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RABIES—HYDROPHOBIA.

BY THEODORE R. MAC CLURE, LANSING, MICHIGAN.

[Reprinted from the Proceedings of the Sanitary Convention at Charlotte, Michigan, Nov. 22 and 23, 1894, published as a Supplement to the Annual Report of the Michigan State Board of Health for the year 1895.]

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RABIES—HYDROPHOBIA.*

BY THEODORE R. MACCLURE, LANSING, MICHIGAN.

INTRODUCTION.

Rabies is a disease common to both man and animals, and can be classed with the diseases dangerous to the public health. Rabies in man may be attended with one symptom which is spoken of as "fear of water" from which the term *hydrophobia* originates, but really there is no great difference between the rabies of man and the rabies of animals. Water and other liquids or even a draft of air from a window or from a fan may cause the spasm or convulsion. The spasm caused by water has led to the term hydrophobia. Many writers seem to favor using the term hydrophobia when speaking of rabies in man, and rabies when speaking of the disease in animals, although technically speaking there is no such disease as hydrophobia. It seems, however, to be a convenient usage of terms; and I may in the pages following use the term hydrophobia when speaking of rabies in man and rabies when referring to the disease in animals.

Through my work in the office of the State Board of Health, in giving attention to the reports of alleged outbreaks of rabies and cases of hydrophobia, I have become much interested in the subject. The disease does not cause three thousand deaths in man in Michigan every year, as does consumption, nor does it cause such great mortality in the human race every year as does diphtheria, scarlet fever, typhoid fever or measles, but I presume there is no disease to which the human race is heir that causes more fear or consternation than does a case of hydrophobia or rabies. Many people think that small-pox is a dreadful disease and causes many deaths, but I presume that a yearly average for the last ten years will show that there have been in Michigan not many more deaths from small-pox than from hydrophobia. Neither small-pox nor hydrophobia is as frequent as it was many years ago, when preventive medicine was not known. In 1780 JENNER discovered preventive vaccination against small-pox, and in 1885 LOUIS PASTEUR discovered the preventive treatment against hydrophobia and rabies, and to-day millions of people are being vaccinated every year to protect themselves against an attack of small-pox, and thousands of people having been bitten by dogs or other animals known or supposed to have been mad, have received treatment which has generally insured them against the development of that fearful disease—hydrophobia.

* This paper was not read (except by title); but an outline of the paper was placed before the Executive Committee of the Convention, and members of the State Board of Health and it was unanimously voted that the paper should be printed in the pamphlet proceedings of the Convention.

NOTE.—In the preparation of this paper, especially that portion relating to Etiology, I am indebted to the kind assistance of DOCTOR GEORGE H. CATTERMOLE, of Lansing.

I am sorry that I am not in a position to give the results of some original researches as are most of the persons who attempt to write on this subject; but, as that is one of the impossibilities, I will endeavor to reiterate only what has probably already been said. My object in writing this paper is to place before the people some facts which may be of interest to them and may directly or indirectly be the means of saving some human lives, because it does not seem to me that there is any necessity for persons bitten by rabid animals to suffer the agonies which are attended with death from that terrible disease.

EARLY HISTORY.

Rabies has existed for many centuries; and, as the disease may occur in almost any warm-blooded animal, it is not at all improbable that there may have been cases of rabies soon after the creation of animals as mentioned in the first book of the Bible. As the disease most frequently occurs in dogs, I presume that history would record cases as early as 1,500 years before Christ, for about that time dogs were mentioned by MOSES, and about 32, Anno Domini, dogs were spoken of as "eating the crumbs which fall from their master's table."

The early history of canine rabies is somewhat obscure, but, whenever spoken of by the early writers, it seems to be dreaded as much as at this period. PLUTARCH says that hydrophobia was first observed in the days of ASCLEPIAS, the God of Medicine. ARISTOTLE spoke of canine rabies, but thought the disease was never communicated to the human race. CELSUS gave the subject especial attention and believed that, on account of a morbid virus, the bite of all animals was dangerous. OVID states that hydrophobia and gout were in his day reckoned among the incurable diseases. During the first centuries of the Christian era considerable attention was given to the causation and treatment of hydrophobia. Many different theories as to its causation were advanced, but PEDANIUS DIOSCORIDES was probably about the first (in the fourth or fifth century, Anno Domini) to give an exact description of the disease. In his work on "Materia Medica" he mentioned its transmissibility from animals to mankind, its certain fatality when once developed, and its prevention by cauterization. But up to the eighteenth century there was little progress made in ascertaining the nature and causation of rabies or hydrophobia and their restriction and prevention.

As early as 900, Anno Domini, outbreaks of rabies were recorded. "One day a mad bear, following the course of the river Saône, at last reached the quay at Lyons. Everybody fled at its approach, except some boatmen who, armed with heavy sticks, attempted to kill it. The bear, however, little intimidated by their number, rushed amongst them and bit many—about twenty. Of this party six were smothered in about twenty-seven days on account of fearful madness. The other fourteen, however, had thrown themselves into the river to escape the animal's attacks, and having to swim to the opposite bank, where thus preserved from the effects of the poison; the water of the river had saved them, for in beating against their wounds, it had washed away the venom."* In the sixteenth century, according to FLEMING, rabies was reported in Spain, Flanders, Turkey, Hungary, Austria, et cetera, and in Hungary in 1712 wild beasts of all kinds went mad, as did also many persons, and in England many dogs went mad and bit many people. "In 1768 rabies was alarmingly frequent in

* FLEMING'S "Animal Plagues," 1871, page 51.

Boston and other towns of North America," and a few years later in Boston and vicinity rabies was present in dogs and foxes, and swine were the principal victims of the animals' rage.

It is useless to cite further outbreaks of rabies and hydrophobia, for during the fifteenth and sixteenth centuries and up to the present time history is prolific with outbreaks of the disease in animals and in man. One has but to read FLEMING'S work on "Rabies and Hydrophobia" to become thoroughly convinced that these diseases were frequent and widespread, causing great destruction of property and human lives.

ETIOLOGY.

Some observers have thought that rabies might occur spontaneously in animals but I think there is not now much question but that most, if not all, the rabies comes from a previous case and is due to a specific poison which has been inoculated into the animal, generally by the bite of another animal. It has been claimed that certain conditions either directly or indirectly were the cause of the disease, but the recognized authorities now believe that neither climate, season, sex, age, etc., cause the disease, although they may have modifying influences.

We now know that the disease arises from the inoculation of the specific virus which seems to be more abundant in the saliva than any other secretion of the body. ROLL, FLEMING and others believe the poison is present in the blood and consequently in all parts of the body, but other authorities have failed to cause rabies by inoculation of the blood of rabid animals. M. GALTIER has shown that the saliva of animals dead of rabies or killed after having developed the disease does not lose its virulence for some time after death. Animals inoculated with the fresh saliva, blood, et cetera, do not always contract the disease, on account of some animals being less susceptible than others. FLEMING says that "dogs and cats hold the first place in the scale of susceptibility; then man and pigs; next ruminants, the sheep and the goat being more susceptible than the ox, and lastly the horse." RENAULT inoculated ninety-nine animals (horses, dogs and sheep) and only sixty-seven were affected with the disease. ROLL says that successful inoculations vary from twenty-four to seventy per cent., whilst from the bite of dogs it varies from twenty to seventy per cent., showing that the disease is less liable to be produced by the bite of a rabid animal than from experimental inoculation, which can probably be attributed to the fact that experimental inoculation occurs under different conditions than does the bite, and that their hair, et cetera, protect the animals somewhat from the introduction of the specific virus. Then, again, it is not so sure that the poison is really inoculated by a bite as by experimental inoculation.

The etiology of rabies is still questioned,* but many of those who at first doubted its specific character, and its transmission by inoculation, have, on continuing their experiments and improving their methods of operation, come to conclusions almost identical with those of PASTEUR and his school.† Among the class of writers, who draw their conclusions from experimentation, there is a consensus of opinion that the disease is due to inoculation with virus containing the specific cause of the disease.

* DULLES: *The Medical Record*, 1877, page 672; *The Medical News*, 1894, pages 653-655. STOCKWELL BRILL, SPITZKA, JOHNE: *Jahresbericht*, 1889. Von Frisch, Vienna.

† PROFESSOR A. HOGYES: "Die Experimentale Basis der Antirabischen Schutzimpfungen Pasteur's," Stuttgart, 1889.

DANA says:—"In order to prove that a certain disease is autonomous, distinct and special we must establish the fact that its etiology and its clinical history are essentially uniform, or that the anatomical changes found after death are the same, or that inoculations of animals with the secretions or tissues of the victims of the disease reproduce the disease."

With regard to his first requirement—uniform etiology—there is not a case on record where rabies appeared in an animal without its having been inoculated with material from another animal which is suffering from the same disease. Usually the infection in man can be traced directly to animals suspected from their actions, of having rabies, but in some cases the injury is considered as a simple abrasion until the characteristic symptoms appear.*

DOCTOR PAUL GIBIER states, in a letter to me, that—"The disease may be communicated by a rabid dog licking the bare part of a person's skin on which some slight abrasion exists."†

As to the second of DANA'S requirements—a uniformity in the clinical history—while the symptoms vary some in different animals, they are very uniform for any certain species, as the extended irritative period (furious rabies) in the dog, and the more marked stage of paralysis in the rabbit.

There are many good reasons for believing that rabies is due to microorganisms, whether a single species or not, we cannot say; different investigators find different microscopic forms present in the victims of the disease (as FOL'S micrococcus, BABES' bacillus, et cetera, and GIBIER'S micrococcus),‡ and the symptoms vary enough to make a mixed infection possible.

There is strong evidence in favor of the belief that rabies is due to some biological factor or living cause; this may be a bacterium, or one of the lower animal forms, as protozoa, coccidia, or psorosperm. Considering the period of incubation, the fact that minute quantities when inoculated will cause the disease, and the ease with which the virus is rendered inert, by means which, while sufficient to destroy low forms of living organisms, do not change the chemical products contained therein, we see at once the resemblance between the properties and action of this virus and that of other diseases which are known to be due to microorganisms, and it is evident from the following facts, that the causal agent is something capable of reproduction and growth, and not a chemical poison contained in the inoculating virus: (a) filtration removes the virulent matter from the emulsion; (b) a longer or shorter period occurs, between the inoculation and the onset of the disease, in which time (period of incubation) the cause, if a biological one, has an opportunity of increasing; and (c) the exposure of rabic virus for one hour to a temperature of 50° centigrade (122° Fahrenheit), or to desiccation and direct sunlight for three hours will destroy the virulence, and exposure to a one per cent. carbolic acid solution, or to a one-tenth per cent. corrosive sublimate solution, for three hours, renders the virus inert.§

PASTEUR, ROUX, CHAMBERLAND and others made careful search for microorganisms in the various tissues of animals affected with rabies; small

* "American Reference Hand-Book of Medical Science," Volume VI. Ruffer: *The British Medical Journal*, Volume II, 1889, page 637.

† WELCH on "Hydrophobia"—"Transactions of the Maryland Medical and Chirurgical Faculty," 1889. In the *Annals de l'Institute Pasteur*, 1889, was published an account of the cases of Pierre Butt and his wife, who were licked on open wounds by a rabid dog. Butt was given antirabic treatment and did not have rabies; his wife declined treatment and died of the disease.

