid in place of old ones.

After cleaning thoroughly with hoe and broom, and hose if running water is convenient, and if the barn contains a boiler with scalding water, or live steam, applied with a hose, or failing that, with boiling water and soft soap or washing soda. A solution of bichloride of mercury (corrosive sublimate), 1 to 1,000 parts of water, should be applied with a whitewash brush and poured over the floors. (Corrosive sublimate should be used in wooden vessels, as it corrodes metal ones.)

After applying the corrosive sublimate, the ceilings, walls, partitions, mangers, etc., should again be washed and gone over with warm freshly made whitewash; a half pound of chloride of lime to the gallon of whitewash is an addition that may make it more effective. Fumigating with sulphur or chlorine gas is not of any great value in ordinary stables.

In using corrosive sublimate it must be borne in mind that it is a dangerous poison, and mangers and partitions should be carefully washed after applying this mixture, and then again scalded or whitewashed.

If at a season of the year when the animals can be turned out, the stables should be left vacant for some time with doors and windows open.

Six months after the first test the herd should again be tested and undergo a careful physical examination, so as to be certain that no diseased animals have been overlooked, and the barns should again be thoroughly disinfected.

Great care also should be taken that all animals have been tested before their introduction to the herd.

THE DECREASE OF TUBERCULOSIS.

Over most parts of Western Europe, Great Britain and the United States, there has, for half a century, been a marked decrease in the number of deaths due to tubercular diseases, and particularly in deaths from consumption. The figures, of course, vary somewhat in different localities, but the fact of marked decline is illustrated by almost all registration reports which cover a considerable number of years. It seems hardly necessary to present a mass of statistics to demonstrate this, but it may not be uninteresting to examine the data from local sources which are herewith presented. The following table is from the advance sheets of the report on births, marriages and deaths in Providence, for 1899. The main fact of the decline is shown graphically in the succeeding diagram :

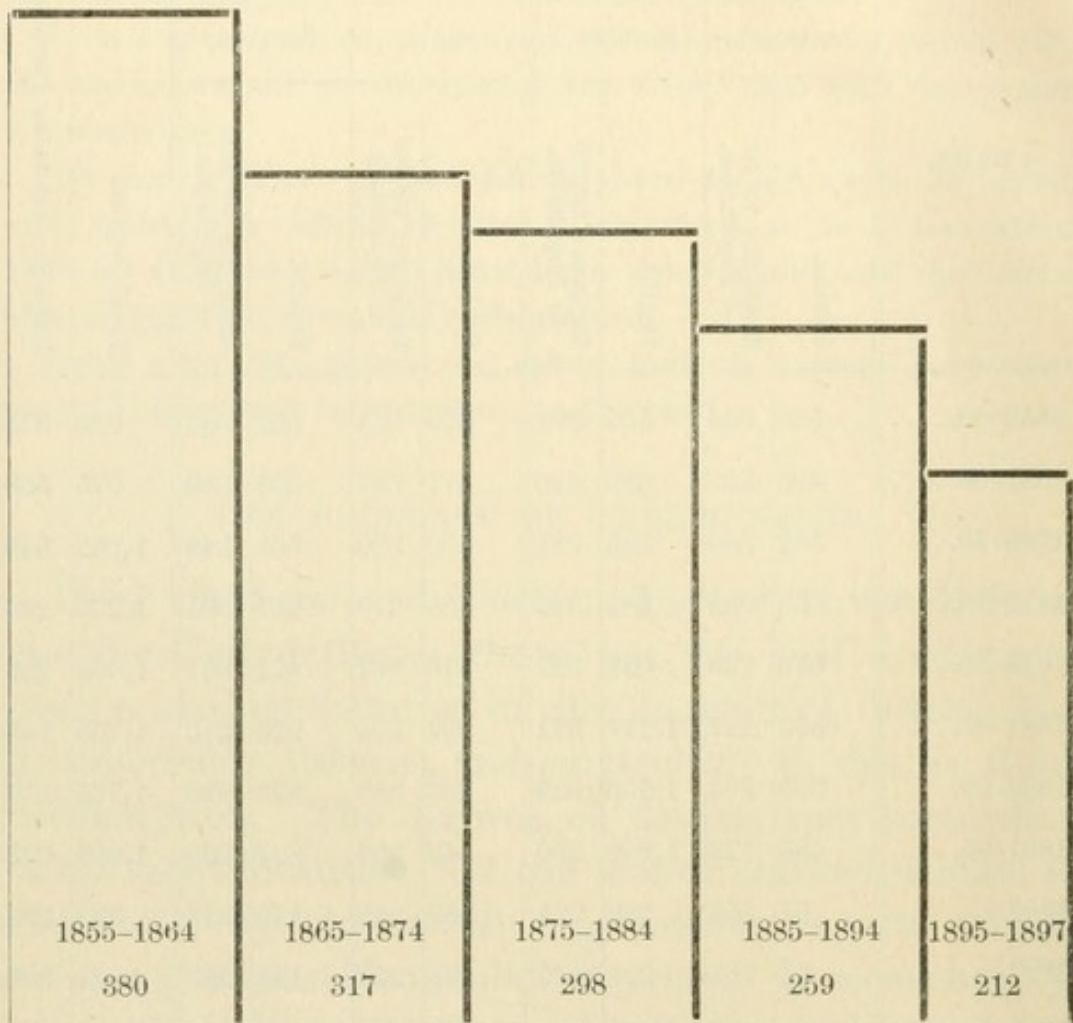
DECEDENTS FROM PHTHISIS, FORTY-FOUR YEARS, 1856-1899.

