Rabies: Its Cause, Frequency, and Treatment.

By D. E. Salmon, D. V. M.,
Chief of the Bureau of Animal Industry.

Rabies in the District of Columbia.

In December of the year 1892 the brain of a man who had died of a mysterious nervous affection was brought to the laboratory of the Bureau of Animal Industry for examination. It was thought that the symptoms exhibited by the patient resembled somewhat those of hydrophobia, but the physician hesitated to make this diagnosis, as it was not known that rabies existed among the dogs in the District of Columbia, and as the opinion had been widely circulated by certain authors, supposed to have knowledge of the subject, that the disease was so very rare that a single case could not be found by years of energetic search. A careful consideration of the symptoms, however, led to the inoculation of rabbits in order to test the theory of hydrophobia, and somewhat to our surprise, these rabbits in due time became affected with and died of rabies. As the rabies of animals is identical with the hydrophobia of man, and as hydrophobia is practically always contracted from the bite of a rabid animal, the result of this experiment was a demonstration that the man had died of hydrophobia, with a strong presumption that rabies existed among the animals of this section of the country.

Owing to the supposed infrequency of the disease, this case aroused considerable interest; and when, in the following month (January, 1893), information was received that a horse had been destroyed in the city of Washington because it was thought to be affected with rabies, further inoculations were made from the brain of this animal. The rabbits used in this experiment also became affected with rabies.

About this time a disease of cattle was under investigation by the pathological division of the Bureau, and the conclusion was reached that the disease was rabies; but before making a definite decision it was thought advisable to compare it experimentally with the rabies of dogs. Several veterinarians were accordingly requested to bring to the experiment station all dogs suspected of rabies, and the superintendent of the station shot a number of dogs which appeared to be affected. These dogs were all tested by inoculation experiments, and from March 24 to December 12, 1893, eleven were found affected with rabies.
As the investigations which required the virus of rabid dogs were closed in 1893, no further effort was made to procure cases, and no more were recorded until the fall of 1895. Interest was revived in the subject at that time by the death of a woman in Washington from this dreaded disease. Inoculations were made from the dog which bit this woman, but unfortunately the disease developed in the patient at the same time as in the inoculated rabbits, and there was, consequently, no opportunity for prophylactic treatment. This case was reported by Dr. Behrend to the Medical Society of the District of Columbia, and attracted considerable attention.

Arrangements were now made between the District health officer and the chief of the Bureau of Animal Industry whereby all dogs or other animals suspected of having rabies were to be sent to the Bureau laboratory in order that a positive diagnosis might be made. As a result of all these investigations, the number of cases of rabies which have been positively diagnosed and recorded in animals is as follows: 1893, 11 dogs, 1 horse; 1895, 4 dogs, 2 foxes; 1896, 5 dogs; 1897, 2 dogs, 1 cow; 1898, 7 dogs; 1899, 19 dogs, 1 cow, 1 cat; 1900, January to August, inclusive, 32 dogs, 3 cows, 1 horse, 1 cat. The total number of animals which have been proved to be suffering from rabies in the period from 1893 to August, 1900, is therefore 91. Twenty-eight persons were reported as having been bitten by these rabid animals. The records of the health department of the District of Columbia show 7 deaths of human beings from hydrophobia since August 1, 1874.

These developments were entirely unexpected. It was not supposed before the investigations began that rabies existed to this extent anywhere in the United States. Instead of being an extremely rare disease, to be found but once or twice in a lifetime, even by those who are diligently seeking it for the purpose of investigation, as has been represented, the facts cited show that rabies has existed for years almost continuously at the National Capital.

THE DISTRIBUTION OF RABIES IN THE UNITED STATES.

In order to learn something of the occurrence of rabies in other parts of the United States, information was requested of veterinary schools, State veterinarians, and other persons who would probably be in possession of such facts. A number of very carefully prepared replies were received, from which the following summaries have been made:

Dr. Charles P. Lyman, dean of the School of Veterinary Medicine, Harvard University, Boston, Mass.: During an outbreak of rabies, which was recognized as existing in Boston, there suddenly appeared in Harvard Square, Cambridge, one morning, a large crossbred Newfoundland dog. The animal entered a butcher shop and behaved in such a manner as to induce the butcher to throw him a bone and drive him away. The dog seized the bone and went into the street, and after gnawing for a short time
he went one after another to 5 dogs and bit them all. He also bit a horse rather severely in the upper lip. The 5 dogs came under Dr. Lyman’s professional care, and 3 of them died, showing all the symptoms recognized and described in the books as belonging to rabies. The wound on the horse was seared with a hot iron probably within thirty minutes from the time the injury was inflicted. Notwithstanding this treatment, the horse contracted the disease recognized and described as being rabies.

During a subsequent outbreak a dog bit a policeman on the streets of Lynn. This man declined to take the Pasteur treatment, said he was not afraid, and would take his chances. Within a short time he was taken ill with symptoms recognized by the local medical men as being those of hydrophobia, and he died after dreadful suffering.

Dr. Lyman estimates that there have been 25 to 30 cases of rabies observed at the Harvard Veterinary School during the last eighteen years.

Dr. W. J. Cootes, chief surgeon of the American Veterinary College, New York: In looking over record books finds on the average about 7 cases a year for the past twenty-five years. Has never seen a case of rabies in man.

Dr. H. D. Gill, professor of surgery in the New York American Veterinary College, formerly dean of the New York College of Veterinary Surgeons: During the month of May last (1900) 3 positive cases of rabies came to the hospital, one dog having bitten the three. For the past three years the average was 8 cases a year.

Dr. Robert J. Wilson, assistant bacteriologist, department of health, city of New York: Has confirmed the diagnosis of rabies in about 40 cases in domestic animals, and 3 in the human subject. His attention has also been called to 2 other undoubted cases in that city, where no opportunity was afforded to prove the diagnosis. All of these cases have been observed during the past three years.

Dr. Wilfred Lellmann, professor in the New York American Veterinary College, formerly of the New York College of Veterinary Surgeons: Has been lecturing on canine pathology for the past six years. During the last session has demonstrated to the students 4 evident cases of rabies. In his private practice met with 1 case. Of these 5 cases, 4 were mute rabies, while the 1 in private practice was of furious rabies. Besides these 5 cases, he saw 2 more at Dr. Gill’s clinic. A physician, Dr. Schwyzer, a friend of his, has observed a case of rabies in a man at the German Hospital in New York City.

Dr. Leonard Pearson, dean of the department of veterinary medicine, University of Pennsylvania, and State veterinarian: A great many cases of the rabies have been brought to the hospital connected with this school. Can not tell without looking over a great many records just how many. Estimates that during the fourteen years’ existence of the school from 300 to 400 unquestionable cases of rabies have been received in the hospital. Knows of several cases of rabies in man that have occurred in Pennsylvania, and the diagnoses in some of these cases have been confirmed by the inoculation of animals with pieces of the brain. During the last year there have been 2 fatal cases in Lancaster, 1 in Kennett Square, 1 in Philadelphia, and 1 in Allegheny. Three years ago one of the prominent veterinarians of Pennsylvania died of rabies following the bite of a rabid dog. There has been a great deal of rabies among the farm animals in different parts of the State. Cattle, swine, sheep, and horses have developed rabies of the furious form after having been bitten by a mad dog. A great many of these cases have been examined very carefully, and the diagnoses have been sustained by the results of laboratory examination.

Dr. J. M. Wright, professor in McKillip Veterinary College, Chicago (writing under date of April 5, 1900): Since January 1, 1900, his attention has been called to 11 cases in the dog and 3 in the horse. During the last year he has handled 20 cases, which is a fair yearly average.
Dr. A. H. Baker, professor of theory and practice and dean of Chicago Veterinary College: "Many cases of rabies in dogs and horses have been brought here. We have kept no record of the number of cases, but I can safely say that during the last year we have had at least 10 cases in horses and 50 in dogs. I have never seen a case of rabies in man. I may add that we are sincere believers in the Pasteur preventive treatment for rabies in man."

Dr. James Law, director of New York State Veterinary College, Cornell University, Ithaca, N. Y., says: "This particular locality has never, to my knowledge, since 1868, furnished a single case of casual rabies. It has, however, been repeatedly sent to us from different parts of the State (Chatham, Saratoga, Buffalo, etc.) in the form of brains of the diseased animals, from which small animals were experimentally inoculated and the disease produced, so as to confirm the original diagnosis or suspicion.

"I know of the case of Neil, the keeper of the dog pound at Newark, N. J., who died of rabies consequent on the bite of a rabid dog. I brought a portion of his medulla to Ithaca and inoculated a dog and a number of rabbits, some on the brain and others subcutaneously, with the result that all showed rabies after the customary periods of incubation. I have the best of evidence of a number of men who contracted rabies after the bite, and from whom (saliva or brain) inoculation of the disease was successfully made on the lower animals to prove its infective character.

"On the other hand, I know of a number of cases in which people who had been bitten by dogs have developed symptoms of hydrophobia as the simple result of fear, mimicking the symptoms as nearly as their knowledge of the disease would guide them. * * * The unreal nature of such fanciful cases is not, however, any disproof of the actual infections in which the virulent saliva or brain of the human victim has produced rabies in the lower animals in a continuous series, though they can have no apprehension of such a result. The person who denies the real because there exists a counterfeit is in this case an exceedingly dangerous person, about as much in need of seclusion as the rabid dog itself. The disease prevails at present in Erie County, N. Y."

Dr. S. Stewart, secretary Kansas City Veterinary College: Eleven or 12 cases have been brought to the hospital during the last three years, 5 within one year. No cases of rabies in man have come under his personal observation. Four or more authentic cases have occurred in that city in past five years. Typical, well-marked cases in dogs, horses, cattle, and swine have come under his personal observation.

Dr. John J. Repp, professor of pathology and therapeutics of veterinary department, Iowa State College of Agriculture and Mechanic Arts, says: "Since my connection with this school, a little over a year, no case of rabies has been brought to it. By consulting the records, I find that no case of rabies has been brought to this school during the twelve years covered by them. * * * "During the past winter Dr. J. R. Sanders, Corydon, Iowa, has noted the death of 18 cattle in his vicinity, 7 out of one herd of 50, all showing rabiform symptoms. He killed one of the seven out of the herd of 50 when it was suffering from these symptoms in a violent form, removed the cerebellum and medulla oblongata, according to my direction, and sent them to me packed in ice. I received the tissues in excellent condition, and at once inoculated a rabbit subdurally with a small portion of a mixture made with sterile water and about one-eighth of a cubic centimeter of the medulla cut from the floor of the fourth ventricle. On April 7, two weeks and four days after the inoculation, the rabbit died, after four days' suffering, from gradually increasing paralysis. * * * My diagnosis, therefore, is that the steer from which the tissues were taken was suffering from rabies at the time of his death, a diagnosis borne out by the symptoms presented. If this steer had rabies, it is presumed that the other cattle suffering in like manner had rabies also."
"During my four years' residence at the University of Pennsylvania I saw a large number of cases of rabies in the dog and made a number of rabbit inoculations from such cases with invariably positive results. Rabbits which I inoculated in the same manner from suspected but doubtful cases frequently remained perfectly well, showing that the mere operation will not bring on the symptoms of paralysis and death, and leading to a decision that the suspected cases were not rabies."