‡ STERNBERG'S "Manual of Bacteriology," 1892, page 522.

§ BIGGS: "Transactions of the New York Academy of Medicine," 1891. WELCH: "Transactions of the Maryland Medical and Chirurgical Faculty," 1889.

bodies were seen in the medulla which were thought to be micrococci, but later these were considered as having little or no relation to the disease. In 1884 GIBIER described his observations of supposed micrococci in the medulla of animals dead of rabies.* In 1885 FOL was able to demonstrate small granules resembling micrococci in the lymph spaces of the cord taken from animals which had died of this disease; thin sections of the cord were stained after WIEGERT'S method, with a solution of hematoxyline. BABES † describes his observations of organisms resembling micrococci in the brain and cord of animals suffering from rabies, which are stained a rose color by LOEFFLER'S alkaline methylene blue solution. He has succeeded in making cultures of this germ, which will cause symptoms of rabies when injected into animals, but not in all cases.

Curve-shaped bacilli and spindle-shaped bacilli are described as being present in the brains of animals, and thick, curved motile bacilli are said to be found in the blood of rabbits during the stage of fever. ‡

In the opinion of STERNBERG death is caused in cases of rabies by the action of a potent chemical poison of the class of toxalbumins, which is possibly the same as the substance which PASTEUR calls *matière vaccinale* contained in the emulsion used in the antirabic treatment and supposed by him to produce the immunity. He says it is contained in the inoculating material, but is not identical with the microorganism causing rabies.

It has been found by experimentation that if large doses of the strong virus are injected into the subcutaneous tissue the animal is less likely to contract the disease than when a small amount of the strong virus is used. FERRAN requires that his patients agree to finish the treatment before he gives them the first inoculation, because, he thinks that the immunity is in proportion to the amount of virulent virus used. BAREGGI lost five patients by using the superintensive method, which misfortune FERRAN attributes to using too little of the virus. These results may be due to the large amount of chemical product (toxalbumin) contained in the large dose being sufficient to prevent the growth of the microorganisms, or the poison may so stimulate the tissue cells that they are able to cope successfully with the living matter contained in the emulsion.

PASTEUR and others, § I believe, have studied the action of these chemical substances found in the emulsion, et cetera. It would seem possible in reviewing the results obtained from the use of antitoxins in diphtheria, malignant edema, anthrax, et cetera, that the use of the sterilized emulsion of rabic medulla, when used in the proper amount, might give immunity from rabies.

The specific cause of the disease seems to select the central nervous system as its most favorable habitat. It is usually present in the saliva and salivary glands of dogs, as demonstrated by inoculation of other animals with this material being followed by rabies, but whether the saliva of men who have the disease is infectious is an open question. LAGORIO writes me that he has made a number of experiments with the saliva of three rabid men, and in no instance did rabies develop in the inoculated rabbits.

In BARDACH'S experiments the juice from the salivary glands of twenty-two persons who died of rabies caused the disease when injected into rabbits. BORDONI and UFFREDDUZZI made similar experiments in two

* Published at the School of Medicine, in Paris, 1884.

† "Les Bacteries" (second edition).

‡ WOODHEAD: "Bacteria and their Products," page 517.

§ TRIZZONI and CENTANNI—"Chemical Vaccine Against Rabies:" *The British Medical Journal*, Volume 1, 1893.

cases with negative results. The glands, in BARDACH'S experiments, were not removed until twelve or twenty-four hours after death, while those used by UFFREDDUZZI were removed in three to six hours after death; post-mortem changes may have occurred in the former.

The statistics of the PASTEUR Institute in Moscow,* for 1892, give two instances where the disease was communicated from man to man. DOCTOR CALMETTE reports one instance of the disease being contracted from the bite of a man, as having occurred in the Cochin China Institute.*

PATHOLOGICAL ANATOMY.

There is "an acute hyperemia of the larynx, trachea, and bronchi" (OSLER), and GOWERS says there is "perivascular exudation of leucocytes, and minute hemorrhages, in the oblongata." This is found more marked in the animals which survive for some time, and is known as miliary abscess.† In man where the disease is so rapidly fatal this condition is not so well marked, but in men who died of paralytic rabies these changes resemble those found in the medulla of the rabbit and may be widely diffused.

WELCH, in describing the lesions he had observed in the post-mortem examination of three cases of rabies, says: "These lesions were microscopical, and their extent and distribution could be determined only by the examination of a large number of sections of different parts. The lesions were especially well marked in and near the nuclei of origin of the spinal accessory, pneumo-gastric, and glosso-pharyngeal nerves, and in the motor nucleus of the trigeminus."

That the pathological anatomy does not show the extent and presence of the specific cause is obvious, as tissues or fluids from various parts of the body of infected animals when inoculated into healthy animals will produce the disease, although nothing can be demonstrated in the tissues or fluids to account for the disease.

SYMPTOMS IN ANIMALS.

There are two distinct varieties of the disease—the maniacal and the paralytic. The disease has three well-marked stages—prodromal, irritative, and paralytic.

The *prodromal* stage in rabies is characterized by an alteration in the manner and usual actions and habits of animals. If the disease occurs in a domestic animal which is naturally friendly, it may suddenly change, become cross and surly, and almost as suddenly again become natural and affectionate. The animal is restless and not contented to remain in one place. Many animals are dull, lazy and seek secluded places. There is irritation at the seat of the wound demonstrated by a tendency to scratch, rub or ruffle the cicatrix. Frequently the appetite is lost and, in others there is a depraved ravenous appetite, evinced in dogs and pigs by eating all sorts of strange things, such as pieces of wood, and iron. Carnivorous animals "gulp" as if trying to free themselves from something, such as a bone in their throat, and vomiting frequently occurs. The visible mucous membranes are red and saliva (except in horses) 'drivels

* Statistics from various PASTEUR Institutes will be found on subsequent pages of this paper.

† BARSTOW and HORSLEY: "Transactions of the Clinical Society of London, November, 1888."

from the mouth. These symptoms generally last from twelve to forty-eight hours, and then pass either to the irritative or paralytic stage.

During the *irritative* stage there is great propensity to injure other animals, uneasiness, paroxysms of fury, with intervals of quietude, and exhaustion. During the paroxysms dogs may tear their bedding, or whatever comes in their way, and snap at imaginary objects. The tongue is swollen and frequently dipped in water to cool it, but the poor animal may not be able to swallow and saliva hangs in strings from its mouth. However, in some animals this symptom is not so bad, and the animal wants and takes a great amount of water. The gait or carriage of a dog is unsteady and he soon begins to totter. The dog generally goes with an unsteady gait, tail between his legs, bright and staring eyes that soon become dull, head rolling from side to side, stomach tucked up, mouth open and tongue protruding. It is said by those who have seen them that it is quite easy to distinguish a mad dog by the actions above described. In FLEMING'S work on "Hydrophobia and Rabies" can be seen a picture of a rabid dog, and it is probable that a person would never forget it should he once see one. A peculiar characteristic of a mad dog is that he is devoid of sense of pain and will hold a red-hot iron in his mouth without uttering a cry.

Cats are very savage and are very dangerous on account of their great ferocity. Horses become violent, stamp their feet, kick, bite, et cetera, and try to get loose. Cattle rarely use their teeth but paw and bellow, and use their horns and frequently break them. Pigs slaver at the mouth, bite at their fellows and become very wild. The voice of all animals is altered and strange. In dogs the voice is one of the best diagnostic symptoms. It has a peculiar high-toned, croupy, ringing sound, as if the bark and the howl were blended together. At first the paroxysms are prolonged and violent, and finally become weak and short, and it may then be said that the paralytic stage has set in.

In the *paralytic* stage there is paralysis of the lower jaw, which renders the animal unable to bite. The dog generally stays at home. If he does go away he quickly returns, and seeks some secluded spot, in which he may die. The tongue is swollen, livid and hangs out of the mouth; the saliva is tenacious and abundant, paralysis of the posterior extremities sets in and death soon follows.

Rabies generally makes quick work of the animal, and may take a rapid course and kill within forty-eight hours. It rarely lasts more than ten days, although there have been cases of canine rabies lasting twenty days. The duration depends largely upon the constitutional vigor of the animal.

Hydrophobia is an affection of the nervous system, and the stimulus which excites the paroxysm is conducted often from the ganglia of special sense, or even from the brain, so that the sight or sound of fluids, or even the idea of them, occasions equally with their contact, or with that of a current of air, most distressing convulsions (CARPENTER).

SYMPTOMS IN MAN.

There are many points of similarity between the symptoms of hydrophobia and those of rabies. There is some sense of pain in or near the seat of the wound, extending toward the body, if the injury had occurred on the limbs. There may be considerable irritation or very acute pain in the cicatrix. The old wound may swell and open, or, if yet unhealed, assume

an unhealthy appearance, discharging a thin, ichorous fluid instead of pus. Usually there is a general nervous disturbance; the patient becomes dejected, irritable and restless, but does not appear to have any idea of what may be the cause of his peculiar feeling, or, if he does, he is careful not to mention it; he seeks solitude or amusement away from home; his sleep is troubled; he often starts up from a sound sleep; pains are often experienced in different parts of the body; and frequently there is disorder with the digestive apparatus. After these premonitory symptoms, which vary from a few hours to a few days, the patient becomes sensible of a stiffness or tightness about the throat and he experiences some difficulty in swallowing, especially fluids, which may be considered as the commencement of the attack in man.

The difficulty in connection with swallowing rapidly increases and soon becomes quite impossible, unless it is attempted with determination, which generally throws the patient into convulsions; there is a sensation of tightness in the chest, as well as throat; difficulty in breathing and necessity for fresh air. The most marked symptoms are the spasms or convulsions which are brought on by an attempt to swallow, or may even be brought on by the mere mention of liquids or knowledge that they are near, or by a draft from the window or fan. The sound of a liquid being poured from one vessel to another, or the application of any cold or damp substance to the body may bring on the paroxysms. The patient's face wears an expression of terror, anxiety or despair. During one of these convulsions the patient suffers great agony and it is quite impossible to stand by and witness the suffering. The spasms generally last but a few seconds and the patient then becomes tranquil, but the least disturbance may bring on a fresh attack. During the intervals between the spasms, the patient is calm, rational and may feel thirsty, but on trying to drink is uniformly thrown into another convulsion. The patient is frequently aware of the approach of these attacks, and, fearful of doing injury, begs to be restrained. The patient may be troubled with hallucinations of both sight and hearing. Sometimes the patient gives away to wild fury, may roar, howl, curse, strike, may try to bite others or himself, and finally, through exhaustion, will sink into a gloomy and sleepy state, until attacked by another paroxysm. The tongue is swollen and red, there is often a sense of burning in the throat, with thirst which cannot be satisfied. There is generally a secretion of a viscid tenacious mucus in the fauces (called the "hydrophobic slaver"), of which the patient makes every effort to free himself and spits it out to drop wherever it may. This mucus is generally abundant as the disease advances and the lower jaw is frequently paralyzed, and the mucus flows from the corners of the mouth. Paralysis may become quite general before death. There may occur times during the disease that the patient may take both food and water without the convulsions, but it is always with much difficulty. The temperature gradually rises from the commencement of the disease, and frequently as high as 105° Fahrenheit and 106° Fahrenheit. Death generally follows after a hard convulsion. The desire to bite is rare in man, but cases are recorded where the bite of a man has caused the disease.