| YEARS. | PARENTAGE. | | | | SEX. | | | | Total Deaths. | Ratio per 100,000 of Population. |
|----------------|------------|----------------------------------|----------|----------------------------------|---------|----------------------------------|----------|----------------------------------|---------------|----------------------------------|
| | American. | | Foreign. | | Males. | | Females. | | | |
| | Deaths. | Ratio per 100,000 of Population. | Deaths. | Ratio per 100,000 of Population. | Deaths. | Ratio per 100,000 of Population. | Deaths. | Ratio per 100,000 of Population. | | |
| 1856-60. | 525 | 364 | 405 | 391 | 379 | 324 | 551 | 421 | 930 | 375 |
| 1861-65. | 495 | 329 | 480 | 420 | 477 | 387 | 498 | 352 | 975 | 368 |
| 1866-70. | 532 | 306 | 520 | 384 | 490 | 339 | 562 | 342 | 1,052 | 340 |
| 1871-75. | 553 | 252 | 682 | 332 | 568 | 279 | 667 | 301 | 1,235 | 290 |
| 1876-80. | 570 | 235 | 928 | 322 | 676 | 267 | 822 | 301 | 1,498 | 285 |
| 1881-85. | 573 | 227 | 1,177 | 371 | 824 | 304 | 926 | 310 | 1,750 | 307 |
| 1886-90. | 525 | 204 | 1,206 | 329 | 863 | 288 | 872 | 266 | 1,735 | 277 |
| 1891-95. | 486 | 176 | 1,202 | 286 | 846 | 253 | 842 | 233 | 1,688 | 243 |
| 1896. | 91 | 153 | 259 | 285 | 180 | 249 | 170 | 218 | 350 | 233 |
| 1897. | 92 | 151 | 229 | 246 | 173 | 233 | 148 | 185 | 321 | 208 |
| 1898. | 87 | 135 | 238 | 243 | 178 | 228 | 147 | 174 | 325 | 200 |
| 1899. | 99 | 149 | 268 | 264 | 177 | 219 | 190 | 218 | 367 | 218 |
| 44 years. | 4,632 | 236 | 7,594 | 326 | 5,831 | 285 | 6,395 | 285 | 12,226 | 285 |

PROVIDENCE, R. I.

PHTHISIS.

DEATHS PER 100,000 LIVING.