Dr. H. J. Detmers, Columbus, Ohio, formerly professor of veterinary medicine in Ohio State University: Has observed 4 very pronounced and unmistakable cases, 3 dogs and 1 horse, since 1893.

The health department of Buffalo, N. Y.: In a recent outbreak, not yet entirely over, investigated, on complaint, 45 cases in dogs; in addition 74 cases of dumb rabies and 41 cases of furious rabies were brought to the pound. Inoculations were made early from the case of a stray dog that ran amuck at Evans, biting 17 dogs and 2 cats. The dogs inoculated developed typical rabies on the twenty-third day following.

Records of the county superintendent of poor and the city department of health show that 29 persons were sent to the Pasteur Institute at New York, 4 of these being bitten by rabid cats. Four persons died of the disease—the first, a child, eighty-one days after being bitten; the second, the owner of the dog which bit the child, who was sent to the Pasteur Institute at New York, dying there, the disease in him developing on the eighty-third day; third, a young man, bitten by strange dog which he was trying to throw out of a crowded dancing hall, and which was acting strangely; fourth, a woman, who died in October, 1899, having been bitten by a dog. A considerable number of animals other than dogs also died of the disease.

Dr. A. W. Bitting, veterinarian of the Agricultural Experiment Station of Indiana (writing under date of April 18, 1900), says:

"Your letter was received on the 10th, and upon the 11th we had a typical case of rabies in a dog at this station. This makes the third outbreak at this place. One outbreak occurred last August and September, in which 1 dog, 7 horses, and 8 head of cattle died. Part of these were brought to the experiment station laboratories. The first outbreak occurred some years ago, and some two or three dogs in the neighborhood and several sheep and hogs belonging to the station were affected. A number of outbreaks have been reported in the State. I have never seen a case of rabies in man, but our State board of health records 3 deaths from such a cause last year."

Dr. C. A. Cary, professor of veterinary science in Agricultural and Mechanical College of Alabama: Six cases have been brought to the college and many others have occurred in the vicinity; altogether 24 cases of rabies are recorded at the college.

Dr. J. W. Scheibler, State veterinarian, Memphis, Tenn.: Has seen about 20 cases of what he believed to be rabies.

Dr. George H. Bailey, State veterinarian, Portland, Me.: Has had 1 case in his private practice, and the Maine general hospital had 1 case in a young man several years ago.

Dr. A. W. Clement, State veterinarian, Baltimore, Md.: Has had about 30 cases brought to his attention officially.

Dr. Samuel S. Buckley, veterinarian at Maryland Agricultural Experiment Station, College Park, Md., says:

"We had, several years ago, an outbreak in this town, originating, as far as we know, in a collie. This animal, in the course of his depredations, bit 3 cows, a cat, a calf, and the farm superintendent and his son. All the animals developed the disease before being destroyed. The farmer and his son were treated by Dr. Gibier, of New York, and never suffered any trouble."

Dr. Cooper Curtice, State veterinarian of North Carolina: Although he has been in that State but about a year, he has noted 1 case there in the human subject.
Dr. W. H. Dalrymple, veterinarian, State University and Agricultural and Mechanical College, Baton Rouge, La.: Has seen 1 typical case of rabies in the horse and at least half a dozen cases in cattle. From an interview with Dr. J. W. Dupree, surgeon-general of the State and ex-president of the State Medical Association, he learned that the latter has had in his practice 3 typical cases in the human subject resulting from the bites of dogs. The dogs were not destroyed but kept under observation, and they died, showing typical symptoms of the disease.

Dr. F. A. Bolser, State veterinarian of Indiana: Three outbreaks of rabies in six years, affecting horses, mules, cattle, and hogs. Two young men were bitten, badly lacerated, and died in great agony.

Dr. H. P. Clute, State veterinarian of Wisconsin: Fourteen cases in dogs, sheep, cattle, and horses. A successful inoculation of rabies with virus taken from the brain of a calf and dog has just been made at the experimental station at Madison. The calf died, having been bitten by a sheep that was bitten by a dog. All of these animals died of rabies. Rabbits inoculated with virus from the brain of the dog on March 15 died of rabies on the eighteenth and nineteenth days after inoculation. Those inoculated with virus from the brain of the calf died of rabies on the twenty-first and twenty-second days after inoculation.

Dr. A. T. Neale, director of Delaware Agricultural Experiment Station: Has seen many cases of rabies during the last ten years. Horses, cows, and dogs have been the victims. Has no complete record of the number of cases. Specifies the following cases:

1. A cow, seen before death, was killed two days later, and medulla and section of cord removed and taken to University of Pennsylvania, where rabbits were successfully inoculated. Ten days later these inoculated animals died of dumb rabies. This cow was one of three or four in the same herd which died with similar symptoms.

2. Inoculation from a suspicious dog at experiment station on rabbit caused death by paralysis ten days later.

3. A horse observed at 10 a.m. died after four or five hours; was undoubtedly affected with rabies. No inoculation test made.

Two or three dog cases have been demonstrated by Professor Chester and Dr. Robin at this station since last summer. In every instance rabbits have been the test animals, and in every case the rabid dogs have been under observation for several hours prior to death.

Dr. H. P. Eves, of Wilmington, Del., has many cases of cows and dogs in his practice, victims of this disease. Dr. J. J. Black, of Newcastle, has had human cases in his practice.

Dr. M. E. Knowles, State veterinarian of Montana: Has seen about 60 cases of rabies during a practice of fifteen years, of which 53 cases were brought to his attention officially.

Dr. J. W. Elliott, State veterinary surgeon of South Dakota: Has had as many as 100 cases brought to his notice officially in the last two years, mostly in cattle, and the origin could be traced to dogs afflicted with rabies.

Dr. G. T. Seabury, State veterinarian of Wyoming: Destroyed a dog affected with rabies in Cheyenne on March 30, and has seen 3 cases of the disease.

Dr. Sol. Bock, State veterinary surgeon of Colorado: Has seen at least 50 cases of rabies in the past year.

Dr. Paul Fischer, State veterinarian and professor of veterinary science and pathology of Kansas State Agricultural College: Reports a case of rabies in a horse in 1897. The animal was brought to the college and showed very characteristic symptoms. It
had been bitten by a rabid dog three weeks before. The animal died on the following day. Intracranial inoculation of a rabbit with portion of cord of the horse produced death after thirty days from paralytic rabies.

Dr. A. T. Peters, animal pathologist at University of Nebraska: Reports about eight different outbreaks of rabies recorded there. In one outbreak a dog bit several other dogs, and also a cow and a horse. The cow, a fine Jersey heifer, was bitten in the nose. She was quarantined, and thirty-one days afterwards showed all the symptoms of rabies. The horse was bitten very slightly, and showed the disease some two hundred days later.

Dr. L. L. Lewis, professor of zoology and veterinary science at Oklahoma Agricultural and Mechanical College: Two cases of rabies have come under his observation since he has been in that position.

At this writing (December, 1900) information is received from Dr. George W. Coler, health officer of the city of Rochester, N. Y., of an extensive outbreak of rabies in that city and vicinity. Dr. Coler has officially reported to the mayor that since June 1 he has seen from 25 to 50 dogs with unmistakable evidences of rabies, a number of the animals having been shown to be rabid by inoculation experiments, which in 4 cases were verified by Prof. V. A. Moore, of Cornell University, and Dr. M. P. Ravenel, of the University of Pennsylvania. Upon the recommendation of the health officer, the mayor has issued a proclamation ordering “that, until further notice, the owners of dogs are prohibited from allowing them to run at large in any public street or place within the city of Rochester, unless such dogs be securely muzzled or led by a line or chain so as effectively to prevent them from biting any person or animal.”

In a valuable article published in the St. Paul Medical Journal, October, 1900, Dr. F. F. Wesbrook, director of State board of health bacteriological laboratory and professor of pathology and bacteriology in the University of Minnesota, details investigations of specimens from suspected cases of rabies, from which he concludes:

It is very evident that rabies does exist in this State and is fairly widespread in distribution and number of cases. The cases examined, and which proved to be rabies, include 1 human being, 20 dogs, 1 horse, 7 cattle, 1 pig, 1 sheep, and 1 wolf. We have histories which show that infection was known to be due in these cases to the bites of 19 different dogs, and perhaps 1 skunk, in which rabies infection may be assumed from the demonstration of rabies virus in the cases bitten by them. We have also data which show that at the time of the infection of the cases investigated by the laboratory 1 man, 8 dogs, 8 cattle, 6 swine, and 6 sheep were known to have been bitten, and of these, 8 cattle, 6 swine, 6 sheep, and 3 dogs died of rabies—that is, all of the cattle, swine, and sheep developed rabies. The man received Pasteur treatment.

The animals which were thus shown to have had rabies on laboratory investigation are known to have bitten 7 human beings, 3 dogs, 6 cattle, 1 horse, and 5 hogs. Of these, 5 of the people received Pasteur treatment, and none, so far as is known, developed rabies. Of the animals bitten, 5 cattle, 1 horse, 1 hog, and 4 dogs developed rabies and died or were killed. Many more of the dogs known to have been bitten were killed before rabies had a chance to develop. As an example, it may be
mentioned that in Willmar 30 were killed at one time. These estimates have been carefully made, and where the information at hand stated that several animals had been bitten, account was taken only of one.¹

It will, therefore, be seen that from these 46 cases examined, of which 31 were shown to be rabies, and concerning which there was data in only a small portion of the cases, we have been able to obtain positive knowledge of 84 cases of rabies in this State. (See table below.)