The duration of the disease is somewhat varied, lasting from two to ten days. In 324 cases death occurred in the majority of cases between the second and fourth days, in a few death occurred the first day, and in a few cases life was prolonged even to fifteen days.

PERIOD OF INCUBATION IN MAN.

The period of incubation is that time between the bite and the appearance of the characteristic symptoms of the disease. During this period the patient often experiences unnatural conditions. These conditions have been described on preceding pages of this paper under the head of prodromal or premonitory symptoms.

Much attention has been given to the subject of the period of incubation; and, although there has been found no fixed number of days in which the disease will surely appear, if at all, in most cases the disease shows itself between forty and sixty days. The period has frequently been much less, and even as short as one day in some cases, and in other cases as long as two and one-half or three years. ROUCHE has observed that in Algiers the average period is fifty-one days, the ordinary minimum thirty days and the maximum ninety days. DOCTOR FLEMING records 224 cases in which the latency was less than a month in 40, from one to three months in 143, from three to six months in 30, and from six to twelve months in 11 cases. TROUSSEAU says the incubation period may vary from a few days to a year. HAGUENOT cites a case where a peasant was suffering from hydrophobia on the third day after receiving his wound from a mad wolf. FINCO, of Padua, cites a case where a young woman developed the disease 14 years after being bitten by a mad dog. Instances of extremely short or extremely long periods of incubation are recorded but it is possible that there are mistakes made as regards the date of receiving the bite which causes the disease.

DOCTOR BAUER recorded his observations on 510 cases and found that the average period was 72 days. In the male the average period was 80 days, and in the female it was 65 days. He thought that age had considerable influence and that the period was shortened 20 days in patients under fourteen years of age. He found that in

49	cases	where	a	wolf	caused	the	bite,	the	av.	incubation	period	was	39	days.
293	"	"	"	dog	"	"	"	"	"	"	"	"	73	"
2	"	"	"	fox	"	"	"	"	"	"	"	"	33	"
31	"	"	"	cat	"	"	"	"	"	"	"	"	80	"
1	"	"	"	cow	"	"	"	"	"	"	"	"	30	"

DOCTOR KRAIOUCHKINE, director of the Saint Petersburg Institute, informs me that his experience, during the years 1886 to 1892, leads him to announce that the period of incubation varies from 16 to 494 days; the average period being about 60 days.

DOCTOR AUGUSTO F. DES SANTOS, director of the Pasteur Institute at Rio Janerio, writes me that his experience indicates that the period of incubation is from 30 to 90 days.

DOCTOR PADILLA, of the National Department of Hygiene of the Argentine Republic, states that in cases he has observed the average period was 40 days.

DOCTOR A. N. BLODGETT, of Boston, says that in seventeen per cent. of all cases of rabies in man the period is three months or over.

PASTEUR says that the disease shows itself in a majority of cases in 40 to 60 days after receiving the bite, which is probably the period which will most commonly be observed. However, the location of the bite has

much to do in influencing the time of the appearance of the disease. It has been found that where the wound was located on the head or neck the incubation period was 35 days, on the upper extremities 81 days, and on the lower extremities 74 days.

In India, in 1893, it has been observed that in the cases of hydrophobia, the period of incubation was uniformly about 90 days.

INCUBATORY PERIOD IN ANIMALS.

In regard to the period of incubation in animals, DOCTOR FLEMING, in his exhaustive work, "Hydrophobia and Rabies," gives detailed and elaborate results of different observers. LAFOSS states that the shortest authenticated period in the *dog* that occurred in his experience was 7 days and the longest was 155. BLAINE asserts that the majority of cases occurred between the third and seventh week. HAUBNER'S experience in 200 cases showed that in 83 per cent. the period was within two months; the average being three months.

With the *cat* the incubatory period is said to be from two to four weeks.

According to RÖLL the period in the *horse* varies from 15 days to two months.

HAUBNER found that in the *ox* that it varied from nine days to several months. In 234 cases 10 per cent. developed the disease in about three months.

In *sheep* two weeks seem to be the minimum and four weeks the maximum.

Pigs occasionally develop rabies in nine days, but it does not usually appear until the fourth week after infection.

THE PASTEUR TREATMENT.

Prior to October 26, 1885, when M. PASTEUR announced to the Academie des Sciences de Paris that he had discovered a treatment which would prevent the development of hydrophobia in man, it was conceded generally that hydrophobia was always fatal. Imagine the great surprise and wonder which followed the announcement of this great discovery, second only perhaps in importance in preventive medicine to that of JENNER.* It is not, however, to be wondered at that the suspicious and incredulous were ready to question the efficacy of the treatment, but it is now gratifying to say that the method has been thoroughly tested by scientific men all over the world and there is probably now no doubt in any informed mind but that LOUIS PASTEUR is a great benefactor and has done much to relieve suffering humanity.

The careful and unbiased experiments of DOCTOR ERNST, of Boston, DOCTORS WELCH and KIERLE, of Baltimore, DOCTOR SHAKESPEARE, of Philadelphia, and others in this country have fully confirmed the statements and methods of M. PASTEUR and his illustrious co-workers in Europe.

Before PASTEUR announced his discovery, he and other experimenters spent much valuable time in trying to bring about the same results, but

* Up to this time the antitoxin treatment of diphtheria has not been universally adopted.

PASTEUR was first to make his method public, and has since treated many persons proved to be or supposed to have been innoculated with hydrophobic virus. At first his inoculations were made at his laboratory in the Rue d'Ulm; but since the method came to be recognized by nearly all the world, a grant of several million francs, from the Imperial Treasury, for a new laboratory and its equipment, and a donation of a whole block of ground in the heart of that great city, PASTEUR has built and is now occupying a magnificent institute, standing back from the street, occupying the block donated by the city and surrounded by a beautiful grass-plot. In front on the lawn will be found a bronze statue representing a boy struggling with a mad dog which indicates at least one branch of work carried on inside the building. This well-equipped laboratory is occupied by PASTEUR and his corps of untiring searchers for knowledge, ever trying to discover some new vaccine or other preventive of disease. The laboratory is for practical work in different branches of micro-biology, and associated with PASTEUR are some fifteen directors and assistants. Among these valuable assistants may be mentioned such notables as ROUX, YERSIN, METSOHNIKOFF, STRAUS, DUCLAUX, CHANTEMESSE, GRANCHER, and others, each working in his special line.

In way of digression, and as an instance of some of the recent valuable work coming from this institute, I might mention that it was DOCTOR ROUX, of the Paris PASTEUR Institute, who, at the meeting of the International Congress of Hygiene and Demography, at Budapesth, September 1 to 9, 1894, gave to the congress and to the public the results of his experiments in connection with the treatment of diphtheria by the immunizing blood serum of the horse. While DOCTOR BEHRING practically left his method a secret, DOCTOR ROUX revealed every detail of his method, and offered to supply the serum, and made known his intention to give his time to the prevention of diphtheria.

One can well see how a man of PASTEUR'S temperament should have such a deep interest in a disease attended by such fearful suffering for both patient and friends. It was in 1880 that he began his study of the etiology of hydrophobia. He obtained from a child suffering with the disease a small quantity of the saliva and injected it under the skin of a rabbit; the animal died in two days. Taking some of the saliva of this rabbit, he treated another rabbit, and in that the disease was produced in a most virulent form. Continuing his experiments he found that by trephining a healthy rabbit and taking a few drops of the cerebro-spinal fluid and injecting it under the dura mater of the healthy rabbit the disease rapidly developed and with more certainty than by the use of the saliva, but was not of so virulent a type. Fragments of the brain and spinal cord also produced the disease, and he then abandoned the use of the saliva. Knowing by previous experiments with anthrax virus that the virulence of the virus might be increased or decreased by inoculation into animals of another species he followed out the same lines of work with hydrophobic virus and obtained similar results. Inoculation from dog to dog killed at the same period of incubation and in practically the same time; but inoculation from dogs to monkeys gave a weaker or more attenuated virus, the virus becoming more attenuated by successive inoculations from monkey to monkey, until there came a time when the virus was so weak that it would fail to cause the disease. If this weakened virus were then inoculated into a rabbit or dog it remained inactive for a

time, but by successive inoculations the virus regained its original virulence. However, if these series of inoculations be made into a rabbit with the primary virus from a dog the virus gradually grows stronger instead of weaker until it is even more malignant than the fresh virus from a dog suffering from street rabies. For instance, if a rabbit be inoculated with the virus of a rabid dog the rabbit will show symptoms in about fifteen days, never shorter than nine days; if, however, the virus of this first rabbit be used on a second rabbit the period of incubation is shorter; if a third rabbit be likewise treated with the virus of the second, the period is still shorter, and so on until it is reduced to six or seven days, at which time the period of incubation becomes stationary or what PASTEUR calls a "fixed" virus; that is, the period of incubation is always six or seven days, and the animal certainly dies on the tenth day after inoculation. This discovery was of great importance to PASTEUR, as he was able to determine exactly when the animal would die, and was able to obtain a fixed and regular supply of virus for his every-day inoculations.

PASTEUR had observed that the spinal cord of rabbits dead from rabies gradually lost its virulence in direct ratio to the time intervening after the death of the rabbit. This and other facts lead him to believe he could obtain an inoculation material of different degrees of virulence, which could be relied upon for the treatment of human beings. Accordingly he injected a rabbit with the "fixed" virus, and when the rabbit died the spinal cord was hung in a dry, sterilized bottle and kept at a temperature of 17° centigrade to 18° centigrade (63° Fahrenheit to 65° Fahrenheit).

The cord of "one day" drying was found to be slightly weaker and when injected into another rabbit still produced the disease, but the death of the rabbit was prolonged just one day more than it would have been had the rabbit been inoculated with the fresh virus. Inoculation with the spinal cord of two days' drying prolonged life in the rabbit one day longer. He found that the virulence decreased in direct proportion to the temperature and the length of time it had been dried, the weaker the injecting emulsion, the longer the period of incubation and the longer death was delayed; the cord that had been dried fifteen days nearly uniformly failed to produce the disease; and the cord that had been dried only one day was nearly as strong as the first virus.

DOCTOR UFFREDDUZZI* found that if the cord was dried—

2	days	it	produced	death	in	11	to	17	days,	but	postponing	it	1	to	2	days.	
3	"	"	"	"	"	14	to	16	"	"	"	"	"	4	to	6	"
4	"	"	"	"	"	12	to	15	"	"	"	"	"	2	to	5	"
5	"	"	"	"	"	17	to	20	"	"	"	"	"	7	to	10	"
6	"	"	"	"	"	12	to	22	"	"	"	"	"	2	to	12	"
7	"	"	"	"	"	23	to	29	"	"	"	"	"	13	to	19	"
8	"	"	"	"	"	24	to	27	"	"	"	"	"	14	to	17	"
9	"	"	"	"	"	27	to	40	"	"	"	"	"	17	to	30	"
10	"	"	"	"	"	32	to	36	"	"	"	"	"	22	to	26	"
11	"	"	"	"	"	30	to	35	"	"	"	"	"	20	to	25	"

* From a paper by DOCTOR RUFFER, read before the Section on Medicine of the British Medical Association, at Leeds, August, 1889.