It has been claimed by many that this diminution in the death rate of phthisis is, to a large extent, due to the application of the knowledge recently acquired.

The writer, however, does not believe that this is the case. Certainly, in most places, as has been shown, very little has as yet been accomplished in regard to the purification of milk supplies or the eradication of bovine disease. Expectoration laws are not enforced, and no more consumptives are cared for in hospitals than formerly. It is true that some few cases do,

undoubtedly, take rational measures to prevent infecting others. Physicians have been able to teach a minority of their patients to do this. It can scarcely be believed that such very little progress has produced such marked results. The decrease in consumption in the United States has not been due to state control, for the excellent reason that the state, as yet, has not been able to exercise any efficient control. The only city where anything of consequence has been done to check the spread of tuberculosis from man to man is New York. An inspection of the death rate from phthisis in that city does not show that it has decreased any more rapidly since 1895 than it did before.

It is not necessary in this paper to attempt to explain why consumption of late years has diminished to a certain extent, but it is generally believed to be due to improved living on the part of our people. Better food, better clothing, better shelter and better care of the sick have done much to improve the general health. Shorter hours for work and more time spent in the open air, especially by women, are supposed to be elements in causing the decrease.

METHODS OF CONTROL PROPOSED.

Notification.

The writer believes that one of the most important things to be done to control tuberculosis is to study still further the manner in which the disease is caused. Experimental evidence is desired on many points, as has been referred to in the preceding pages. Clinical evidence is still more to be desired, and this can be best obtained by government investigation. It is necessary to study a very large number of cases etiologically.

If for no other purpose than to give an opportunity for such study, the state should require the report of all cases of tuberculosis. It is just as important to study other varieties of tuberculosis as it is to study phthisis. They should all be reported as is required in a number of existing regulations. There has been considerable opposition to the notification of this disease, but it is believed that this has been due largely to a fear that the health officer would interfere with the family physician by the advice which he might give to the patient. If the health officer does not so interfere, but merely co-operates with the physician, it is believed that it will not be any more difficult to secure reports of tuberculosis than it is of scarlet fever. It should be the duty of the health officer to study with the help of the attending physician the causation of every case reported. Notification presupposes correct diagnosis, and therefore every state and city should certainly offer facilities for the examination of suspected sputum.

Education.

Every sanitary official should do all that he can in every way to spread abroad a correct knowledge of the causation of this as of all other communicable diseases. The daily press usually affords valuable assistance in this. Another and most useful means of educating people is by means of circulars. Every local health officer should provide himself with a circular explaining the means by which tuberculosis is spread, and describing what precautions should be taken to prevent its spread from one person to another. Such a circular should be prepared with very great care. It should be

expressed in language which can be readily understood, and it is very important that it should contain no statements which cannot be fully substantiated. Impossible things should not be required. It is advisable to send such a circular to every family in the community, stating upon it that this is done. By so doing, no one can be offended. It is, of course, very desirable that it should be made certain that the family of every consumptive should receive a copy, and where there is a physician in attendance, the circulars may well be presented by him. The following is offered as a form of circular for general distribution :

Consumption, or tuberculosis of the lungs, is caused by the bacillus of tuberculosis, a kind of germ or microbe. This germ also sometimes causes consumption of the bowels especially in children, and sometimes it causes disease of the bones or of other parts of the body. All these different kinds of tuberculosis are caused by the germs getting into the body in one way or another.

Persons who have consumption usually have a cough, and the matter that they cough up contains great numbers of the tiny germs which cause the disease. If the sputum or matter coughed up gets on the carpet, floor, furniture or clothing, it may become dry and powdered, and float about in the air. It may then be breathed in by another person and thus start another case of the disease.

In cases of consumption the face and hands are likely to become soiled with this sputum, and cups, spoons, forks, pencils, handkerchiefs and other things are likely to be infected in the same way. If other persons use these things before they are thoroughly washed they are likely to catch the disease.

In cases of consumption germs are not given off by ordinary breathing, though in coughing or sneezing they may be. But there is probably not much danger from this except to a person who remains much in close contact with the patient. A person who has consumption should always sleep alone.