<table>
<thead>
<tr>
<th>Items</th>
<th>Human beings</th>
<th>Horses</th>
<th>Cattle</th>
<th>Sheep</th>
<th>Swine</th>
<th>Dogs</th>
<th>Wolves</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabies diagnosed by laboratory, Minnesota State board of health</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>20</td>
<td>1</td>
<td>81</td>
</tr>
<tr>
<td>Animals which bit the animals shown by the laboratory to have been rabid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19</td>
</tr>
<tr>
<td>Animals which developed rabies and died from bites inflicted under the same circumstances as those animals which were shown to have been rabid by laboratory investigation</td>
<td></td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td></td>
<td></td>
<td>23</td>
</tr>
<tr>
<td>Animals which developed rabies after having been bitten by animals shown by the laboratory to have been rabid</td>
<td></td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td></td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>2</td>
<td>19</td>
<td>7</td>
<td>8</td>
<td>46</td>
<td>1</td>
<td>84</td>
</tr>
</tbody>
</table>

In the Fifth Biennial Report of the West Virginia State Board of Agriculture for the years 1899 and 1900, Dr. S. E. Hershey, consulting veterinarian, states that quite a number of outbreaks of rabies have occurred within that State in the past few years, with considerable damage and loss of stock. He gives, as coming under his personal observation during the period covered by the report, 4 cases of cattle and 1 of a horse, 4 of which animals were known to have been bitten by dogs. In addition there were many similar cases in the same herds or on the same farms which he did not personally see. In Lewis County several horses died with rabies and several people were bitten. Some of the people were sent to the Pasteur Institute at New York for treatment. Several deaths occurred in the human family in that county.

The Biennial Report of the State Veterinary Sanitary Board and the State Veterinary Surgeon, of Colorado, for the years 1899 and 1900, contains this paragraph:

Last year an epizootic of rabies occurred in this State, but the outbreaks in all cases have been vigorously handled by the local health authorities, and at the time of making report the epizootic may be considered to be effectually suppressed.

¹This statement apparently explains the inconsistency of some of the figures, and indicates that in some cases they are below the actual number.
In the vital statistics of the census of 1890, the deaths from hydrophobia in man are reported by States for the year ending May 31, 1890, as follows:

<table>
<thead>
<tr>
<th>State</th>
<th>Number of Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>7</td>
</tr>
<tr>
<td>Arkansas</td>
<td>4</td>
</tr>
<tr>
<td>California</td>
<td>1</td>
</tr>
<tr>
<td>Colorado</td>
<td>2</td>
</tr>
<tr>
<td>Connecticut</td>
<td>2</td>
</tr>
<tr>
<td>Florida</td>
<td>2</td>
</tr>
<tr>
<td>Georgia</td>
<td>16</td>
</tr>
<tr>
<td>Illinois</td>
<td>3</td>
</tr>
<tr>
<td>Indiana</td>
<td>4</td>
</tr>
<tr>
<td>Kansas</td>
<td>3</td>
</tr>
<tr>
<td>Kentucky</td>
<td>5</td>
</tr>
<tr>
<td>Louisiana</td>
<td>5</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>21</td>
</tr>
<tr>
<td>Michigan</td>
<td>2</td>
</tr>
<tr>
<td>Minnesota</td>
<td>4</td>
</tr>
<tr>
<td>Mississippi</td>
<td>5</td>
</tr>
<tr>
<td>Missouri</td>
<td>11</td>
</tr>
<tr>
<td>Nebraska</td>
<td>2</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>1</td>
</tr>
<tr>
<td>New Jersey</td>
<td>3</td>
</tr>
<tr>
<td>New Mexico</td>
<td>6</td>
</tr>
<tr>
<td>New York</td>
<td>5</td>
</tr>
<tr>
<td>North Carolina</td>
<td>3</td>
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<tr>
<td>South Carolina</td>
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</tr>
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<td>South Dakota</td>
<td>1</td>
</tr>
<tr>
<td>Tennessee</td>
<td>5</td>
</tr>
<tr>
<td>Texas</td>
<td>3</td>
</tr>
<tr>
<td>Virginia</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>143</td>
</tr>
</tbody>
</table>

The results of the census of 1900 not being available, application was made to the health officers of the principal cities of the United States for the number of deaths from hydrophobia in man during the decade from 1890 to 1899, according to their official records. The reports received, to which have been added a few cases reported from unofficial but reliable sources, show that for the period named, and including in some instances the first half of the year 1900, there were in 73 cities 230 deaths from this disease after eliminating cases in which the diagnosis was reported as doubtful. The figures for some of the leading cities are as follows:

<table>
<thead>
<tr>
<th>City</th>
<th>Number of Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater New York</td>
<td>127</td>
</tr>
<tr>
<td>Chicago</td>
<td>68</td>
</tr>
<tr>
<td>Philadelphia</td>
<td>28</td>
</tr>
<tr>
<td>Baltimore</td>
<td>8</td>
</tr>
<tr>
<td>New Orleans</td>
<td>14</td>
</tr>
<tr>
<td>Buffalo</td>
<td>34</td>
</tr>
<tr>
<td>Pittsburg</td>
<td>7</td>
</tr>
<tr>
<td>Washington</td>
<td>5</td>
</tr>
<tr>
<td>Nashville</td>
<td>5</td>
</tr>
</tbody>
</table>

In a number of these cases the diagnoses were verified by inoculations of small animals with material from the human subjects.

1 Incomplete, as the records of some of the boroughs did not go back for the whole period.
2 Only 6 of these cases are officially reported by the health department, and these are all prior to 1897. In one of the remaining cases inoculation experiments were made with positive results, and the other is well authenticated, though the coroner is reported as refusing to accept certificates of death from hydrophobia, and requiring that the certificates be made to ascribe the deaths to other diseases.
3 All occurred in 1900. No report was received covering the period previous to this outbreak.
Facts and Fallacies Concerning Rabies.

It required many years of patient scientific research to lead the ablest investigators to a clear comprehension of the cause, nature, and characteristics of rabies, and it is only recently that this has been accomplished. From the earliest dawn of history the disease has been feared and dreaded; its terrible manifestations have been surrounded with an atmosphere of awe and mystery, and it is not surprising that myths, fallacies, and misconceptions in regard to it have been common and widely accepted. Nor have such errors been confined to the ignorant or those unfamiliar with the subject of disease, but, on the contrary, they have been shared and propagated by men of learning, some of whom have stood high in the medical world.

As the investigations by which we have come to a tolerably clear understanding of the facts concerning rabies have been comparatively recent, and have appeared for the most part in scientific periodicals, fallacies in regard to the disease still have a strong hold upon the public mind, and are industriously circulated by many who believe they are working in the cause of truth and humanity. Persons in a position to know the facts have either not had the time, the disposition, or the opportunity to take up this subject and show its importance to the people and the desirability of educational work with a view to the control of the contagion. For years we have been living in fancied security from this disease; we have been told that it was extremely rare, if, indeed, it had any existence outside the imagination; and during these years the plague has spread, with only the feeblest efforts for its control, until now it has become so common as to be a positive and constant menace to our animals and to human life. The facts already presented demonstrate its frequency, but they do not give an adequate idea of the losses from it.

In many sections where it exists its nature is not recognized. Some outbreaks, in which most of the cases were of the dumb or mute form, were not recognized even by veterinarians. One such case, where 50 or 60 dogs were reported affected, was so characteristic in symptoms that its nature could not be doubted. The "dropping" of the jaw and the uniformly fatal results after a few days' illness attracted attention, but apparently did not excite suspicion. In the Rochester outbreak so many cases of dumb rabies occurred that the disease was popularly known as "drop jaw." Three animals so affected, the health officer states, were found in one load of dogs that was taken to the pound.

In order to convey a clear idea of the subject, some of the principal questions concerning rabies will be briefly considered seriatim.

The Reality of Rabies.

The first point in regard to which the earnest inquirer seeks information is the reality of rabies. Is there a particular and well-defined
disease which can be clearly determined and separated from all other
diseases, and which conforms to the description that has become classi-
cal in our text-books and has been accepted for generations? In other
words, Do we know there is such a disease as rabies? and, if so, How
do we know it?

GENERAL RECOGNITION OF SUCH A DISEASE AS RABIES.

From the time of Aristotle (322 B. C.) till the present day we have
clear accounts of this disease existing through every age, and provok-
ing fear and horror in many countries. It was caused by the bite of
an animal, and such animal was generally alleged to be rabid. It was
almost invariably described as fatal in men and animals. The symp-
ptoms, from the earliest times, have been given as nervousness, excit-
ability, restlessness, fear, irritability, great sensitiveness of the skin,
paroxysms of fury, spasmodic contractions of certain muscles, paral-
ysis, and death.

The medical profession, as a whole, has always recognized the exist-
ence of such a disease as rabies in man, and also that this disease is
caused by the bite of a rabid animal. The veterinary profession has,
from its foundation, recognized the existence and contagiousness of
the disease. Its schools, from the earliest to the latest, have consist-
ently taught this doctrine, and its text-books are all but unanimous on
the subject. The same may be said of the text-books on human dis-
eases. Would it not be extraordinary, amazing, incredible, if, at this
late day, it were proved that the thousands and hundreds of thousands
of observations recorded from the birth of history to the present day,
by the trained physician or veterinarian as well as by the layman, were
misconceptions, that the authors were deceived, and that the disease
was a myth? Where can a parallel be found to such a sudden and
complete overthrow of an ancient and almost universally accepted
conclusion concerning a phenomenon so accessible to observation and
investigation?

INSUFFICIENCY OF OBSERVATION TO PROVE THE DISEASE.

There have, however, apparently been a few persons in all ages who
have questioned the existence of rabies. The mysterious and unusual
phenomena were sufficient to explain this doubt on the part of thinkers
and writers without personal experience with the disease, or who
approached its study with preconceived opinions. Previous to the
nineteenth century it was difficult to answer the objections of such
critics. At the most, it could be affirmed that cases of a disease with
such a train of symptoms had been observed, and that this disease fol-
lowed the bite of a dog supposed to be rabid. It could not be proved
that the dog which did the biting actually was rabid, or that the dis-
 ease certainly resulted from the bite, or that the disease in the dog
and the man were identical.
With the beginning of the century came a new era in the medical world. The student of disease began to feel the necessity for a more substantial foundation for his knowledge than the ordinary observation of the accidental cases which from time to time occurred in his practice. These accidental cases were often too widely separated for comparative study, the conditions under which they developed could not be known or controlled, and the essential phenomena could not be determined. Observations made and conclusions reached under such circumstances were unreliable. Different observers would reach diametrically different opinions, and one apparently had as good evidence for his views as the other. The confusion and absurd hypotheses which resulted can only be realized by comparing the text-books of a century ago with those of the present day.