It had been known for some time that every microorganism during its growth excreted substances, just as higher animals excrete certain substances every day, and that some microorganisms, such as those of anthrax, malignant edema, et cetera, excrete a chemical substance (ptomain, toxin, et cetera), which when injected into an animal will render that animal immune against an invasion of the specific organisms of that disease. PASTEUR was the first to point out that vaccination could probably be accomplished by use of these chemical substances, and thus opened a new field for original research.

By inoculating under the skin of a dog an emulsion of the spinal cord of a rabbit recently dead of rabies the microorganism of rabies and the chemical excrement of the microorganism are at the same time introduced. This chemical substance at once proceeds to destroy the microorganism and by the time the microorganism would naturally produce the disease the chemical substance has performed its work and has produced the immunity. If a small quantity of the rabic virus (emulsion) be introduced into an animal only a small quantity of organism and a small quantity of the vaccinating substance are introduced and the animal dies from rabies; but if 10 to 20 or 30 cubic centimetres of the emulsion be injected a large quantity of the organisms and at the same time a large quantity of the chemical vaccinating substance is introduced which overpowers the microorganism and prevents the disease from developing.

PASTEUR took fifty dogs and inoculated them in ten successive days, commencing with the weakest virus and each day using one of more strength until at the end of the treatment he could inoculate them with the strongest virus, even with the virus of a dog suffering with street rabies (*rage de la rue*). In this way he produced an immunity which lasted apparently for at least two years, and probably for a considerably longer time.

Thus PASTEUR had been able to protect animals from rabies, but he found his method for animals was not entirely applicable to man. However, PASTEUR was equal to the difficulty. It will be remembered the longer the cord was dried the fewer the microorganisms, but there was left a goodly quantity of their chemical excrement or vaccinating substance for his treatment of man. He made two injections each day, commencing with the cord of fourteen and thirteen days, on the second day with the emulsion of the cord of twelve and eleven days, the third day with the cord of ten and nine days, the fourth day the cord of eight and seven days drying, the fifth day only the cord of six days, and so on. This process finally came to be known as the "simple method."

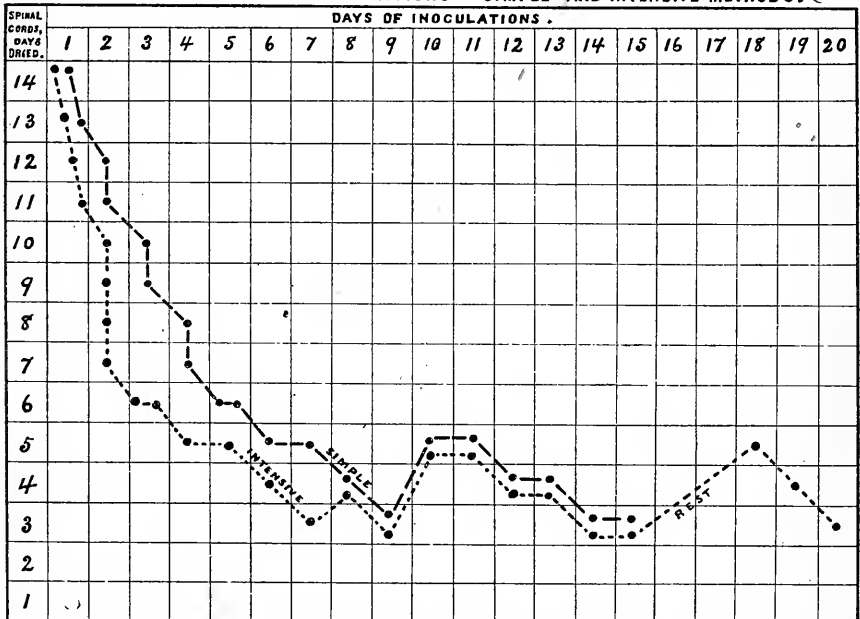
The simple method has been found sufficient in most cases; but, where the patient has been bitten badly on the face or head, a more intensive method has been found necessary, because in such cases the period of incubation is generally shorter and there is need for more active and vigorous measures, and thus the "intensive method" came to be used. Each injection consists of one-half cubic centimeter of the crushed cord in two cubic centimeters of sterilized beef tea. The patient is inoculated on the

1st day with the cord of 14, 13, 12, 11 days drying.		
2d " " " " " 10, 9, 8, 7 " "		
3d " " " " " 6 " "		(Two inoculations)
4th " " " " " 5 " "		
5th " " " " " 5 " "		
6th " " " " " 4 " "		
7th " " " " " 3 " "		
8th " " " " " 4 " "		
9th " " " " " 3 " "		
10th " " " " " 5 " "		
11th " " " " " 5 " "		
12th " " " " " 4 " "		
13th " " " " " 4 " "		
14th " " " " " 3 " "		
15th " " " " " 3 " "		

On the sixteenth and seventeenth days there is a rest, and on the eighteenth, nineteenth and twentieth days there is one inoculation each day with the cord of five, four and three days drying, respectively, which ends the treatment.

The following diagram will show at a glance the "simple" and "intensive" methods of treatment employed at the PASTEUR Institute:

PASTEUR'S ANTIRABIC INOCULATIONS—"SIMPLE" AND "INTENSIVE" METHODS.



Note—Each Dot represents one injection. Each injection consists of about one-half of a cubic centimeter of spinal cord crushed in two cubic centimeters of sterilized beef tea.

By means of the hypodermic needle subcutaneous injections are made into either side of the abdomen just above the crest of the ilium. Every precaution is taken that other complications—as abscess, syphilis, erysipelas, et cetera—are not spread from one patient to another. The injecting fluid is perfectly free from all pus-forming microorganisms, the needle is sterilized after each injection and in other ways asepsis is provided. DOCTOR RUFFER says he has seen many thousands of inoculations made and has yet to observe one instance of abscess resulting therefrom.

The personal inconveniences experienced during the antihydrophobic treatment are very slight. Following the example of a number of other directors and assistants connected with other PASTEUR institutes and for protection against a possible accidental inoculation while performing their every-day duties, DOCTOR PAUL GIBIER, director of the New York Institute, inoculated himself and two of his assistants. In a paper read before the New York County Medical Association, May, 1890, he gives in detail these interesting experiments. A brief mention of their experience may be of interest to the readers of this paper.

The treatment was according to the simple method. The injections of the first four days were followed by a slight irritation and redness at the site of the injection, and sleep was somewhat disturbed at night by a sensitiveness at the spot of inoculation. There was also a slight rise of temperature. These symptoms remained during the first ten days of the treatment; then the tissues seemed to have accustomed themselves to the injections and the above-mentioned symptoms decreased in severity and three days after the last inoculation there remained hardly a trace of the injections. GIBIER said there was unusual activity of his salivary glands, and several times each day he was obliged to eject; that during the last week of the treatment and the week following he had a certain heaviness of his head and felt unable to work. The same symptoms, with the following additional ones, were experienced by his assistants: after inoculation with marrow of the sixth day, one assistant complained of sudden pain in his right side lasting about one hour, and at times during the last week of the treatment suffered neuralgic pains in different parts of his body, and dizziness which rendered walking difficult; during most of the treatment the other assistant suffered more or less severe local and general pains. These symptoms continued for about fifteen days after the treatment, accompanied by unusual sexual excitement, sadness, undefined preoccupation and neuralgic pains. About fifteen days after the last inoculation each assistant experienced pain in the spots where the injections were made.

DOCTOR KRAIOUCHKINE, of the Saint Petersburg Institute, says he has noticed during the treatment almost no general reaction on the organism, but, with the exception of very rare cases, he has observed lassitude, or fatigue, accompanied with headache and sleepiness but without elevation of temperature. Very often there is a local reaction of the pricked spot, redness, swelling, edema and hardening, but a little cold cream and rice powder makes it disappear rapidly. This local reaction produces principally on the individual a very thick cutaneous tissue, but abscesses have never formed.

DOCTOR ULLMANN and his four assistants also took the treatment to insure against accidental inoculations.

PASTEURISM, AND ITS RESULTS.

SINCE the establishment of the Paris PASTEUR Institute for the preventive treatment of hydrophobia, many institutes and laboratories have made preparations to give the treatment, until to-day such institutions are so numerous, and conveniently located as to be accessible to all. To my knowledge they are now located in Paris, Saint Petersburg, Odessa, Vienna, Moscow, Constantinople, Milan, Naples, Lisbon, Barcelona, Bucharest, Cochin China (at Sagon), Mexico, Havana, Tunis, Padua, Kharkof, Budapest, Stamboul (Turkey), Buenos Ayres, Rio de Janeiro, Turin, Calcutta and, last but not least, in New York and Chicago.

Early in the year effort was made toward the establishment of a PASTEUR Institute at Simla, India, not only for antihydrophobia inoculations but for the systematic and specialized investigations into the causation and prevention of various diseases. The movement has been received with much favor. Donations, government grants and subscriptions from individuals and municipalities have been made, and the government has promised the services of a capable medical official. It is probable that the institute is now in working order.

In April of this year the British Institute for Preventive Medicine made application to erect a PASTEUR Institute at Chelsea, England. There was some objection by the residents of Chelsea, claiming that it would not only depreciate the adjoining property, but would be a possible source of infection. The institute has been commenced and although the building proper is not yet completed work is being pursued.

It is announced that antihydrophobia stations are soon to be established in various cities of Turkey, among which are especially mentioned Yemen, Bagdad, Damascus, Erzeroum, and Monastir.

In Paris—M. Pasteur, Director.

Since JOSEPH MEISTER was treated antihydrophobically many thousands of people have undergone the inoculations at the Paris PASTEUR Institute. The following table will give you the results during the years 1886—1893:

Years.	Persons treated.	Deaths.	Death-rate per cent.
1886.....	2,571	25	0.94
1887.....	1,770	14	0.79
1888.....	1,622	9	0.55
1889.....	1,830	7	0.38
1890.....	1,540	5	0.32
1891.....	1,559	4	0.25
1892.....	1,790	4	0.22
1893.....	1,648	4	0.24
Total.....	14,330	72	0.50

PASTEUR has established a custom of dividing the cases into three classes, namely:

(A) Those bitten by animals proved to be rabid, by laboratory experiments, or by the death of other persons or animals bitten by the same animal.

(B) Those bitten by animals recognized by clinical or veterinary examination to be rabid; and

(C) Those bitten by animals supposed to have been rabid.

These rules have been generally followed out in the statistical results of PASTEUR Institutes.

Years.	A			B			C		
	Number treated.	Died.	Mortality per cent.	Number treated.	Died.	Mortality per cent.	Number treated.	Died.	Mortality per cent.
1886---	223	5	2.15	1,931	24	1.24	518	7	1.35
1887---	357	2	0.56	1,161	15	1.29	260	4	1.54
1888---	403	7	1.74	974	4	0.41	248	1	0.40
1889---	348	4	1.15	1,188	9	0.25	298	3	1.00
1890---	385	0	0	960	3	0.95	223	0	0
1891---	313	0	0	967	7	0.72	313	2	0.64
1892---	139	1	0.72	1,052	3	0.29	609	2	0.33
1893---	111	0	0	937	7	0.75	497	2	0.40
	2,279	19	-----	9,170	72	-----	2,966	21	-----

Of the 1,648 treated during 1893, 178 came from places outside of France; 43 from Spain; 35 from Greece; 23 from England; 22 from Belgium; 18 from Egypt; 14 from British India; 9 from Switzerland; 9 from Holland; 6 from Portugal; Germany and Turkey, 2 each; and Austria, United States, Brazil, Russia and Morocco, one each.