Cows have tuberculosis as frequently as human beings do. When they have it the milk is likely to contain the germs of the

disease, and persons who drink the milk are likely to have tuberculosis. No milkman ought to keep a tuberculous cow in his herd. He ought to have his cows examined every year and kill all that are sick. It is a good plan for all persons to inquire of their milkmen as to whether their cows have been tested for tuberculosis.

It is the duty of every person who has consumption to take the greatest care of his sputum, for it is this that is particularly dangerous to others. When at home he should always spit in a cup which should contain water, so that the matter may not dry. This cup should be emptied into the water closet at least twice each day and be thoroughly washed in boiling water. Paper spit cups may be used which can be burned. These are furnished by the health department to those unable to pay for them. When away from home a person who has this disease should spit into a pocket flask which should be emptied into the water closet and scalded on returning home. These flasks are furnished by the health department. A person with consumption should never spit anywhere except into a spit cup or flask. He should take great pains not to get sputum on his hands or clothes. Handkerchiefs used to wipe the lips and nose may be carried in a rubber-lined pocket so arranged that the lining can be removed and washed. Handkerchiefs should be washed frequently.

As the face and hands of the patient are certain to be more or less infected they should be frequently washed in hot water and soap. It is best for a man with consumption not to wear either mustache or beard. All dishes used by a consumptive should be thoroughly scalded before they are used by another. The bed clothes and night clothes of a person with consumption should be changed often.

While consumption is contagious the contagion is almost entirely in the sputum, and if this is taken care of there is probably not much danger in living or working with a consumptive.

Consumption is not always a fatal disease. A great many persons who have the disease recover from it. A large proportion of cases get well if they take proper care of themselves.

When a person with consumption has been sick a long time in one room, even if great care has been taken, the woodwork and

furniture are liable to be infected and should be thoroughly washed. It is a good plan to use washing soda for this. The walls should be repapered, the old paper being taken off. Carpets and rugs should be disinfected with steam.

Control of Expectoration.

As has been said, indiscriminate spitting is a nuisance and should be stopped. Spitting in public places should, by statute law, be made an offence. In place of statute law, if such cannot be obtained, every municipality should have a regulation of this kind and enforce it. It is not at all improbable that such enforcement might have considerable influence in checking the spread of consumption.

It is perhaps possible for the health officer to do much in the way of helping the individual to care for his expectoration. The plan followed in New York city of visiting the patient, unless the attending physician requests otherwise, appears to be a good one; and, in that city, has been productive of good results. Subsequent visits should, however, be made, and if the inspector has tact and gains the confidence of the patient, much may be accomplished. When in the house, it is probable that the best thing for a patient to do is to use a spit-cup. These are made in various forms and one made by Seabury & Johnson, which has a paper lining which can be removed, and, with its contents, burned, is a very good one. If a person is able to be about, and, particularly if he is able to work, he must be provided with a pocket flask and perhaps, also, with some sputum receptacle at his place of business. A pocket flask made of aluminum in two pieces, so that it can be readily taken apart and cleaned, has been devised by Knopf and is probably the best that

can be obtained. If such a flask is not employed, handkerchiefs may be used, but, if they are, the pocket which holds them should have a rubber lining kept in place by clamps. Cups, flasks and rubber lining should all be frequently washed and scalded, and disinfected if feasible. If the consumptive can be induced to thus take care of his expectoration, the danger of his transmitting the disease to others will be reduced to a minimum. The health inspector, either by himself or with the assistance of the attending physician, can doubtless do very much to bring about this desired end, but it is not, by any means, recommended that any compulsion should be employed. It might be advisable for the municipality to furnish the spit cups and flasks to those who cannot afford them.

Disinfection.

Every municipality should be ready to show how apartments can be disinfected after cases of consumption have been removed from them, and should stand ready to disinfect if it is probable that it will not otherwise be properly done. It might, perhaps, be advisable to require by ordinance that all premises occupied by consumptives should be disinfected before they are occupied by others. There seems to be little doubt that cleansing, as practiced by the board of health in New York, is as good as disinfection. Disinfection, if practiced, should always be by washing, and steaming, if necessary; gaseous disinfection should not be relied upon.