The doubts, errors, and confusion which arose in the attempt to study disease by the observation of accidental cases were finally dispelled by experimentation. What could be more rational, for example, in case there was a doubt as to the transmission of canine madness by biting, than to make an experiment by allowing a rabid dog to bite four or five other dogs and to keep an equal number unbitten for comparison. If the bitten dogs contracted rabies and the unbitten ones remained free that would be presumptive evidence of transmission. Such an experiment, repeated perhaps a few times, with precautions against accidental infection, would afford positive demonstration as to this essential point in our knowledge of the disease.

DEMOnSTRATION OF RABIES BY EXPERIMENTATION.

Zinke,\(^1\) in 1804, announced that he had inoculated a dog, a rabbit, and a cock with saliva from a rabid dog, taking the saliva with a brush from the animal soon after its death and spreading it over superficial wounds of the inoculated animals. The dog was inoculated in an anterior limb, and showed prodromic symptoms on the eighth day, and was rabid on the ninth day. The rabbit was rabid on the eleventh and the cock on the fourteenth day.

This experiment, made so early in the century, proved (1) the virulence of the saliva of rabid dogs; (2) that the disease might be artificially inoculated; (3) that the disease might be communicated by inoculation to the dog, the rabbit, and the fowl; and, (4) it disproved the old doctrine that the contagion disappeared at the instant of the animal's death (*morte la bête, mort la venin.*)

Count Salm-Reiferscheid, in 1813, recorded experiments in which several dogs were inoculated, part with fluid and part with dried saliva from a rabid dog. These were affected with rabies in eight to ten

\(^1\)Zinke, Gottfried: Neue Ansichten der Hundswuth, etc., Jena, 1804, S. 180. Quoted by A. Högyes: Lyssa, Wien, 1897, p. 32.
days. This experiment proved that the saliva remained virulent a considerable time after the dog's death, and that it would even withstand a certain amount of drying.

These two series of experiments give us the evidence of the existence of a specific, communicable disease of the dog, which is transmitted by inoculation with the saliva. There was still a question as to whether cattle and sheep, animals which do not naturally defend themselves or combat others by biting, developed virulent saliva when they contracted the disease. To determine this, Berndt, in 1822, inoculated four wethers with saliva from the mouth of an ox which had died of rabies. All of these sheep contracted rabies, the period between inoculation and the appearance of the first symptoms being twenty-two, twenty-five, twenty-six, and thirty-one days.¹

In 1841-42 Professor Rey, of the Veterinary School of Lyons, France, inoculated from sheep to sheep, using the saliva and inserting by lancet punctures. Of 7 animals inoculated in this manner, 6 contracted the disease.²

Renault reported that from 1836 to 1860 he had inoculated or caused to be bitten 131 dogs in his experiments, and that 68 of these afterwards became affected with rabies. The period of incubation varied with these animals from ten days to one hundred and eighteen days, and with about 18 per cent it was sixty days or longer.³ This report gave much information as to the proportion of inoculated dogs which contracted the disease and as to the period which may be expected to elapse between the inoculation and the appearance of the symptoms.

There were many persons, including physicians, who at the beginning of the century doubted the transmission of rabies to man. The medical doctrines at that time were unfavorable to the idea of contagion, and the inclination was to look upon rabies as a simple irritation of the central nervous system. These views were exploded by Magendie, who inoculated a dog under the skin of the frontal region with the saliva of a young man under treatment for rabies. This dog became rabid in about a month, and was allowed to bite 2 other dogs, which in turn became rabid after forty days.⁴

Earle, Hertwig, Renault, and others made similar inoculations from affected persons to rabbits, conveying the disease. It was also shown that children so young that they could not cause the disease by worry and dread were affected by the bites of rabid dogs in the same manner as adults.⁵

³ Comptes Rendus Acad. des Sciences, 1863, p. 72.
⁴ F. Magendie: Journal de Physiologie Expérimentale, 1821, p. 42.
It was, consequently, demonstrated that rabies is communicable to man as well as to animals, and that the saliva becomes virulent with man, as it does with the lower animals.

The diagnosis of rabies has been called in question in all ages, and there have always been persons who have asked, How do you know that this particular animal or that this individual person is affected with rabies and not with some other disease of the nervous system? The answer of the investigator is: If inoculations from this animal or this person transmit the disease to the inoculated animals, then it is certain that the individual from which the inoculation was made was affected with the disease, that is to say, rabies can not be produced with the saliva of animals or men affected with noncontagious diseases, nor is there any other known contagious disease with similar characteristics which may be confounded with rabies. The inoculation or biological test is therefore an accurate and reliable test, and should be used in all cases of doubt. It is identical in principle with the biological tests of glanders, pleuropneumonia, foot-and-mouth disease, rinderpest, variola, and other contagious diseases of animals which have long been used and relied upon in case other methods of diagnosis fail.

The value of rabbits for making the biological test of rabies was pointed out by Galtier in 1879 and by Pasteur a few years later. The obstacles to this test in practice were (1) that the saliva generally contained various kinds of bacteria and might cause the death of the rabbits from septic infection, and (2) that the period of incubation might be long and uncertain when cutaneous or subcutaneous inoculations were made. The investigations of Pasteur (1881) showed the constant virulence of the brain and medulla, and that these organs, being protected from saprophytic germs, furnished a pure virus which might be used for biological tests. He also showed that the inoculations might be made upon the surface of the brain, in which case the disease was certainly transmitted, and the period of incubation was reduced to a minimum.

Of late years the methods of Pasteur have been widely adopted. There are still skeptics, however, who object to this test, on the ground that it is the irritation to the brain, caused by the inoculation, that produces the disease, and that there is no proof of contagion when the rabbits die of supposed rabies. These people forget, however, that it is always possible in case of doubt to make the inoculation in the skin or muscles, or even to use larger animals, such as horses, cattle, sheep, or dogs. Rabbits are only used because they are cheap and convenient. Brain inoculations are made because they are more certain in results and the disease appears sooner. The Pasteur method has been sufficiently confirmed by other methods, and its reliability clearly demonstrated.
Successful experiments of this order, numerous, and made by competent men, are absolutely conclusive as to the existence of a disease of the dog communicable to human beings, to dogs, and other animals by biting and by inoculation with the saliva. If this disease is not rabies, what is it? And if it is given some other name, do not the facts stand the same under one name as under another?

It is a mistake to say that the disease alleged to be rabies has not been defined with sufficient clearness for its identification. Consider for a moment the description: A disease affecting principally the nervous system, shown by nervousness, excitability, restlessness, irritability, paroxysms of fury, uncontrollable desire to bite all other animals, convulsions, paralysis, death; caused by the bite of an animal similarly affected; communicable by inoculation with the saliva; having a long period of incubation (three to six weeks); comparatively short course of disease (two to ten days); invariably fatal. Is not that picture clear enough for identification? With what other disease can it possibly be confused?

The reality of rabies has been demonstrated by crucial experiments, so often repeated that there is no longer any reason for doubt. It is a fact established with the same certainty as any other fact in science, and it can not be overthrown by hypothetical arguments or general denials based upon intuitive reasoning.

THE COMMUNICABILITY OF RABIES TO MAN.

Aristotle taught that rabies was fatal to dogs and to every other creature which they bite except mankind. This early mistake as to the immunity of man has been carefully handed down across the succeeding twenty-two centuries as though it were the most precious bit of knowledge, and is still repeated on every hand by the many who oppose measures for the prevention of the disease. There was some apparent support for this opinion in a number of facts connected with the disease. First, only a portion of the persons bitten by rabid dogs subsequently show symptoms of the disease; taking all the statistics available, not more than one individual in every six thus bitten is found to contract rabies even when no prophylactic treatment is administered. Second, there are other abnormal conditions of the nervous system in man which are accompanied by symptoms resembling more or less closely those ascribed to rabies. Third, some persons who have been bitten by dogs not rabid have by constant worry, anxiety, and fear of rabies induced a nervous, hysterical condition, with symptoms simulating somewhat those of the actual disease.

With these known facts as a basis, it is not surprising that a certain number of writers of limited experience and the habit of superficial observation should reach the conclusion that the view of Aristotle was correct, and that the disease was not transmissible to man. They
argued that it was only the comparatively few nervous and excitable people among those bitten who afterwards presented symptoms of rabies, and that these few had brought on these symptoms themselves by worry and fear, being affected not with true rabies, but with lyssaphobia (fear of rabies), which is simply a nervous and hysterical condition.

This reasoning was quite plausible a century ago, but it received a definitive answer when Magendie and other investigators inoculated dogs and various other animals from human victims of the disease, reproducing it in typical form. These experiments proved most conclusively that man as well as the lower animals is subject to rabies, and that when so affected his saliva becomes virulent, and may be the means of communicating the malady.

At present, when it is desired to make a positive diagnosis in a case of suspected rabies, this is done by the inoculation of some animal, usually a rabbit. Objection has been made by some critics to results obtained by inoculation of small animals, on the ground that the symptoms of the disease with such animals are not sufficiently characteristic to warrant a positive conclusion. This objection has little weight, since the long period of incubation (fourteen to twenty-eight days), the sudden appearance of the symptoms, the paralysis, and the short course of the disease, ending in death, are not likely to be seen in any other disease. In case of doubt, it is always possible to inoculate a larger animal, such as a dog, calf, or sheep, and thus reach an incontestable decision. The results of rabbit inoculations have been confirmed so many times by the inoculation of other animals that there is no longer any reason to doubt the occurrence of rabies in mankind or the reliability of the diagnosis by the usual tests.

Numerous cases of rabies in the United States affecting the human subject have been reported from various parts of the country, and tests have been made by our most competent investigators. These tests show that the disease not only exists, but that it is far more common than has been generally admitted. The extensive outbreaks of the disease in dogs reported from Buffalo, Rochester, and Washington City during the past year, and the numerous smaller outbreaks which have occurred in widely separated localities, are disquieting, and show the importance of more systematic repressive measures. A considerable number of persons, mostly children, have been bitten in these outbreaks, some of whom have died after the most intense suffering. Others have taken the Pasteur treatment, at great expense and inconvenience.

These are the facts in regard to the occurrence of rabies in man and animals in the United States. When the medical statistics of other countries are consulted there is found in many of them the same conditions. In Austria, Belgium, France, Germany, and Russia the official
reports show a large number of cases of rabies in dogs and other animals each year and a certain number in man. These are among the most enlightened countries of the world, where medical science has achieved its highest advancement, and where the theory of error on the part of the health authorities in regard to the nature of the disease is out of the question.