Since the foundation of the institute, no fewer than 14,330 have been treated by the PASTEUR method in Paris. Of these 1,213 (16 fatal cases) were bitten on the head, 8,032 (45 fatal cases) on the hands, and 5,185 (11 fatal cases) on the limbs.

In August, 1884, in the absence of M. PASTEUR, DOCTOR ROUX replying to an inquiry, stated that nothing had yet been done in preventing the development of hydrophobia in human beings infected with the disease. Contrast this statement of DOCTOR ROUX with a statement that he would have been able to make at the close of the year 1893, when 14,330 persons have been treated with a mortality of only 0.50 per cent.

The statistics of the Paris Institute show that the majority of cases of hydrophobia occur between the months of February and May.

At Turin, Italy.

During the period from September 30, 1886, to September 30, 1893, there have been treated a total of 1,738 persons, with 8 deaths, or a mortality of .46 per cent.

At New York—Doctor Paul Gibier, Director.

Statistics of the Preventive Treatment against Hydrophobia since its opening—from February 18, 1890, to January 1, 1895 (nearly four years):

	A*			B*			C*		
Bites inflicted on the head and on the face	5	7 } 11 }	18	5	6 } 3 }	9	5	17 } 16 }	33
Cauterization { efficacious non-efficacious	7			9			9		
No cauterization	11						24		
Bites inflicted on the hands		64 } 49 }	113		58 } 42 }	100		63 } 50 }	113
Cauterization { efficacious non-efficacious	2			1			1		
No cauterization	49			40			47		
Bites inflicted on the limbs and on the body	61	21 } 23 }	44	59	23 } 15 }	38	65	50 } 19 }	69
Cauterization { efficacious non-efficacious	28			1			3		
No cauterization	16			15			30		
Clothes torn	11			23			36		
Bites inflicted on bare parts	3	1	1	14			5		
Bites inflicted on different parts or the body			12	9			6	5	5
Cauterization { efficacious non-efficacious	1								
No cauterization	4			4			8		
Clothes torn	8			6			7		
Bites inflicted on bare parts	1			1			4		
	9			4			9		
			188			157			231
									576

* The column A refers to persons bitten by animals in which hydrophobia has been evidenced by experimentation or by the death of some other persons or animals bitten by them; column B to persons who have been wounded by animals having been recognized rabid by the clinical or veterinary examination; and column C to cases in which hydrophobia could only be suspected, as the animals had disappeared or were killed instantly and their bodies thrown away.

Of the 576 persons treated during the period from February 18, 1890, to January 1, 1895, there were only four deaths, or a mortality of 0.67 per cent. In *The New York Therapeutic Gazette*, for September, 1894, DOCTOR GIBIER exhibits some very interesting tables. One table shows that 40 persons who were bitten by dogs which bit and caused the death of other animals, were treated successfully. Another table shows where 24 persons who were bitten by dogs whose bite caused the death by hydrophobia of some other persons, were treated successfully. In one of these cases four men, in another three men and a child, in a third a woman and a child and in the rest of these cases one person, all subsequently died of hydrophobia.

Of the 85 persons treated in 1893, 26 were bitten by animals proved to be rabid, 11 by animals recognized by clinical or veterinary examination to be rabid, the remaining 48 were bitten by animals suspected of rage.

At Odessa, Russia—Doctor Buivid, Director.

During the year 1890 there were treated at Odessa 727 persons (443 males and 284 females). Among this number 257 were children of 10 years or under.

In 649 cases the animal causing the bite was a dog, in 43 a cat, in 6 a horse, in 4 a wolf, in 3 an ox, and in 3 a pig.

In 201 cases the animal causing the bite was proved experimentally to be rabid, in 10 by death of other animals bitten at the same time, in 261 by post mortem examination, in 251 by symptoms evinced by the animal, and in 4 it was uncertain.

In 120 cases the wounds were severe and on uncovered parts of the body, in 485 moderately severe, in 103 slight (having been inflicted on the limbs through thick clothing).

In 524 cases the persons presented themselves for treatment within a week after the bite, in 122 cases within two weeks, in 44 within three weeks, in 14 within four weeks, and in 4 a month or more after the bite.

Classified by months of the year, they were as follows:

Months.	Persons bitten.	Months.	Persons bitten.
January	34	July	117
February	40	August	91
March	59	September	40
April	84	October	43
May	76	November	35
June	82	December	31
Total			732

The duration of treatment was in the majority of the cases three weeks. The total number of persons who underwent the complete treatment was 704, with 9 deaths, or a mortality of 0.71 per cent.; of these 4 died during the treatment, and 5 after its completion.

At the Odessa Bacteriological Station, during the year 1893, there were treated 793 persons. Of those who had passed through the treatment, and could be said to have died in spite of the preventive inoculations, there were two deaths or a mortality of only 0.26 per cent. However, 4 of the 793 delayed in commencing the inoculations, and died during the treatment and should not be included in the deaths. If these four were included the number of deaths would have been 6, and the mortality would have been 0.76 per cent. Of the 793 persons admitted for treatment, 83 were bitten by animals proved experimentally to be rabid; 253 by animals pronounced rabid after veterinary or post-mortem examination; 439 were bitten by animals suspected of rage; and 18 were persons who had been subject to the danger of contagion while attending sick persons or animals.

Classifying these persons according to age, 96 were under five years of age, 161 from 5 to 10, 211 from 10 to 20, 231 from 20 to 40, 74 from 40 to 60, and 20 were over 60 years of age.

In	5	cases	the	animal	causing	the	bite	was	a	wolf.
In	710	"	"	"	"	"	"	"	"	dog.
In	56	"	"	"	"	"	"	"	"	cat.
In	2	"	"	"	"	"	"	"	"	calf.
In	1	"	"	"	"	"	"	"	"	pig.
In	1	"	"	"	"	"	"	"	"	horse.

In 18 cases there was possibility of infection while tending sick persons or animals.

At Budapesth, Hungary—Professor Högyes, Director.

From April 15, 1890, to April 14, 1891, the number of persons subjected to the protective inoculations was 701, of whom 8 died of hydrophobia, giving a mortality rate of 1.14 per cent.

From April 15, 1891, to April 14, 1892, there were treated 540, of whom 3 died, giving a mortality of 0.58 per cent. The average mortality for the first two years (April 15, 1890, to April 14, 1892) was 0.88 per cent. Of the 1,241 persons treated 130 had been bitten on the head, face or neck, of these 3, or 2.30 per cent. died; of 486 bitten on the hands 7, or 1.64 per cent. died, and of 625 bitten on the foot or on the trunk, only 1, or 0.16 per cent. died.

Official statistics of the Hungarian Government show that of those who were bitten during these two years, who either did not apply for treatment, or applied too late for successful treatment, the mortality was 26.8 per cent. When this mortality rate is compared with the rate among those treated in time, the difference bears striking testimony to the efficacy of the protective inoculations.

During the year ending April 14, 1893, there were 641 persons treated, with six deaths or a mortality of 0.93 per cent. during the third year of the Institute. In the second year the mortality was 1.16, and in the first it was 0.56. During the three years ending April 14, 1893, there were 1,350 persons treated with 13 deaths, or a mortality of 0.91 per cent. Experience showed that the largest number of cases occurred in June, July, and August, and the least in November. The total number of persons who died of hydrophobia in all Hungary during the same period was 103.

At Moscow, Russia—Doctor Goldenbach, Director.

The statistics for the year 1892 show that 907 persons were treated, of whom 613 were males, and 294 females. Of the 907 treated, 178 were bitten by animals proved to be rabid, 439 by animals pronounced rabid after veterinary or post-mortem examination, 290 by animals probably rabid.

In	769	cases	the	animal	causing	the	bite	was	a	dog.
In	45	"	"	"	"	"	"	"	"	wolf.
In	70	"	"	"	"	"	"	"	"	cat.
In	11	"	"	"	"	"	"	"	"	horse.
In	8	"	"	"	"	"	"	"	"	cow.
In	2	"	"	"	"	"	"	"	"	pig.

In 2 cases the bite was caused by a human being.

Of the 907 treated, 6 died notwithstanding the treatment, giving a mortality of 0.66 per cent.

From June 25, 1886, to June 25, 1892, there have been inoculated a total of 3,961 persons.

At Rio De Janeiro, Brazil—Doctor Augusto Dos Santos, Director.

From the opening of the institute (February 9, 1888) to June 30, 1892, 1,149 persons presented themselves for treatment, but of this number 473 persons were for various reasons rejected. Of the remaining 676 there were 511 males and 165 females; 105 were treated in 1888, 90 in 1889, 158 in 1890, 242 in 1891, and 81 in 1892.

In 505 cases the bites were inflicted on uncovered parts of the body, and in 171 on covered parts of the body, but the animal's teeth had penetrated the clothing.

Cauterization was performed effectually in 34 cases, ineffectually in 392, and there was no cauterization in 250 cases.

The animal causing the bite in 613 cases was a dog, in 52 a cat, in 2 a mule, and in 1 a horse. In the remaining number the treatment was applied because of probable accidental infection while attending the sick persons or animals.

In six cases the bite was on the head, in 236 on the hands, in 131 on the arms, in 201 on the legs, and in 29 on the trunk. In ten cases the patient had been bitten on different parts of the body.

In 80 cases the animal causing the bite was proved experimentally to be rabid, in 287 the animal was recognized rabid because of its symptoms, and in 300 cases the symptoms of the animal were so suspicious as to make it probable that the animal was rabid.

Of the total (676) commencing the inoculations, 15 for various reasons discontinued the treatment, leaving 661 who completed it. Of these 661 only 7 died, giving a mortality of 1.05 per cent.

During the period between February 9, 1888, and August 14, 1889, there were 150 persons treated. Of this number 141 were bitten by dogs and 15 by cats. In 19 cases the animal causing the bite was found to be mad, in 67 cases the animal was recognized by clinical or veterinary examination to be mad and in 70 cases the animal was supposed to be mad.

From February 9, 1888, to May 19, 1894, there were treated 1,147 persons, with only 9 deaths, or a mortality of 0.78 per cent.

At Saigon, Cochinchina—Doctor Calmette, Director.

From April 15, 1891, to May 1, 1892 (first year of the institute), 48 persons were treated. In 16 of these cases the animal was proved to be rabid, and in all other cases confirmation of the virulence of the bite was received before treatment was commenced. Of the number treated during this period, 16 presented themselves on the fifth day after being bitten, 4 from the tenth to the twentieth, 6 from the twentieth to the thirtieth, and 1 on the fortieth day. In spite of the long delay before commencing treatment, only one patient died. In all cases the "intensive method" was used.

Between May 1, 1893, and May 1, 1894, there were 49 treated, with two deaths, one of these deaths occurred immediately after the completion of the treatment.

At this institute the natives are treated at the public expense, and every native bitten by an animal known to be rabid or strongly suspected of rabies, is immediately sent for treatment.

During the twelve months ending May 1, 1893 (second year), there were 62 persons treated, with 1 death, or a mortality of 1.61 per cent. In 12 cases the animal causing the bite was proved, experimentally, to be rabid, and in the other 50 cases the diagnosis was made clinically on the statements of veterinarians, and, in some cases, on the statement of civil or military officials. The dog was the cause of the bite in all instances except one, when the biter was a man suffering from hydrophobia.