Hospitals.

There is no question in the mind of the writer that hospitals furnish the best means available for the state

control of tuberculosis. The majority of consumptive patients are among the poor or people in very moderate circumstances. It is extremely difficult for such to take the precautions necessary to prevent the spread of the disease ; therefore the danger is greatest from this class of persons. Unless something is done to help them, they are almost certain to die. If they can be cared for in suitable sanatoria, a large proportion will recover, provided they are taken in hand early enough in the disease. Furthermore, during the whole time of their treatment, there will be no danger of their infecting others. The state should provide hospitals for the curative treatment of consumption in its early stages. The consumptive poor who are suffering from the last stages of the disease should also be cared for by the state. Although the danger to be apprehended from this class is not great, because they do not move about so freely, and although the chance of cure is slight, humanity demands that they should receive the best of care. General hospitals very properly do not like to receive them, but they are frequently obliged to, to the danger of other patients. The state should also receive them, as well as incipient cases, in its hospitals set apart for this disease. If the state or the municipality can only do one thing to control tuberculosis, it should establish hospitals for consumptives.

Control of the Milk Supply.

As has been shown, the evidence is pretty strong that a considerable amount of tuberculosis in human beings is caused by the ingestion of infected milk. This seems to be sufficiently certain to warrant the making of a very strong effort to prevent the sale of

milk from tuberculous animals. This action is the more warranted, because it will ultimately be to the great advantage of the dairymen, though at first it may cause them some trouble and expense. The only certain way to accomplish the desired result is to license all dealers, register all cows, test them with tuberculin, and slaughter all that are infected. Such drastic measures will rarely meet with popular support, but must be carried out by municipalities that really desire to protect their milk supply, provided they can secure the necessary legislative authority. If this is impossible, as it frequently is, it is worth while to try the Indianapolis plan and endeavor to encourage dairymen to voluntarily eradicate tuberculosis, in order that they may secure from the city a certificate that this has been done.

The Eradication of Tuberculosis in Cattle.

From a review of what has been done and attempted in this line in the United States, it is quite evident that it is impossible to successfully carry out any very drastic measures. Little can be done without the co-operation of the cattle owner. The plan which seems to be most successful is for the state to offer its assistance in freeing herds from tuberculosis. If the owner will agree to the application of the tuberculin test, and will agree to improve and disinfect his stables, as required, and thereafter to purchase none but tested animals, the state should test his herd, slaughter and pay for all infected, and assist in disinfection, and, subsequently, inspect from time to time to see that the health of the herd is maintained. It is believed that by thus gradually securing healthy herds in different parts of the

state, enough friends will finally be secured for the carrying out of more radical measures and the compulsory cleansing of those herds whose owners still persist in maintaining them as foci of the disease. The eradication of tuberculosis in animals, except as it is incidentally involved in the protection of municipal milk supplies, had best be attempted by state rather than municipal authorities.

To summarize what seems to be feasible for the state at present to attempt in the way of control of tuberculosis, it may be said :

First. Every state or city should require the notification of the disease, and offer assistance in diagnosis.

Second. State and municipal health authorities should do everything possible to educate the people by publications and by verbal instructions, in all cases co-operating with and never superceding the attending physician.

Third. The spitting habit should be controlled as much as possible, and effort made to instruct and help the consumptive to care for his sputum.