Such facts are met by the assertion that one prominent physician in Philadelphia has been endeavoring to find a case of rabies in man or in one of the lower animals for sixteen years without success; that another physician in New York has not been able to satisfy himself of the reality of the disease after many years of investigation, and that a neurologist in Washington City has publicly offered a reward of $100 for a case of rabies in man or dog. These assertions are plausible, and to those unacquainted with all the facts, they may be convincing. In reality they are deceptive and misleading. There have been numerous cases of rabies in dogs brought to the veterinary department of the University of Pennsylvania every year for many years, and any physician in Philadelphia could make arrangement with that institution to see and study the cases if he so desired. In the same manner any reputable physician in New York could have arranged with one of the veterinary schools or with the board of health in that city for a similar opportunity. There have been also rather frequent reports in the medical journals of patients at the hospitals in that city affected with this disease, and in some cases inoculation tests have demonstrated the correctness of the diagnosis. How can it be possible that a prominent physician living there and presumably well acquainted with the members of his profession has diligently searched for years for such cases and failed to find any? As to the neurologist in Washington City, the writer publicly answered his advertisement, and proposed to produce a case of rabies, the genuineness of the disease to be decided by a committee appointed by the Medical Society of the District of Columbia, and the reward, if earned, to go to a charitable purpose. The gentleman, however, did not accept the proposition, but withdrew his advertisement, and apparently had no further desire to see a case of the disease.

The Frequency of Rabies.

Some idea of the frequency of rabies in the United States may be obtained from the facts which already have been given. The cases mentioned are, however, only a few of what have occurred in the country, since the inquiry which elicited them has been by no means extensive or exhaustive. It was nevertheless sufficient for the purpose, which was to show the wide distribution and comparatively frequent cases of the disease. It may be safely concluded that instead of being a much more rare disease than is generally supposed, it is a much more common disease than we had reason to expect.
In many other countries the disease is equally prevalent. The official reports of Germany show 1,202 cases of rabies in animals (mostly dogs) in 1898. In France there were 2,374 animals affected in 1899. In Belgium there were 444 cases. In Great Britain there were 727 cases in 1895, and in Hungary 1,397 cases in the same year.

It is frequently asserted as an argument against the existence of rabies, that it is unknown at Constantinople and in India, where dogs are common and unrestrained. But why go to distant countries, from which it is difficult or impossible to get accurate information, for arguments on this subject, when the disease exists in our own cities, where it is accessible and may be investigated. If the condition of New York City, with its newspapers, board of health inspectors, veterinary schools, and highly intelligent population, is misrepresented, what may not be said of Turkey and India without fear of successful contradiction!

Whether rabies is or is not frequent in the Orient has little bearing on its existence here. What we know is that the disease is or has been common in all of the highly advanced and best known countries of the world. Our investigations show that it is equally common in the United States. These facts can not be overturned by the citation of reports from other countries, even if the accuracy of such reports were satisfactorily established. The frequency of rabies in the United States can only be determined by careful scientific investigations here, and not by reports from elsewhere. The cases cited from European countries have been produced simply to show that the disease was common there as well as here, that it is recognized by scientific authorities and by the leading governments, and that, consequently, the statement sometimes made to the effect that the highest authorities in the world deny the existence of rabies is incorrect and without foundation in fact.

THE EFFECT OF SEASONS UPON THE DEVELOPMENT OF RABIES.

Homer is supposed to refer to rabies when he mentions the dog star, or Orion’s dog, as exerting a malignant influence upon the health of mankind. This ancient belief has come down to our times, many intelligent people still holding that it is principally during the dog days that rabies develop, and that the disease can not exist during the cold months of the year. The scientific study of the disease and the statistical records show, however, that rabies is prevalent in winter as well as in summer; and that if the season has any influence upon its development this influence is not very marked.

Bouley compiled statistics showing 755 cases in December, January, and February; 857 in March, April, and May; 788 in June, July, and

August; and 696 in September, October, and November. At the Alfort Veterinary School for the years 1887, 1888, 1889, and 1890 the cases were as follows: January, February, and March, 130; April, May, and June, 60; July, August, and September, 50; October, November, and December, 74.

The following table, giving a large number of cases by months, has been compiled from statistics at hand:

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2 Loc. cit., p. 97.
3 Högyes: Lyssa, Wien, 1897, p. 25.
4 Leblanc: Statistique de la rage, Bul. de l’acad. de med., 1880, pp. 950-963.
5 Official statistics.

These statistics are very interesting, and effectually dispose of the fallacy that rabies can not occur in the winter. The compilation of Bouley shows 755 rabid dogs in December, January, and February, and 788 in June, July, and August—a very slight difference, and one which is probably without significance. The records of the Alfort Veterinary School are of especial value, because the diagnosis was made by the most skillful experts in the world. These show two and one-half times as many cases in January, February, and March as in July, August, and September. Taking the compilation of 14,066 cases by months, it is found that June stands highest, with 1,467 cases, or about 25 per cent more than the average. July is second, with 22.4 per cent over the average. May is third, with 21 per cent over the average. It would appear, therefore, that the most cases of rabies occur during May, June, and July, which are not usually the hottest months of the year. If the heat has any considerable effect in the development of rabies we should expect August to show the largest number of cases; but, as will be seen by the table, it stands fifth in the list of months, with only 10.4 per cent more than the average, being below April, which has 12.8 above the average.

The fewest cases occurred in November, which month had 20.4 per cent less than the average; January had 19.5 per cent less than the
average; March was 18 per cent below the average. As if to emphasize the uncertainty of predicting the distribution of rabies by seasons, according to the average temperature, February stands but 10.8 per cent below the average number of cases and December but 3 per cent below.

In a general way, it may be provisionally admitted that more rabies occurs in dogs in the months from April to September, inclusive, than from October to March; but the disease is seen in every month of the year, and as June stands highest, with 1,467 cases, and November lowest, with 933 cases, the difference is not sufficient to warrant any one in deciding that a suspected animal is not affected with rabies because the symptoms are observed in one of the winter months.

THE SYMPTOMS OF RABIES.

The symptoms of rabies are such as we should expect from serious disease of the central organs of the nervous system: First, irritation; second, paralysis and death. The rabies virus appears to have little effect upon the system until it reaches the brain and spinal cord. There it multiplies, sets up irritation, and finally interrupts the functions.

Rabies is generally divided into two forms: First, furious rabies; second, dumb rabies. In the former the animal is irritable, aggressive, and bites nearly every object which comes in its way; in the latter the muscles of its jaw are paralyzed almost from the first appearance of symptoms, and being unable to bite, the animal remains more quiet and tranquil. Essentially the two forms of the disease are the same, but owing to the parts of the brain attacked and the acuteness of the attack, paralysis appears much sooner in one of these forms than in the other. The saliva from a case of dumb rabies is just as dangerous and virulent as that from a case of furious rabies. The dogs with dumb rabies are less dangerous simply because they are unable to bite and thus insert their saliva into a wound.

The impression should not be formed that dumb rabies and furious rabies always represent two distinct types of disease, and that one may at a glance classify every case as belonging to one or the other of these types. Quite the contrary. The typical cases belong to the two extremes of symptoms, and there are all gradations between the two. In fact, almost every case of furious rabies sooner or later changes into the dumb form, that is, the final stage of rabies is almost invariably paralytic, and the dumb form in its typical development occurs when the paralysis appears on the first day of the disease. The paralysis may not appear, however, until the second, or third, or some subsequent day.

Again, a dog does not necessarily bite everything about it even though it has rabies and its jaws are not paralyzed. It may be
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combative and furious all of the time, or only a part of the time, or
not at all. There is no disease in which the symptoms vary more
than in rabies of the dog, and it is, consequently, impossible in any
description of moderate length to give an idea of the different forms
under which it may appear.

FURIOUS RABIES.

Fleming has well said that it is a great and dangerous error to suppose
that the disease commences with signs of raging madness, and that the
earliest phase of the malady is ushered in with fury and destruction.
The symptoms appear very gradually, and at first there is only the
slightest evidence of brain disease. The animal's habits and behavior
are changed. It may be more restless and affectionate than usual,
seeking to be near its master or mistress, fawning, licking the hands
or face, and apparently seeking for sympathy or assistance. Such
caresses are, however, extremely dangerous, for the animal's tongue,
moist with virulent saliva, coming in contact with a part where the skin
is thin, abraded, or wounded, may fatally infect the person for whom
it is endeavoring to demonstrate its affection. The smallest abrasion
may be, as Bouley has impressively said, a door opened to death; and
such a death! The instances in which hydrophobia has developed from
such inoculations are very numerous, and everyone should be warned
against this kiss of affection, which carries with it not only death, but
sufferings which are far more to be dreaded than the fatal termination.

In most cases dogs first become dull, gloomy, morose, taciturn, seek-
ing solitude and isolation in out-of-the-way places, or retiring under
pieces of furniture. But in this retirement they can not rest; they
are uneasy and agitated; they lie down and assume the attitude of
repose, but in a few minutes are up again walking hither and thither,
"seeking rest, but finding none." Occasionally this restlessness may
disappear for a time, and the animal become lively and affectionate;
oftener it sinks into a sullen gloominess, from which even its master's
voice rouses it but temporarily. It becomes more and more desperate
in its efforts to prepare a comfortable bed, pawing or scattering the
straw, or, if in a house, scratching, tumbling, and tearing cushions,
rugs, curtains, carpets, and everything of that kind within its reach.

At this period dogs may have aberrations of the senses, of the sight,
hearing, and feeling, which cause hallucinations, and lead them to think
that they are being annoyed by something, or that some animal or
person is endeavoring to injure them. They crouch, ready to spring
upon an enemy; they rush forward and snap at the air; they throw
themselves, howling and furious, against a wall, as though they heard
sounds beyond it.

While at first the affected dog may not be disposed to bite, it becomes
more dangerous as his hallucinations and delirium increase. The voice
of the master or of an acquaintance may dispel the aberrations tempo-
rarily and lead him to friendly demonstrations, but an unexpected

movement or touch may bring on another access and lead to a quick

and unexpected bite.

The disturbance of the sensations leads to chills and itching. If the

place where the bite occurred is accessible the dog licks the scar, and

later bites and tears the tissues. This tearing of the flesh is not always

confined to the site of the inoculation, but certain regions of the body

appear to lose their sensitiveness, and at the same time to convey to

the brain the sensation of itching. The animal in this case bites into

its own flesh with apparent pleasure and satisfaction.

Such animals take food until the disease is considerably advanced,

if it is something which can be swallowed without mastication; other-

wise it is dropped after remaining a short time in the mouth.

Difficulty of swallowing is an early symptom, and frequently leads

the unsuspecting owner to conclude that the animal has a bone in his

throat. A dog which appears to have a bone in his throat is on gen-

eral principles one of the most dangerous animals in existence. The

supposed bone may be there, but on the other hand the symptoms

which lead to this supposition may be due to partial paralysis caused

by rabies, and the owner may be inoculated with the virulent saliva

while thrusting his finger or hand in the dog's mouth to discover a

bone which has no existence but in his imagination.