Since the establishment of the institute (April 15, 1891) to May 1, 1893, there were 110 persons treated, with two deaths, or a mortality of 1.81 per cent.

At Padua, Italy—Doctor Giovanni, Director.

During the last seven months of 1890, DOCTOR GIOVANNI had treated 49 persons with no deaths. Twenty-three of these were bitten by animals proved experimentally to be rabid, 18 by animals recognized by clinical or veterinary examination to be rabid, and in the remaining 8 by animals in which rage was only suspected. In all the patients the bite had drawn blood, and in nearly all the wound was on an exposed part of the body, in 30 cases the bite was on the upper limbs, and in 2 the bite was on the head. Three months after the last treatment in 1890 all patients were reported healthy.

In the year 1891 there were 57 persons treated, and in 1892 there were 48. No death occurred in either year.

At Buenos Aires, Argentine Republic—Doctor D. J. Davel, Director.

The institute at Buenos Ayres was the first of its kind in North or South America, and the fifth in the entire world. The first inoculations were made September 4, 1886, in the presence of a distinguished assembly, composed mostly of medical men and students. From September 4, 1886, to September 6, 1894, there were 1,981 cases treated, with 14 deaths, or a mortality of 0.70 per cent. The following are the facts for the several years:

Years.	Number treated.	Deaths.	Death-rate per cent.
1886.....	19*	0	.00
1887.....	77	1	1.29
1888.....	236	1	.42
1889.....	259	5	1.93
1890.....	254	3	1.18
1891.....	285	1	1.35
1892.....	313	0	.00
1893.....	327	2	.61
1894.....	211†	1	.47
Total.....	1,981	14	0.70

* From September 4 to December 31, 1886.

† From January 1 to September 6, 1894.

Of the 14 fatal cases one person sought treatment 36 days after receiving the bite, several delayed 26 days, one 12 days; and, considering these long delays, the great fatality cannot be attributed to the inefficiency of the method of treatment. Again, in some of the 14 cases death was not produced exclusively by rabies, but other serious complications, and the gravity of the bite, were causative factors.

In 683 cases the animal causing the bite was proved, experimentally, to be rabid; and of these only 4 died. It is estimated that thirty per cent. of these 683, or 204 persons, would have died had they not presented themselves for the treatment. Of the total number treated (1,981) there would have resulted, at the same ratio, 594 deaths.

Of the 825 persons treated during the period between September, 1886, to December 31, 1890, the mortality among those bitten by animals proved, experimentally, to be rabid was 2.74 per cent., among those in which the animals were recognized by veterinarians to be rabid 0.85 per cent., and among those bitten by animals suspected of rage it was 0.59 per cent.

At Bucharest—Professor Babes, Director.

At the meeting of the International Medical Congress in Berlin (1890) BABES reported that in the PASTEUR Institute at Bucharest about three hundred persons are inoculated yearly, with a mortality of about 0.40 per cent. in cases bitten by dogs, most of which were demonstrated to be rabid by inoculation experiments made at the institute.

At Naples—Doctor Calabrese, Director.

From August, 1886, to April, 1894, there were inoculated 1,000 persons. Of this number 291 were bitten by animals proved to be rabid, 486 by animals recognized by clinical or veterinary examination to have been rabid, the remaining 223 were bitten by animals only suspected of rage. The number of deaths was 8, or a mortality of 0.80 per cent.

At Havana, Cuba (Bacteriological Laboratory)—Doctor Acosta, Director.

This is reported to have been the first place in the tropics where the PASTEUR method was tried. From April 15, 1887, to December 31, 1889, there were 306 persons treated, with two deaths, or a mortality of 0.65 per cent. In the first 105 persons treated no deaths resulted, although they had been bitten by dogs proved experimentally or clinically to have been mad. Notwithstanding some 700 persons applied for treatment during this period, only the 306 were accepted.

At Saint Petersburg—Doctor M. W. Kraiouchkine, Director.

This antirabic station was established July 13, 1886, and was a gift of his Highness, PRINCE ALEXANDRE PETROVITCH D'OLDENBOURG, and was first installed at the Veterinary Infirmary of the Regiment of Horse Guards, but was in 1892 transferred to the Imperial Institute of Experimental Medicine, which institute was also founded by his Highness.

During the five years ending July 13, 1891, 1,256 persons presented themselves for treatment. Of this number 394 were rejected for various reasons and 23 discontinued the treatment, leaving 839 who completed the treatment.

The following table shows, by years, the number treated during the five years ending July 13, 1891:

Years.	Persons treated.
1886 (last six months)-----	137
1887-----	200
1888-----	184
1889-----	106
1890-----	142
1891 (first six months)-----	70
Total -----	839

Of the 839 persons treated there were 391 men, 192 women, and 256 children (under fifteen years of age).

The largest number of persons were bitten during the months of June, July and August. This may, however, be due to the fact that the peasants were the class of people most commonly bitten and the summer months is the season of the year when they pass most of their time in the fields. The following table will classify the bites, by months of the year:

Months.	Persons bitten.	Months.	Persons bitten.
January-----	66	July-----	116
February-----	74	August-----	88
March-----	62	September-----	73
April-----	68	October-----	63
May-----	45	November-----	56
June-----	92	December-----	36
Total -----			839

The majority of persons bitten presented themselves within one week after being bitten; and, as this is an important factor in the success of the inoculations, the following table is presented:

Those presenting themselves within 3 days after the bite,	213
“ “ “ “ 1 week “ “ “	281
“ “ “ “ 2 weeks “ “ “	213
“ “ “ “ 3 “ “ “ “	80
“ “ “ “ 4 “ “ “ “	37
“ “ “ later than 1 month “ “ “	15
Total,	839

In 735 cases the animal causing the bite was a dog.
 In 75 “ “ “ “ “ “ “ “ cat.
 In 16 “ “ “ “ “ “ “ “ wolf.
 In 4 “ “ “ “ “ “ “ “ horse.
 In 3 “ “ “ “ “ “ “ “ cow.
 In 6 “ “ “ “ “ “ “ “ fox.

Of the 839 treated, 222 were bitten on covered parts, and the remaining 617 are divided as follows:

Those bitten on the head	54
“ “ “ “ superior members	487
“ “ “ “ inferior “	33
“ “ “ “ different parts of the body	43
	617

In 422 cases the animal causing the bite was proved to be rabid, and the mortality was 3.08 per cent.; in 240 cases the animal was recognized by clinical or veterinary examination to be rabid, and the mortality was 1.25 per cent.; and in 177 cases where the animal could only be suspected of rage, the mortality was 3.38 per cent. The general mortality was 2.62 per cent.

The largest number of deaths occurred among those patients presenting multiple bites on the head or other parts of the body. No deaths occurred in the 222 cases where the bite was on covered parts; but, in the 617 cases where the bite was on uncovered parts, there were 22 deaths or a mortality of 3.56 per cent.

In the year 1892 there were 288 persons presented for treatment. Of this number 66 were rejected for various reasons, and 11 discontinued the treatment, thus leaving 211 persons who completed the inoculations. Of this number 109 were men, 43 women, and 59 children (under 15 years of age).

The following table classifies the bites by months of the year:

Months.	Persons bitten.	Months.	Persons bitten.
January	18	July	15
February	9	August	22
March	13	September	21
April	28	October	15
May	19	November	7
June	22	December	6
Total		195	

Those presenting themselves within 3 days after the bite,	25
“ “ “ “ 1 week “ “ “	71
“ “ “ “ 2 weeks “ “ “	63
“ “ “ “ 3 “ “ “	29
“ “ “ “ 4 “ “ “	14
“ “ “ “ later than 1 month “ “ “	9
Total	211

In 181 cases the animal causing the bite was a dog.

In 17 “ “ “ “ “ “ “ “	cat.	}	experimental animals.
In 8 “ “ “ “ “ “ “ “	wolf.		
In 3 “ “ “ “ “ “ “ “	horse.		
In 1 “ “ “ “ “ “ “ “	guinea pig		
In 1 “ “ “ “ “ “ “ “	mouse		

Of the 211 persons treated, 68 were bitten on covered parts, no death occurring. The remaining 143 were bitten as follows:

Those bitten on the head	16
“ “ “ superior members	108
“ “ “ inferior “	11
“ “ “ different parts of the body	8
	143

Of the 211 persons treated during the year 1892, three died, giving a mortality of 1.42 per cent.

At Vienna—Professor Palttauf, Director.

Antihydrophobia inoculations are being given at the Rudolph Stiftung Hospital at Vienna. The inoculations are performed daily between 10 and 11 A. M. At present there is no charge for the treatment, but it is understood that the charge for such treatment is now under consideration.

Preventive inoculations have been given by DOCTOR ULLMANN. In one year 122 persons were treated, within 10 days after the bite, and only 3 died, or a mortality of 2.46 per cent. During the same period several others were bitten by the same dog causing the bite of some of the 122 treated. These persons did not undergo the treatment and have since died.

At Chicago—Doctor A. Lagorio, Director.

During the period between July 2, 1890, and February 9, 1894, 366 persons were treated, and are classified as follows:

Of the total number treated 104 were bitten by animals recognized to be rabid by experimental proof, or by death of other persons or animals bitten by the same animal; 126 were bitten by animals recognized to be rabid by the symptoms of the disease; and 72 were bitten by animals strongly suspected of rabies.

Dogs caused the bite in 341 cases, horses in 9, cats in 7, skunks in 5, wolves in 2, a mule in 1 case, and a pig in 1 case.

Two deaths were reported among the above mentioned patients, giving a mortality of only 0.54 per cent.

In 123 of the cases the animal causing the bite was proved to be rabid, in 160 the animal was recognized to be rabid by the symptoms of the disease shown during life, and in 83 cases the animal causing the bite was strongly suspected of rabies.

Besides the 366 persons who were treated, 372 others were rejected for various reasons.

[DOCTOR LAGORIO records the case of a five-year-old boy, subject to epilepsy, who, on account of the bite of a dog, was treated at the laboratory in August, 1890, and who has not only never suffered bad consequence from the bite, but recovered from the epilepsy as well. Similar cases and results have been noticed at other institutes, although I believe that DOCTOR LAGORIO claims priority].

At Calcutta, Bengal—A. Reuter, Director.

A PASTEUR Institute was successfully inaugurated on January 30, 1894, in the presence of a large company. After the ceremony subscriptions to a considerable amount were promised.

At Milan, Italy—Doctor Remo Segrè, Director.

This institute was established in 1890, by subscription from local business houses. During the years 1890 and 1891, 238 cases were treated. Of these 108 were bitten by animals proved experimentally to be rabid (two deaths), 121 by animals recognized by medical men or veterinary surgeons to have been rabid (two deaths), and 9 were bitten by animals suspected of rage (no death). Thus out of 238 treated there occurred 4 deaths, or a mortality of 1.68 per cent.

At Constantinople, Turkey—Doctor Zoeros, Director.

Between May 1, 1887, and March 1, 1889, 41 persons were treated, with no death resulting. Of these 12 had been bitten by animals proved experimentally to be rabid, 26 by animals recognized rabid by medical men, veterinary surgeons, or other competent persons, and 3 by animals in which rabies was only suspected.

Value of the Dog.

That there is about one dog to every fourth family, and many more dogs than is absolutely necessary, is a fact recognized by nearly every citizen in the United States and probably by the great majority of people in the world; however, that species of animal is still being propagated, until to-day an important question is "What is to be done with the dog?"