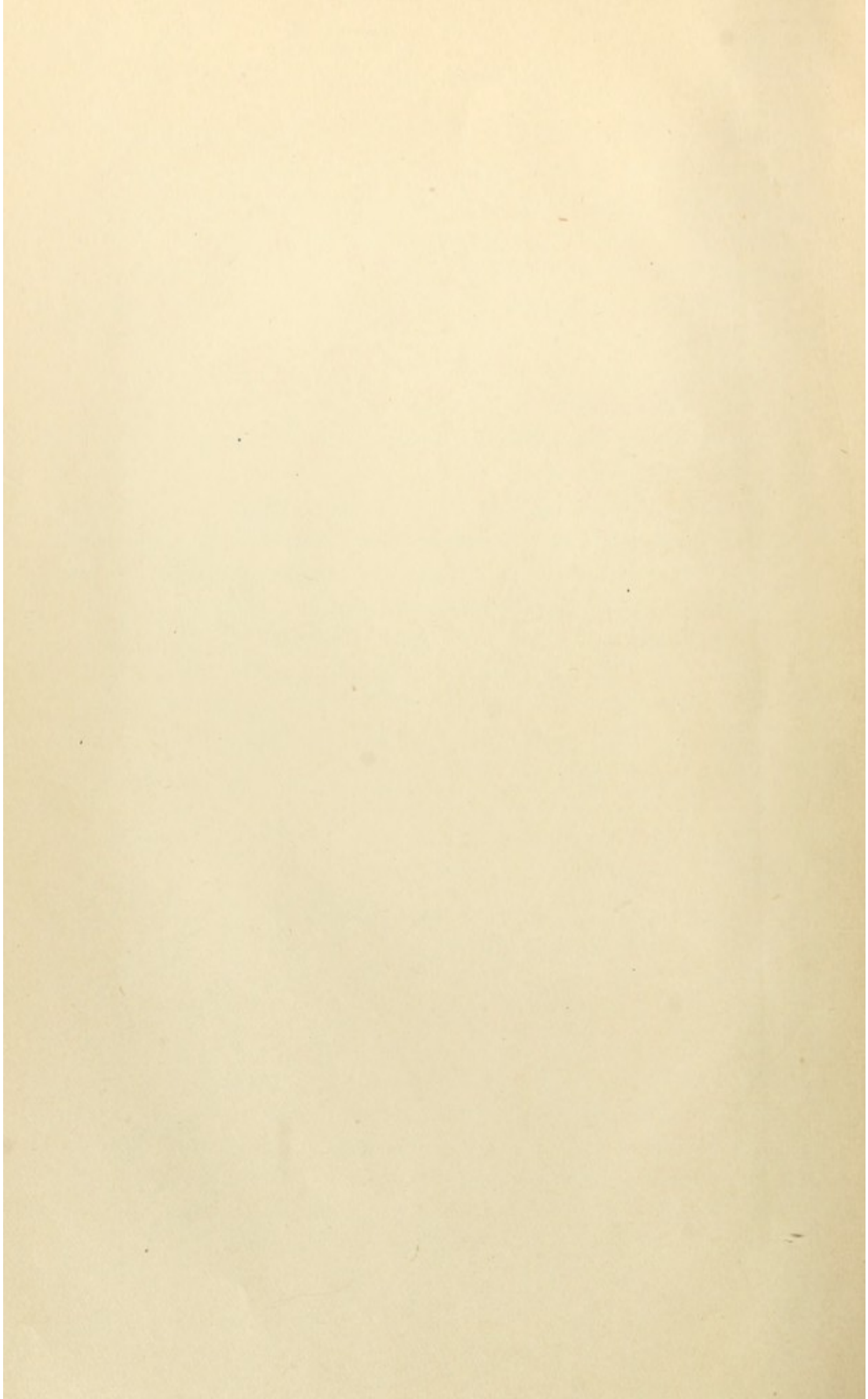
Fourth. Municipalities should assist in cleansing premises occupied by consumptives.

Fifth. The state or the municipality, or both, should offer hospital facilities for the care of this disease.

Sixth. If public opinion will warrant, no milk should be sold except from cows tested with tuberculin. If this cannot be done, effort should be made to induce dairymen to apply this test. Such work must, at present, be chiefly done by municipalities.

Seventh. The state, by means of state officials, should strive to secure the co-operation of cattle owners in the eradication of tuberculosis from their herds, and should test and pay for slaughtered animals.

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