It is commonly believed that mad dogs have fear of water and are

unable to drink, but there could be no greater mistake. In this respect

they differ entirely from the human patient. They have no fear or

dread of water, but continue to drink until paralysis has progressed so

far that they are no longer able to swallow. The fact that a suspected

dog is seen to drink or to wade into a stream is consequently no evi-

dence that he is not mad.

When the furious symptoms come on, the dog leaves his home and

goes upon a long chase, with no apparent object in view other than to

be traveling onward. He trots at a rapid pace, eye haggard, tail

depressed, indifferent to his surroundings. He flies at and bites dogs

and persons whom he meets, but usually does not apparently search

for them, or even notice them if they remain quiet. Dogs in this con-

dition may travel many miles, and finally drop from exhaustion and

die. Often after an absence of a day or two they return to their home,
exhausted, emaciated, covered with dust and blood, and presenting a

most forlorn and miserable appearance. Those who have pity for such

an animal, and try to make it clean and comfortable, are in great dan-
ger of being bitten, for the disease has advanced to a point where the

delirium or insanity is most marked, and where a treacherous bite is
most common. Doubtless the dog has no intention of injuring a friend,

and would not do so did he not see that friend transformed by his
disordered vision into some distorted and unrecognizable shape, which he thinks is about to injure him. But while we may give the dog due credit for not intentionally and deliberately inoculating his friends with this fatal virus, let us not forget that the inoculation is no less deadly because it is the result of the abnormal working of a disordered mind. Whatever the sentiment may be which leads the dog to turn upon his master or mistress and inflict an injury, the duty remains the same for the owner to take due precautions to prevent such an occurrence.

If the animal, instead of being allowed to escape, is kept confined, the paroxysms of fury are seen to occur intermittently, or, in the absence of provocation, they may be entirely wanting. If excited, it howls, rushes upon objects that are thrust toward it, or throws itself against the bars of its cage and bites with great fury.

As death approaches, the animal becomes exhausted and scarcely able to stand; the eyes are dull and sunken, and the expression is that of pain and despair. Paralysis appears in the jaws or in the posterior extremities, and extends rapidly to other parts of the body. The animal, being unable to stand, lies extended upon its side; the respiration becomes more and more difficult; there are spasmodic contractions of certain groups of muscles, complete prostration, and death.

The ordinary course of the disease is four or five days; it may be as short as two or as long as ten days.

**DUMB RABIES.**

When this form of the disease is typical, it comes on with restlessness, depression, a tendency to lick objects, and paralysis of the muscles, which close the jaws. As a consequence of the paralysis, the lower jaw drops, the animal is unable to close the mouth, the tongue hangs out, and an abundance of saliva escapes. The mucous membrane of the mouth becomes dry, discolored, and covered with dust. The animal remains quiet, does not respond to provocations, and appears to understand its helplessness. As Bouley has said, the animal can not bite and does not desire to bite.

When dumb rabies follows a period in which the animal has been affected with the furious form, the desire and tendency to bite may be retained even after the jaw is paralyzed.

The course of the disease is short, death usually occurring in from two to four days.

The dumb form of rabies is very common, and many persons know it as "drop jaw" who have no idea of its true nature.

Many of the common mistakes with reference to rabies arise from an imperfect knowledge of the symptoms. It is on this point that there is greatest need of educational work. Bouley has most earnestly warned us to "distrust a dog when it shows signs of illness; every
sick dog should as a rule be suspected; more particularly distrust a
dog when it becomes dull, morose, and seeks for solitude, which appears
not to know where to rest, which is always on the move, prowling,
snapping at the air, and suddenly barking at nothing when all around
is perfectly still, whose countenance is somber, and only assumes its
usual animated expression by brief starts; beware of the dog that seeks
and scrapes incessantly, and exhibits aggressive movements against
phantoms; and, finally, beware, above all, of the dog which has become
too fond of you, and is continually endeavoring to lick the hands or
face."¹ The writer would add to this warning the injunction to beware
of the dog which appears to have a bone in his throat, and further
beware of this animal when he has wandered from home and returns
covered with dirt, exhausted and miserable.²

THE PERIOD OF INCUBATION OF RABIES.

The period of incubation of a contagious disease is the time which
elapses between the inoculation or exposure and the appearance of the
first symptoms. With rabies this period varies remarkably. It may
be as short as six or seven days, and it occasionally exceeds one hun-
dred days. In rare cases, it has been reported on good authority that
a year, or even fourteen months, elapsed between the time the animal
was bitten and the time when the disease manifested itself. The
majority of cases develop in from three to seven weeks.

During the greater part of the period of incubation the infected
animal is healthy, and would not cause disease in any animal or per-
son which it bites. The saliva may become virulent, however, two or
three days before the appearance of the first symptoms, and any ani-
mal or person bitten after the contagion has contaminated the saliva
is, of course, liable to contract the disease.

There is a very erroneous and rather stupid belief, quite common,
to the effect that if a dog bites a person and becomes mad at any time
thereafter the person so bitten will contract hydrophobia. This fallacy
may have arisen from some instance in which a person had been bitten
within a few days of the appearance of the symptoms of disease in
the dog, and when the saliva was already virulent. However this
may be, it is perfectly certain that a dog can not convey this disease
when he does not have it or before he has himself contracted it. If,
therefore, a dog does not show symptoms of rabies within a week
from the time the bite is inflicted there is no danger of the person con-
tracting the disease. The only possibility of an exception to this rule
is the very doubtful one, that in extremely rare instances a dog may

²In this description of rabies the writer has used as a basis the classical works of
Bouley, Fleming, and Nocard and Leclainche.
RABIES: ITS CAUSE, FREQUENCY, AND TREATMENT.

have rabies and recover from it without showing characteristic symptoms. A very few cases of this kind have been observed among dogs artificially inoculated, but it has not been shown that their saliva became virulent, or that similar cases occur under natural conditions. The fact remains, however, that a person is in no danger of contracting rabies because a healthy dog has bitten him, which dog is afterwards inoculated with rabies.

The virus of this disease has been surrounded with so much mystery, and so many ridiculous opinions have been disseminated concerning it, that it is often looked upon with great awe and fear, as possessing either supernatural properties or at least being altogether different from anything else which has been known and investigated by scientific men. This is in no sense true, for while the rabies virus is peculiar to the disease and distinct from all other contagions and poisons, it is nevertheless subject to the same natural laws. If a person has sat in a crowded street car by the side of another person who some months afterwards contracts smallpox, the former would have no fear of the disease because he had been exposed to the latter before infection had occurred. On the same principle, no one would feel concerned because he had drank pure water from a clean cup, which cup was afterwards used as a receptacle for poisons. These illustrations are strictly germane to the subject, and should be sufficient to show the impossibility of the theory under consideration.

The extremely long period of incubation of rabies in certain cases is a fact which has been incontestably established.

Peuch has compiled a table of 144 cases of rabies in the dog in which the date of inoculation and the appearance of the first symptoms were definitely ascertained. These cases were observed by Renault, Leblanc, Saint-Cyr, and Peuch. This table is so instructive that it is reproduced from the Nouveau Dictionnaire de Médecine, de Chirurgie et d'Hygiène Vétérinaire, and the writer has added a column of percentages.

**Incubation of rabies in the dog.**

<table>
<thead>
<tr>
<th>Number of days of incubation</th>
<th>Number of cases</th>
<th>Per cent.</th>
<th>Number of days of incubation</th>
<th>Number of cases</th>
<th>Per cent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 to 10</td>
<td>3</td>
<td>2.08</td>
<td>55 to 60</td>
<td>2</td>
<td>1.39</td>
</tr>
<tr>
<td>10 to 15</td>
<td>8</td>
<td>5.55</td>
<td>60 to 65</td>
<td>7</td>
<td>4.86</td>
</tr>
<tr>
<td>15 to 20</td>
<td>13</td>
<td>9.03</td>
<td>65 to 70</td>
<td>1</td>
<td>.69</td>
</tr>
<tr>
<td>20 to 25</td>
<td>25</td>
<td>17.36</td>
<td>70 to 75</td>
<td>5</td>
<td>3.47</td>
</tr>
<tr>
<td>25 to 30</td>
<td>13</td>
<td>9.03</td>
<td>80 to 90</td>
<td>7</td>
<td>4.86</td>
</tr>
<tr>
<td>30 to 35</td>
<td>25</td>
<td>17.36</td>
<td>100 to 120</td>
<td>4</td>
<td>2.78</td>
</tr>
<tr>
<td>35 to 40</td>
<td>6</td>
<td>4.17</td>
<td>305</td>
<td>1</td>
<td>.69</td>
</tr>
<tr>
<td>40 to 45</td>
<td>11</td>
<td>7.64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45 to 50</td>
<td>9</td>
<td>6.25</td>
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<tr>
<td>50 to 55</td>
<td>4</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td>144</td>
<td></td>
</tr>
</tbody>
</table>
Haubner mentions a case in which fourteen months elapsed after the bite before the disease developed. It is plain, therefore, that the rabies virus may retain its vitality and activity for a long time after it is deposited in the flesh of the animal body. How it can remain in the animal this length of time before it causes the disease is probably explained by the fact that it must reach the brain and spinal cord and multiply there before the disease develops. Now, the rabies virus is not able to penetrate through the body with the facility of many other forms of contagion; on the contrary, it appears necessary for it to be lodged in the circulating blood through a wounded vessel or to be deposited within the sheath of a nerve. If placed in the connective tissue beneath the skin in such manner as to avoid blood vessels and nerves it does not cause disease. In the cases of long incubation the virus has had difficulty in reaching the central organs of the nervous system.

Admitting, as we must, that a year may elapse between inoculation and the appearance of the disease, we must also accept the still rarer cases of fourteen months' incubation as not improbable. How absurd it is, therefore, to consider a bitten dog as safe after it has been quarantined for three or four weeks, as is the usual custom. Of the 144 cases carefully observed and brought together in the above table, 82, or 57 per cent, failed to develop the disease until after thirty days. A period of more than five weeks was required by 39.5 per cent of the animals, and 21.5 per cent showed no symptoms for seven weeks after being bitten. How long, then, should a dog that has been bitten by a rabid animal be quarantined before it is safe to mingle with the family and with other persons and animals? Is three months sufficient? Evidently not, for 3.47 per cent of this lot of dogs developed the disease after more than ninety days had passed. For absolute safety, every dog bitten by a rabid animal should be destroyed. For comparative safety a quarantine of one year is required.