Recognizing the fact that probably nine-tenths of all the cases of hydrophobia are due to the bite of the dog, many ways to prevent the occurrence of rabies have been suggested. One will advocate the muzzling of all dogs, and another will recommend the extermination of that animal. Preventive inoculation of every dog has been suggested; but, as this has not been generally tried, it does not at present seem entirely practicable.

Muzzling is effective when fully enforced, but experience has shown that it is difficult to keep muzzled every dog. It is stated, however, that in Germany where muzzling is generally enforced there are very few cases of hydrophobia.

In cities the system of "catching and killing" stray dogs has proved efficacious indeed and every year there are thousands of stray dogs caught and, if not claimed within a certain period, they are killed by various methods, such as drowning, smothering in a vacuum chamber, killing by poisonous gasses, et cetera. This seems cruel, but something must be done to rid the country of the over-numerous dogs.

While the protection of human beings is of primary importance, there is still another consideration of no slight importance, namely, the destruction of property. It is not uncommon to have it reported that a mad dog has killed or given rabies to such valuable property as horses, cows, sheep, chickens, et cetera, which usually means death to the animals infected. While there are many instances of destruction of stock, the most notable I now have in mind is the outbreak of rabies near Fowlerville, Michigan, in March, 1888. It is reported that one dog caused the death of some six cows, nine horses, and about seventy-five chickens. The dog also attacked two children; but, as the bite was on parts thoroughly covered and there was no abrasion of the skin, the children did not have hydrophobia. Nearly all of the mentioned animals died of rabies. It is of common

occurrence to hear of outbreaks of rabies of more or less magnitude occurring in different parts of the world. In fact they are so frequent that it would be useless to try to enumerate them; medical journals and statistics abound with them.

The following table will give a vivid idea of the enormous money-loss by dogs in the state of Ohio for the years 1880-1893. Through the kindness of the Secretary of State's office at Columbus, I have been able to secure, and have tabulated the following facts:

NUMBER AND VALUE OF SHEEP KILLED AND INJURED BY DOGS, IN OHIO, FOURTEEN YEARS, 1880-93; AND NUMBER OF MILCH COWS COMPARED WITH NUMBER OF DOGS, IN OHIO, FOURTEEN YEARS, 1880-93.

Year.	Sheep killed by dogs.		Sheep injured by dogs.		Total No. of milch cows.	Total No. of dogs.
	No. of sheep.	Value of sheep.	No. of sheep.	Value of sheep.		
1880.....	28,763	\$97,277	23,625	\$41,671	*	121,656
1881.....	33,297	122,684	31,609	60,394	*	*
1882.....	34,606	133,765	31,422	58,748	556,425	*
1883.....	32,955	122,788	24,814	51,188	556,425	214,794
1884.....	30,327	104,622	21,685	43,256	576,147	160,072
1885.....	21,146	85,590	18,807	33,039	579,990	160,018
1886.....	29,006	82,183	19,484	35,098	595,524	168,398
1887.....	19,029	84,701	18,283	51,490	580,538	162,809
1888.....	31,836	107,749	25,296	44,264	610,477	162,644
1889.....	32,080	103,531	26,152	48,503	619,483	155,446
1890.....	27,862	100,536	21,823	42,857	595,133	148,409
1191.....	25,057	94,965	17,705	40,464	613,507	153,892
1892.....	28,469	107,181	22,040	44,509	612,766	158,142
1893.....	29,915	107,431	22,840	46,893	600,463	152,764
	403,348	\$1,456,003	325,585	\$642,374	-----	-----

* No statistics reported to the Secretary of State.

The Agricultural Statistics of Ohio for the last ten years show that on an average every year there are about 600,000 milch cows and about 150,000 dogs existing in the state, or about one dog to every four cows. These facts plainly show the prevalence of the dog. The dog is probably as numerous in other states. Considering the comparative value of the two animals, it does not seem possible that the citizens of any state will keep an animal which is of so little value, and no small expense, as the average dog. Every one knows the value of a milch cow, but there are people who rather part with a whole herd of milch cows than to part with their pet dog even though the dog be the worst kind of a mongrel.

From the foregoing table it will be observed that in the state of Ohio alone, during the fourteen years (1880-1893) 401,348 sheep were killed and 325,585 were injured, giving an appalling money-loss of \$2,098,377. Supposing such a statement were made for the whole world, and the loss of human life should be included, would not the facts be a powerful argument for *less dog*, less sacrifice of property and less sacrifice of human life?

To counterbalance the immense loss of property and human life every year there is provided in many cities and countries a dog-tax or license which is a revenue to the local funds amounting to millions of dollars. In Chicago the dog-tax without regard to the sex of the animal is two dollars per year, the number of licenses issued each year averaging from 34,000 to 35,000, which means that in Chicago alone there is turned into the city treasury a sum averaging about \$75,000 yearly.

Of course the number licensed does not cover all the dogs, because they are "caught and killed," and many are never licensed. I presume a conservative estimate would be that in cities where there is an effective dog ordinance about three-fourths of the dogs are licensed; while in smaller towns and cities about one-tenth would be a fair estimate of the number licensed.

In Detroit the ordinance provides a license of \$1.00 for male and \$2.00 for female dogs, with an additional ten cents each for the tag. During the four years, 1890-93, there were 8,507 licenses issued with a revenue to the city of \$9,574.70. But as Detroit claimed about 250,000 citizens, there ought to have been in the four years at least 75,000 dogs licensed, with a revenue of at least \$100,000 instead of only \$9,574.70. It is evident the dog ordinance is not being rigidly enforced.

I am informed that there is no law or ordinance in Philadelphia compelling dogs to be registered or providing for a dog-tax. There is, however, an ordinance requiring all dogs running at large to be muzzled, and if any are found unmuzzled, they are taken up by the "dog catchers" and turned over to the pound-master where they may be redeemed by paying \$2.00. If not redeemed they are killed by some kind of gas. In 1891 there were 6,052 dogs captured, and 4,829 were killed; the redemption money paid to the city was \$2,128. By paying \$1.25 at the office of the Clerk of Quarter Sessions, the owner may receive a life-long registration certificate for his dog which makes the animal the personal property of the owner. This certificate may be transferred by paying the sum of 12 cents. From September, 1860, to November 22, 1894, about 8,519 dogs were registered becoming the personal property of the owner.

In Bavaria from 1863 to 1876 the deaths from hydrophobia ranged from 14 to 31 each year. A striking contrast are the statistics for the first seven years (1893-1889) of the enforcement of the muzzling order which provides for the killing of stray dogs. During this period of enforcement of the order, only three deaths have occurred in a population of five and one-half millions of people.

During the month of August, 1889, the police in London seized 3,290 stray dogs; 47 either rabid or supposed to be were killed on the streets; 19 were proved by post-mortem examination to be rabid; and 1,681 persons were reported to have been bitten by dogs. In May, 1894, the London police captured 2,161 stray dogs, and 148 persons were reported to have been bitten by vicious dogs.

There are reported to be 150,716 dogs in the Seine Department, France. In 1892 the municipal tax was collected from the owners of 130,716 dogs, and in 20,000 the tax was avoided.

A vicious dog may cause his owner a considerable expense as well as trouble. A dog that destroys property may be an expensive pet. In France only a few years ago a man was bitten by a vicious dog from which he received a permanent injury. He instituted an action for damages and

the courts awarded him a judgment of 11,000 francs (about \$2,500) and ruled that the owner of a dog was responsible for any damages done by the animal.

The dog, and especially the house dog, may be a source of contagium in infectious diseases. The Iowa State Board of Health has recently (September, 1894) reported a death from diphtheria in which the source of infection was traced to a pet dog. DOCTOR STILES, of the Bureau of Animal Industry tells how animal parasites dangerous to man, such as the tongue-worm (*Linguatula rhinaria*) the tape-worm (*Tenia echinococcus*), et cetera, are conveyed to man by way of the pet dog.

RULES AND REGULATIONS SHOULD BE FRAMED AND PUBLISHED.

One of the most efficient means employed for the restriction of the spread of rabies is a set of rules which shall regulate the action and movements of animals infected with the disease. Each local board of health should frame and publish (in accordance with state laws) rules which would enable the health officer to act promptly upon the appearance of a case of this disease so dangerous to the public health and life. If a health officer is obliged to wait until the local board can be called together, the disease may have been allowed to spread, instead of restricting it to the first case.

On the occurrence of a case of rabies the facts should be reported to the local health officer, and promptly restricted by him in accordance with Act 137, Laws of 1883. The health officer should, in compliance with Sections 5 and 6, Act 125, Laws of 1889, report the fact to the president of the State Live Stock Commission, who at present resides at Stanton, Michigan. The local health authorities should isolate the animal or animals and keep them so, until they are taken care of by the State Live Stock Commission or State Veterinarian; but, under no circumstance should the local health authorities fail to guard the public health and life. Whether in man or animals the full facts regarding the outbreak of the disease should be reported to the Secretary of the State Board of Health, at Lansing.

In cities the "Dog Ordinance" generally regulates the action of animals most likely to be infected with rabies. Every city should be equipped with an efficient ordinance and should demand its strict enforcement. An ordinance may be ever so efficient, but if not enforced is useless, and the stray and ownerless dogs will be permitted to roam about the city to become infected with rabies and transmit the disease to human beings. The following is an ordinance in force in a certain city of the U. S. which it seems to me no city would make a mistake by copying:

Be it ordained by the City Council of the City of

SECTION 1.—Every owner of, or person who harbors or keeps, a dog within the limits of this city, shall report to the City Collector annually, within thirty days after the first day of May in each year, his or her name and address, and shall give the name, breed, color and sex of each and every dog owned or kept by such person, and shall pay to such officer the sum of two dollars for each and every dog, and cause such dog, or dogs, to be registered for license in the office of the City Clerk, who shall furnish the owner or keeper of same with a license tag.

SECTION 2.—Every dog shall be provided by its owner or keeper, with a leather or chain collar, to which a license tag shall be securely fastened, and every dog shall also be muzzled, if so ordered, as hereinafter provided. No dog shall be permitted to remain within the limits of the City of, unless the owner, or keeper thereof, shall have caused such dog to be registered and licensed, and provided with such collar and tag, and be muzzled, if so ordered, and any owner, or keeper, of a dog failing to provide

such collar, tag or muzzle, if required, shall be subject to a fine of five dollars for every such dog so unprovided, to which fine shall be added, if unlicensed, the amount of the license tax, and costs, if any, incurred.

SECTION 3.—The City Clerk shall keep a complete registry, in a book to be kept for that purpose, of all licensed dogs, describing same by name, breed, color and sex, and shall also enter the name and address of the owner or keeper as given, and the number of the city license tag.

He shall provide, each and every year, such number of metal tags as may be necessary (the shape to be changed each year) having stamped thereon the year for which the tax is paid, the letters D. T., and also the number of the tag, and it shall be the duty of the City Clerk to deliver one of such metal tags, number to correspond with the number of the registry of the dog, to the person having paid the tax upon any such dog.

The City Clerk shall also send a duplicate of such registry to the Pound-master, who shall record the same in a book to be kept by him for that purpose, and such record shall be open to public inspection.