**DOES RABIES ORIGINATE SPONTANEOUSLY?**

Most of the older writers on rabies, those whose writings appeared before 1865, admitted that the disease might develop spontaneously in the bodies of certain animals as a result of certain conditions of life and atmospheric influences. These same writers believed that most other contagious diseases frequently originated in the same manner. It was a time when the spontaneous generation of many living things was freely admitted, and when the ignorance of the nature of all kinds of contagion, with the exception of the larger animal parasites, was complete and impenetrable. Science had not yet definitely passed upon the doctrine of the spontaneous and continuous generation of living matter.

It was not a very long time before this when it was believed that the
mite which causes scabies or itch was continuously developed spontaneously, and that it was folly for people to try to protect themselves from this disease. About the same time, or possibly a little earlier, it was thought that lice were spontaneously developed, and that both the domesticated animals and mankind were doomed to suffer from them for all time. Still earlier there was a common belief that crocodiles and other animal life developed spontaneously from the mud of the rivers and lakes in which they were found.

The study of natural history and the progress of science disproved one by one these ancient beliefs, and made it clear that all animals developed from preexisting animals of the same kind. Even lice and the mites of scabies were found to be subject to this invariable law of nature, and the eradication of such pests was taken up with energy and perseverance. The rarity with which these parasitic pests are encountered among civilized people of the present day proves the value of correct views upon such questions.

The last point to be yielded by the believers in spontaneous generation was the origin of the protozoa and bacteria, microscopic animals and plants so small that their life history could be studied only with great difficulty. It was finally shown, however, that even these infinitely small organisms obeyed the general law of nature and propagated and developed from ancestors, each species after its kind, and that in the absence of ancestors not even these low forms of life could appear.

About this time it began to be suspected that the cause of the contagious fevers was microscopic organisms, which were able to live a parasitic life in the bodies of men and the larger animals. After many observations pointing in that direction it was finally demonstrated in 1876 that the cause of anthrax was a bacillus, and shortly afterwards that fowl cholera, septicæmia, hog cholera, tetanus, blackleg, tuberculosis, and various other diseases were due to similar microscopic vegetable organisms, each disease being caused by its own distinct species of germs. It was also shown that malaria, Texas fever, and some other diseases were caused by microscopic animal organisms belonging to the protozoa, and that here again each disease had its own definite and distinct species. In every case the minute plant or animal parasite had its own definite form and certain biological characters by which it might be distinguished from all other living things. Each species multiplies and propagates its kind, and there is no more evidence here than elsewhere in nature to sustain the doctrine of the spontaneous appearance of living things.

The first effect of these scientific demonstrations was to clear away a vast amount of rubbish which had accumulated in the standard teachings as to the cause of contagious diseases. If, for example, anthrax is caused by the Bacillus anthracis gaining entrance to the interior of the body and multiplying there, and if the disease can not be produced
in the absence of this bacillus, then it becomes plain that the disease is not caused by electrical disturbances of the atmosphere, by too much food or too little food, by forage containing too much water or that which is too dry, by intense heat of summers or extreme cold of winters, or indeed by any of the other influences to which the development of the disease had been usually attributed. It was contact with substances containing the bacillus which produced the disease, and when this bacillus gained access to the animal body the disease developed without reference to the atmospheric conditions, the food, or the other elements of the environment.

The comprehension of this fact led Bouley and other great pathologists to revise their opinions regarding the origin of many contagious diseases. It had been held that glanders originated spontaneously from overwork and insufficient food; that bovine pleuropneumonia developed as a result of exposure of cattle in the mountains of Europe to extremely low temperatures; that cattle plague arose spontaneously in eastern Europe, and particularly on the steppes of Russia, and that rabies in the dog resulted from unfavorable conditions of life. The demonstration of the germ theory of contagion, which was quite unexpected by the majority of medical men, completely overturned these old views, based upon an entirely different hypothesis. The idea of spontaneous development, of origin de novo, was generally abandoned, and the further scientific researches have been pushed, the more incontestible does it appear that the one and only factor of consequence in the production of these diseases is the entrance of the disease germ into the interior of the animal body, where it can multiply and disseminate itself.

If proper measures are taken to protect animals from the bacilli of anthrax, of glanders, of pleuropneumonia, they do not contract these diseases. Investigation of cattle plague in central Europe indicated that the disease always came from the East. Investigations on the steppes of Russia showed that it did not originate there, but came from the plains of Asia. Investigations in Asia indicate that even there the disease is always the result of contagion from some other affected animal. In the same manner, investigations of rabies failed to bring out any evidence to indicate that the disease might originate in any way except by contagion, that is, by inoculation from an affected animal. It may, therefore, be accepted as practically certain that rabies does not develop spontaneously in any animal, but that it is always the result of inoculation from some other affected animal.

If the doctrine of spontaneous generation, or abiogenesis, has been abandoned by scientific men, it has by no means lost caste with many persons who consider themselves philosophers; and these persons hesitate to accept or indeed bitterly contest the conclusion of science, which has been outlined above. If, they ask, every dog with rabies
contracted the disease from some other dog affected with it, how did the first dog get it? This is a question as to the origin of things, which we may with equal reason ask in regard to all living organisms. If every dog is brought into the world by the sexual union of two other dogs, where did the first dog come from? This question is just as difficult, but no more difficult than the other. Because we have in our question implied the philosophical absurdity of a series of dogs without a beginning, we have not convinced anyone that dogs can originate in any manner except by ancestors of their own species; nor is the similar question as to the origin of the first case of rabies any better reason for accepting the theory of the spontaneous origin at the present day of this disease.

There are many diseases of which it may be said that in our time and in our country they arise only by contagion. Prominent among these are smallpox, scarlet fever, measles, cholera, tuberculosis, glanders, bovine pleuroneumonia, foot-and-mouth disease, and rabies. Recorded history does not tell us where and under what circumstances the first case of any of these diseases appeared, any more than it tells us where and under what circumstances the first dog appeared. We know by observation, and by observation alone, how dogs are propagated at the present day, and we accept observation as conclusive upon this point. Why should we not accept observation and experimentation as conclusive in regard to the propagation of a contagious disease?

While we can not reasonably expect at this late day to decide the cause of contagious diseases by speculation as to the first appearance among animals of such diseases, it is legitimate to make such an inquiry in order to obtain a better understanding of these plagues. Science has made great progress in explaining the origin of species, and even in tracing in general terms the development of life upon earth; and while it can not say definitely where, when, and how the dog originated, it has been made plain that in some prehistoric age the dog developed from some earlier and related animal form, not by a sudden transformation, but by gradual transition. And in the same manner this early ancestor of the dog developed from a still earlier ancestor, doubtless quite different from the dog as he is to-day. To be brief, in tracing the development of the dog, we should be obliged to go back, step by step, toward the dawn of creation, toward simpler and simpler forms of life, until the primordial germ is reached. Just where in this long series of succeeding forms or just when in the countless ages that have elapsed since the beginning of the series the disease known as rabies appeared it is impossible to say. It may have been in comparatively recent times, and when the dog had arrived at substantially its present form and development, or it may have been in some previous geologic age, when the conditions of environment
upon all parts of the earth were far different from what they are at the present day.

It is not to be supposed that the strange animals whose fossil remains prove their existence many thousands of years ago were free from contagious diseases any more than are the animals which live to-day; but whether the diseases of the prehistoric animal species were propagated from animal to animal until our time, or whether they disappeared and were replaced by more recent plagues, it is now impossible to say.

A study of the communicable diseases indicates that most if not all of them are caused by parasitic organisms. Indeed, the animal body has become the host of a multitude of parasites, most astonishing because of the number of species and the great variety of forms. All of these parasites probably at one time in the existence of their species, or of the ancestors of their species, lived elsewhere in nature. Under certain conditions they were attracted to certain kinds of animals; they found they could live upon or within them; they adapted themselves to these new conditions; their form and their physiological requirements were gradually changed, until finally in the course of time they could not exist elsewhere. They were then strictly parasitic.

So far has this development and adaptation to the conditions of environment gone that we find different species and varieties of lice, of mites, and of worms living upon each different species of animals, and in most cases these parasites perish if transferred from one species of animals to another species. If, therefore, these parasites can not exist when transferred to a different species of animals from that upon which they have developed and to which they have become adapted, there is all the more reason why they can not exist in nature elsewhere than upon or within the animal body. Hence, we find animal species living as parasites upon other animals, and having no individuals of their species living a nonparasitic existence. They have developed and have been modified since they began their existence as parasites, just as the species of animals living free in nature have been modified. Consequently, if an animal becomes infected with lice or mites at the present day it must get them from some other animal which bears them.

The adaptation and modification of the bacteria and protozoa which cause the contagious diseases has probably occurred in much the same manner as that of the larger animal parasites which we have been considering. The glanders bacillus has lived a parasitic existence in the bodies of animals of the horse kind for many thousands of years. It is no longer able to multiply or live for any considerable time in nature outside of the animal body. It is therefore a strictly parasitic organism. The bacillus of tuberculosis is even further developed as a parasite than the bacillus of glanders, as it is much more difficult to cultivate in the laboratory even under the most carefully adjusted conditions.
Rabies: Its Cause, Frequency, and Treatment.

There is no reason to suppose that any bacilli exist in nature having the same biological characteristics as have the glanders and tuberculosis bacilli.

The exact form of the rabies virus has never been satisfactorily determined, but what we know of it leads to the conclusion that it is a parasitic organism of some kind, which has been modified by thousands of years of existence within the animal body, and which has no counterpart elsewhere in nature. Inoculation with it is easy; it has specialized as to the conditions of life to such an extent that it multiplies only in the brain, spinal cord, nerve trunks, and a few glands; it can not be made to grow outside of the body by any methods now known. All of these facts indicate an obligatory parasitic existence. When or under what conditions in the prehistoric ages of the past it first became parasitic can never be known, nor can we determine at this late day how long a time was required to transform it from an organism which was only occasionally or accidentally parasitic into one which could live no other than a parasitic life. What appears certain is that for more than two thousand years rabies has been the same disease it is to-day; that it has been propagated by the same species of animals, manifested itself by the same symptoms, and produced the same fatal results.

It is not unlikely that other microscopic organisms will from time to time take up their habitat in the animal body and become obligatory parasites. There are a number of different bacilli now known which are capable of living in the flesh and causing fatal disease, but which only do this under accidental conditions. Among these are the anthrax bacillus, the bacillus of blackleg, the bacillus of malignant oedema, and the bacillus of tetanus, all of which are deadly in their effects on animals inoculated with them, but all of which lack some quality required for their rapid dissemination or for the ready infection of susceptible animals. Consequently, they do not usually spread from animal to animal. With slight modification the anthrax bacillus might become the most terrible of the known disease germs. But that such modifications require time and conditions not often found, is proved by the fact that though this disease has been known since the beginning of medical knowledge, the bacillus has in the memory of man made no progress as a disease-producing organism, but on the contrary appears less capable to-day of gaining entrance to the tissues than it was two or three centuries ago.

THE PREVENTION OF RABIES.

It is unfortunate and inconsistent that those who pretend to love dogs most and to be most anxious for their welfare should be the ones who place the greatest obstacles in the way of attempts to control this disease. Of all animals, the dog is most often the victim of rabies,
and he suffers not only from the disease, but from the reputation of propagating it. And to make the matter worse, he is still falsely accused of being a party to the spontaneous generation of the contagion. His true friends should come to the rescue and relieve him of this incubus, which he has borne so long.

There is no contagious disease more easily eradicated than rabies. As the disease can only arise from contagion, and as the contagion is practically always transferred by a bite, and as the animals which do the biting are almost always dogs, it suffices to stop the dogs from biting for a period sufficient to cover the incubatory stage of the disease, that is, for about a year, in order to stamp out the malady. As a scientific problem, therefore, the eradication of rabies is a very simple matter, but as a practical question it is one of the most difficult which confronts the sanitarian. And this difficulty arises not from anything inherent in the work to be accomplished, but in the opposition of those who own and keep dogs. The measures necessary for the eradication of rabies are two in number: (1) Destruction of worthless, ownerless, and vagrant dogs; (2) efficient muzzling of all dogs which appear upon the streets or in public places.

The dog tax and license are efficient means of securing the destruction of worthless dogs, and if these are combined with the requirement that every licensed dog shall wear a metal tag of special form, the ownerless and vagrant dogs may be at once recognized and captured. As more than half of the dogs in the country are worthless or ownerless, this measure at once reduces very largely the canine population, and correspondingly lessens the material upon which the disease can work, as well as the chances of infection.

An efficient muzzle prevents dogs from biting, and, therefore, prevents the propagation of rabies. Muzzling is for this reason the most effective measure with which to combat the disease. Public sentiment in this country is generally against muzzling, and this measure is either not adopted or it is so imperfectly enforced as to have no other effect than to irritate the supersensitive dog owners. In Germany and Great Britain muzzling has had an immediate and most marked effect in eradicating the contagion.

The effect of these measures depends entirely upon the energy and thoroughness with which they are enforced. There should be a dog-catching force adequate to the work, whose duty it should be to seize all dogs found in public places without tags and all dogs wearing inefficient muzzles, and if these animals are not redeemed within a specified time to destroy them. Usually the requirements for tags and muzzles are evaded by a large number of dog owners, and it is common to see on the streets of cities, where they are supposed to be in force, numerous dogs without tags, and even a greater number with muzzles that are of no value as a means of preventing the animal from biting. This is
due to the fact that there is seldom a sufficient force of dog catchers, and that the sympathy of the community is with those who violate the law rather than with those who endeavor to enforce it.

When there is an unusual prevalence of rabies among dogs, or when, unfortunately, some person contracts the disease, particularly if that person happens to be well known or prominent in the community, there may be a temporary exhibition of strict and energetic enforcement of the regulations. But as soon as the public alarm subsides the efforts are relaxed, the dog catcher disappears, the dogs are seen upon the streets with or without tags and muzzles, and all things go on as before the panic occurred. While the number of dogs is thus periodically reduced somewhat, it is seldom that this reduction is sufficient to have much effect upon the propagation of the disease. It is probable that the tendency at such times to keep dogs confined in order to prevent them from being seized has more influence in arresting the propagation of rabies than has the mere reduction in numbers.

In nearly all cases when reliance has been placed upon the one measure of reducing the canine population the result has been unsatisfactory. What other disease would we attempt to stamp out by simply killing off one-fourth or one-third of the animals of the species affected? And if this measure is not efficient with other diseases, why should we expect it to be with rabies? It appears self-evident from a sanitary point of view that there should be some direct measures instituted to prevent the propagation of the contagion. Such a measure would be the quarantine and confinement of all dogs for a sufficient time to cover the ordinary incubation period of rabies. As the enforced and continuous confinement of dogs without open-air exercise for a prolonged period may be detrimental to the animals, they may be allowed in public places under such conditions as will absolutely prevent them from biting, that is, the animals should wear an efficient muzzle, or they should be muzzled and led in leash. As rabies is only propagated in nature by biting, such a regulation, if thoroughly enforced, would at once stop the transmission of the disease and soon lead to its disappearance. When this measure is inaugurated, however, it is at once opposed by a large class of citizens who hold it to be cruel and unnecessary. Some muzzles are unquestionably cruel, but a properly made muzzle is not cruel, nor does it greatly inconvenience the dog after he becomes accustomed to it. The authorities should, therefore, prescribe the kind of muzzle to be used, and should select one which covers the mouth with a wire cage so as to prevent biting without interfering with the movements of the jaw and the ingestion of liquids.

There have been many who have denied the utility of the muzzle, the strongest argument being that dogs do not wear it at home, and when they develop rabies and escape it is always when they are unmuzzled. Admitting the force of this argument, it is nevertheless
a fact that if all dogs were required to be muzzled when in public places, the appearance of a dog without a muzzle would at once attract attention, leading persons to avoid it and causing its early seizure by the authorities. Children might be instructed that an unmuzzled dog was dangerous and that they should keep at a distance from it, and especially that they should never touch or fondle such an animal.

The results which have been obtained by muzzling justify its enforcement wherever there is an outbreak of rabies. Most of us have heard of the experience of Berlin with this measure about the middle of the century. From 1845 to 1853 there were received at the Berlin Veterinary School 278 rabid animals. This is an average of 35 a year. From March, 1852, to the same month in 1853 the number was 82, and from March, 1853, to the end of July there were 37 more. On July 20 it was ordered that the use of the muzzle should become general. From July to the close of the year but 6 cases were admitted. Only 4 cases were observed in the whole city during 1854, and but a single case in 1855. For the seven years following there was not a single case recorded.¹

While some have attributed the disappearance of rabies from Berlin at the time mentioned to other causes, muzzling has been adopted in Germany as the principal reliance in repressing this disease. It appears that the number of cases of rabies in Berlin increased progressively after 1863, until in 1868 it reached 66, declining again to 7 in 1870, only to increase in 1872 to 69. In 1875 a law was passed, extending to the whole of Prussia, which provides that all dogs suspected of rabies shall be immediately killed, as also all animals which it is evident have been bitten by rabid animals, and that all dogs in a district which has been infected by an outbreak of rabies shall be confined, or, when abroad, both muzzled and led. The technical section of the veterinary board in Berlin are of the opinion that the passing of this law, and not alone the existence of the muzzling order in that city, is the cause of the extinction of rabies in Berlin. No case has occurred there since 1883.²

Consul-General Mason reports from Berlin to the State Department that "in Berlin, Frankfort, and, so far as I know or can ascertain, in all cities and large towns in Germany, dogs are required to be muzzled whenever they are on the street or public place, and this regulation is enforced in cities even when the dog is led or held in leash by the owner, or is harnessed for working purposes to a cart or other vehicle."³

³ Consular Reports, June 19, 1900.
Fleming states that “in Vienna rabies was entirely suppressed by eighteen months of stringent muzzling, but that in 1886 the muzzling order was rescinded and badges had to be worn on dog collars instead; in the following half year there was only one case of the disease, but in the next half year rabies became epidemic, and the muzzle had again to be worn, with the result that the malady soon subsided and disappeared.”

In Holland, before 1875, rabies was prevalent to a very serious extent, but in June of that year the use of the muzzle was ordered, with the result that in the autumn the number of cases fell to 41; in the next whole year there were 55 cases; in 1877 there were 14; in 1878 there were 4, and in 1879 there were 3. These, and the cases which have since been reported, occurred only on or near the frontier of Belgium, in which country the muzzle is not in use, though rabies is always prevalent.

In the Grand Duchy of Baden during the years 1871, 1872, 1873, 1874, and 1875 the number of cases of rabies was, respectively, 18, 37, 37, 50, and 43. Then the muzzle was rigorously applied, and in 1876 there were 28 cases; in 1877, 3; in 1878, 4; in 1879, 2; in 1880, 2; in 1881, 2; in 1882, 3; in 1883, 2; in 1884, 2. Since that year only 1 case has been observed, and that was a dog from Metz contaminated before its arrival in Baden.

In Sweden rabies was at one time a somewhat common disease, and from 8 to 10 people died annually of hydrophobia; but, muzzling being enforced, and the importation of dogs prevented, rabies has been unknown for many years, and no deaths from hydrophobia have occurred since 1870.

The value of the muzzle in suppressing rabies has been perhaps best demonstrated in London on several occasions, and specially in 1885. In the previous years hydrophobia had increased to a very alarming extent in England, and no steps worthy of note had been taken to check the mortality. For London alone in that year no fewer than 27 deaths were reported as due to the bites of rabid dogs. A muzzling order was then enforced, and at the end of 1886 not a death was recorded. Unfortunately, the order prescribing the use of the muzzle was then rescinded, and in a few months a case of hydrophobia occurred in the south of London, soon to be followed by others, and in 1889, 10 deaths were registered. In July of that year the muzzling order was again issued and stringently carried out, and rabies and hydrophobia once more disappeared.¹

In the whole of Great Britain the results from enforcing the muzzling order have been phenomenal, both in the opposition encountered

by the authorities and in the successful eradication of the disease. The number of rabid dogs officially reported was, in 1887, 217; 1888, 160; 1889, 312. In the last-mentioned year muzzling was adopted, and the number of cases fell to 129 in 1890, 79 in 1891, and 38 in 1892. Then, owing to persistent opposition, muzzling was stopped, and the effect of withdrawing this measure was at once seen in the increase of rabies. In 1893 there were 93 cases; in 1894, 248, and in 1895, 672. At this point, owing to public alarm, muzzling was again enforced, reducing the number of cases in 1896 to 438, in 1897 to 151, in 1898 to 17, in 1899 to 9. As no case was discovered from November, 1899, to March, 1900, it was believed by the veterinary officer that the disease had been extinguished from Great Britain.

These examples are certainly sufficient to demonstrate the value of muzzling as a means of repressing rabies, and it may be added that in countries like France and Belgium, where muzzling has not been adopted, the disease continues to prevail to a very serious degree.