SECTION 4.—Whenever the Mayor of this city shall deem it necessary, he shall issue an order prohibiting for a certain time therein specified all dogs from running at large on any street, alley, or other public place, in this city, unless such dog be securely muzzled, or led by a line or chain, so as to effectually prevent them from biting any person or animal, which order shall be published in a daily newspaper of general circulation in the City of

SECTION 5.—It shall be the duty of the Superintendent of Police, his assistants, and of all the policemen of the City of, to take up and impound in such suitable place, or places, as may be designated by the Mayor (of which place or places, notice shall be given by posting a card or notice in some conspicuous place in the office of the Chief of Police, and in the office of the City Collector, and also by publication, of such place or places, in some daily newspaper of the City of, of general circulation, to be designated by the Mayor), any dog found running at large in the City of, contrary to the provisions of any ordinance, or of any order issued by the Mayor.

SECTION 6.—The City Pound-master shall, immediately upon receiving any dog at the pound, make a complete registry of same, enter the breed, color and sex, and whether licensed or not, if ascertained, and if licensed, he shall, if known, enter the name and address of the owner or keeper, and the number of the license tag, if any, and shall keep impounded licensed dogs separate from unlicensed dogs.

A list of all licensed dogs impounded, if any, shall be immediately sent to the City Clerk, for entry, by the Pound-master, who shall also forthwith give notice, through the postoffice, to the owners or keepers of such licensed dogs, of their being impounded.

SECTION 7.—For every dog taken up and confined in the dog pound, as provided in this ordinance, for which no license tax has been paid, a redemption fee of three dollars, together with the amount of the tax, shall be paid to the City Collector for the use of the city; and upon procuring a certificate from the City Collector, stating that said amount has been paid, and paying to the Pound-master for taking up such dog the further sum of fifty cents, and the cost of keeping such dog, not to exceed twenty-five cents per day, and cost of advertising, if any, as hereinafter provided, the owner or keeper thereof, within five days after the impounding, or any other person, after five days, shall be entitled to redeem such dog, and if such dog shall not be redeemed within five days after being taken up, such dog shall be destroyed by the Pound-keeper, except that at the expiration of the five days allowed for the redemption of impounded dogs, the Pound-master shall advertise immediately in a daily newspaper of general circulation in this city, all unredeemed licensed dogs, if known or identified as such, and if such dogs be not redeemed at the expiration of the fifth day after such advertising, they shall then be destroyed.

SECTION 8.—Any dog for which a license has been paid, which may be impounded for being at large without collar or tag, or without a muzzle, if required (if it shall be made to appear to the satisfaction of the City Collector by the affidavit of the owner or keeper, or by other sufficient testimony, that a license for such dog was procured, and a collar put around its neck, with license tag attached, as provided in this ordinance, or was muzzled, as required by any order of the Mayor, but that such collar, tag or muzzle has been accidentally lost), may be redeemed upon the payment to the City Collector, for the use of the city, of two dollars, and payment to the Pound-keeper his charges, as provided in Section 7 of this ordinance, and the City Collector may deliver to the person redeeming such dog, a duplicate license tag to correspond with the registry, for which duplicate tag twenty-five cents shall be paid.

SECTION 9.—It shall be the duty of the Chief of Police, or any police officer, to kill any dog which may be found in the City of without an owner or keeper, or found at large contrary to any ordinance, or to any order of the Mayor: *Provided*, Such dog cannot be safely taken up and impounded, and unless a dog cannot be safely taken up and impounded, it shall not be lawful for any officer of the

City of _____, or any other person, to kill, or attempt to kill, any dog at any other place than the dog pound.

No dog shall be subject to molestation under this ordinance, or under any order of the Mayor, while on the premises of its owner or keeper, and any officer of the City of _____, or other person, who shall invade private premises to capture, entice, or take any dog out, of the enclosure of the possessor of such dog, or who shall molest or seize any dog while held, or led by a line or chain by any person, or who shall bring into the city any dog, for the purpose of taking up and impounding the same, shall, on conviction, be fined in a sum not less than five, nor more than fifty dollars.

SECTION 10.—If any fierce or dangerous dog shall be found at large in the streets of _____, or upon any public place, or upon the private premises of any other person than the owner or keeper of the dog, and shall there annoy or endanger any person thereon, the owner or keeper thereof shall forfeit and pay to the City of _____ a sum of money not exceeding ten dollars, for the first offense on the part of said owner or keeper, in permitting such fierce and dangerous dog to be at large; and upon a second or further conviction, for the same offense, a sum not exceeding twenty-five dollars; and it may be part of the sentence, upon such second conviction, that such fierce and dangerous dog immediately be killed, and this sentence shall be forthwith executed by the Chief of Police or any police officer, for which killing the owner or keeper shall pay the further sum of one dollar, which sum shall be included in said judgment.

SECTION 11.—Whenever complaint shall be made and filed with any Justice of the Peace, or Police Magistrate, setting forth that any dog has, in any manner, disturbed the quiet of any person or neighborhood, or has bitten a person within the City of _____, and that the person so bitten was not at the time trespassing upon the person or property of the owner or keeper of such dog, the Justice of the Peace or Police-Magistrate, shall issue a summons directed to the Sheriff, Constable or Police Officer, which summons shall be returnable forthwith, and upon the return of such summons the Justice of the Peace or Police Magistrate, shall proceed to hear and determine the matter, and if it shall appear that such dog has so disturbed any person or neighborhood, or that the person so bitten by such dog was not at the time trespassing upon the person or property of the owner or keeper of such dog, the Justice of the Peace, or Police Magistrate, shall order said dog to be removed or killed, and shall issue an order to the owner, or keeper of such dog, to remove or kill it within twenty-four hours from the time of receiving a copy of such order.

The owner or keeper of any such dog who shall refuse or neglect to remove or kill, or cause such dog to be removed or killed, within twenty-four hours after having received a copy of said order from the Justice of the Peace, or Police Magistrate, aforesaid, shall be fined in a sum not exceeding twenty-five dollars, and the further sum of twenty-five dollars for every twenty-four hours thereafter until such dog shall be removed or killed.

It shall be the duty of any Police Officer, or Constable, to kill said dog whenever it shall be found at large in said City of _____, twelve hours after the service of a copy of said order on the owner or keeper of such dog.

SECTION 12.—The word dog, whenever used in this ordinance, shall be intended to mean a female as well as a male dog.

SECTION 13.—All ordinances or parts of ordinances inconsistent with the provisions of this ordinance are hereby repealed.

ISOLATE ALL INFECTED OR SUSPECTED ANIMALS.

For the restriction of the spread of rabies and hydrophobia, it is important that prompt action should be taken with any suspicious animal. When a dog or other animal acts strangely and there is suspicion of madness, the animal should be immediately confined, *not killed*, and kept under observation for a week or ten days. Have the animal examined by a competent physician or veterinary surgeon, and if the animal is rabid the characteristic symptoms will soon be observed. PASTEUR says "the animal will certainly die within eight days. If at the end of that time no symptoms of rabies have been observed, the bite cannot cause hydrophobia, and there is no reason why the animal should be destroyed." If symptoms of rabies do appear in the animal thus under observation, it should be immediately

killed; and, if the animal has bitten a human being, a small portion of the medulla oblongata should be secured and placed in a small vial containing pure glycerine only, for use in experimental inoculations of other animals to determine without doubt whether the animal suspected of rage was really rabid.

If other animals have been bitten by a suspicious animal, they should likewise be confined until it is proved whether or not they are rabid, or until the period of incubation* has past. It is quite frequently the case that valuable stock has been bitten by animals not rabid, and it would be a useless destruction of property to destroy such animals. Do not kill an animal unless you have good reason to believe it is rabid, or unless it is a source of danger to other animals and to human life. Of course a dog may run mad when it is quite impossible to secure the dog, and extremely dangerous for it to run at large, where shooting the animal may be the only safe way. In such a case the animal should not be disposed of until it is absolutely certain that no person has been bitten. If a person has been bitten a portion of the medulla should be prepared as described above. If a human being has been bitten and the animal is destroyed there is no way left to ascertain whether or not the dog was really mad, and whether the person bitten has been inoculated with the virus of a terrible disease.

WHAT SHOULD BE DONE WITH A PERSON BITTEN.

It is important that prompt measures be taken for the care of the patient. The wound might be "sucked" and thoroughly cleansed with a large effusion of hot water, at the same time pressing the wound to cause any liquid, poison, et cetera, to ooze out and to promote bleeding. A solution of boric acid would promote bleeding and aid in cleansing the wound. If the wound is on the leg or arm a bandage might be placed between it and the heart. As soon as possible cauterize the wound. There are many cauteries recommended, such as caustic potash, nitrate of silver (lunar caustic), carbolic acid, bichloride of mercury, † match of Paquelin, et cetera, but as these cauteries, with the exception of the lunar caustic, cannot well be used except by a physician, the white-hot iron will probably be most available in all cases, especially in places where the physician is not accessible. Where a physician can be called without much delay, it is best to leave to him the method, and cautery to be used. Very little time should be lost, however, in calling a physician, because immediate action is important and the most effective cauterizations are those performed within half an hour. The hot iron can be used by a non-professional person; while the other cauteries require more care in their application.

Cauterization may or may not be effective in destroying the poisonous virus; but surely, in most cases, will do no harm, and may be the means of preventing an attack of hydrophobia. Most people believe, as does the illustrious PROFESSOR KEEN, that there is "no treatment that will prove effective in cases of hydrophobia except that of PASTEUR." PASTEUR preventive inoculations have been described on preceding pages of this paper.

* For period of incubation in animal see page 27 of this pamphlet.

† The bichloride of mercury should not be used stronger than 1 to 500.

The PASTEUR treatment can be secured from two central points in the United States; one in New York City, at the corner of Central Park and Ninety-seventh street, and the other in Chicago, at 65 Randolph street. The New York Institute is under the directorship of DOCTOR PAUL GIBIER, and the Chicago Institute is directed by DOCTOR A. LAGORIO. The statistics on preceding pages of this paper will show the results of the work of each institute.

The cost of treatment is small compared with the value of a human life. I understand that the charge for the treatment alone is ordinarily \$200.00, which does not include the expense of living during the period of treatment, which lasts about 15 days.

When it is proposed to send a patient to a PASTEUR institute it should be remembered that it is important to send at the same time the piece of the medula oblongata prepared in the vial of pure glycerine only.

If the person suspected of being infected is himself able, or has friends who are financially able, the problem of securing the treatment is not great. But when the patient or his friends are not able the problem is not so easy, and the question is—

HOW CAN THE PREVENTIVE INOCULATIONS BE SECURED?

In Michigan there is a law which provides that the local board of health shall see that no person sick or infected with a disease dangerous to the public health shall suffer for want of nurses or other "necessaries," which certainly implies that no person is to suffer for want of medical attendance; and, as long as it is recognized that PASTEUR'S inoculations is the only known preventive, no person should be permitted to suffer for want of that treatment. This same statute provides that the expense is chargeable to the county in cases where the patient or the patient's friends are not able. It is not at all improbable that the expense of the PASTEUR treatment might be chargeable to the county in such cases.

In Great Britain and especially in Scotland the municipality has sent many patients to the Paris PASTEUR institute; and in some cases has gone so far as to furnish a medical attendant to accompany the patient. This plan could be employed in the United States.

There is still another way by which the necessary funds might be secured. It is well known that there are many liberal, wealthy men, who are public spirited, and might loan a patient the money to secure the treatment. Then, again, the funds might be secured by means of the subscription paper so commonly used in the relief of the suffering.

