Rabies in California.

By W. A. SAWYER, M. D., Director of State Hygienic Laboratory, Berkeley.

For a year and a half there has been prevalent among dogs in certain parts of California, a disease frequently transmitted to other warm-blooded animals, including cattle and horses, and also to man. Rabies, or hydrophobia, is a striking example of those diseases which are perpetuated among certain animals and occasionally are transmitted in one way or another to man. Other familiar examples of such diseases are glanders in horses and mules, anthrax in cattle, and bubonic plague in rodents, all three of which diseases exist in California in animals, but seldom attack man. Rabies, while essentially a disease of dogs, is very apt to secure victims among valuable domestic animals and human beings, owing to the excitement and delirium which cause many of the infected dogs to travel about and to introduce infectious saliva with their teeth through the skins of animals and persons. While the control of anthrax and glanders offers difficult and complex problems, and while the safety of human beings from plague was accomplished in our state only through the expensive destruction of rats and their hiding places, rabies can be suppressed and even entirely eradicated in a definite circumscribed area by making it impossible, by muzzling, for dogs to bite, and by preventing dogs from entering infected regions until proved by a six months' quarantine to be free from the disease. Such methods have freed the island of Great Britain from the disease, and quarantine has kept the malady out of Australia.[1] These experiences, and many others in Europe and America, have shown that rabies may be suppressed with simple measures if they are thoroughly enforced, and that it is therefore a disease so decidedly preventable that it is a reproach to any community to have an outbreak occur and spread.

The Pacific Slope, after a long freedom from the disease, has at last been forced to add rabies to the list of diseases which demand suppression through concerted activity of the defenders of the public health. This disease, known for many centuries in Europe, was recognized in New England in 1768. In 1908 it was prevalent in the eastern half of the United States and occurred in rare instances somewhat further west.[2]

In a recent article Black and Powers describe a small outbreak of rabies among the dogs of Los Angeles in 1898.[3] Fortunately the disease was suppressed by a muzzling ordinance. In the same article are the reports of a fatal human case which was infected in 1899, from a dog in Pasadena, and of an outbreak in 1906 among the animals at the Soldiers' Home near Los Angeles. With these exceptions we have no authentic record of the existence of rabies in California previous to the summer of 1909, when the present epizoötic first attracted attention in Los Angeles.

The disease may have been slowly carried to the state from the east by dogs and wild animals, such as coyotes and skunks, or it may easily have been introduced through the transportation over the railroad of an infected dog during the incubation period of the disease. It is only to be wondered at that the westward spread of the disease from the Atlantic to the Pacific seaboard required more than a century.

The spread of rabies through railroad transportation is well shown in the story of a dog whose head was sent from Imperial to the State Hygienic Laboratory, where examination proved the presence of rabies. This dog was the pet of a school teacher and accompanied her on a visit to Los Angeles, which is nearly two hundred miles from Imperial. A few weeks after returning, the dog suddenly became frenzied and killed fifteen chickens, but did not bite any human beings or dogs. No other cases have occurred in Imperial, and it is highly probable that the dog had become infected during his unwise visit to a city in which rabies was prevalent. The traveling of dogs to and from infected districts ought certainly to be discouraged if not strictly prohibited by law.

The spread of the disease by wild animals is well illustrated by the first case reported in Oregon of the biting of a person by an animal suspected of rabies. In November, 1910, a child was bitten by a coyote showing symptoms suggesting rabies. The coyote was destroyed before its head could be secured for examination, and the child was given the Pasteur treatment without further evidence. A few weeks later a sheep and a pig which had been bitten by the same coyote developed rabies and their brains showed Negri bodies. I am indebted to Dr. Calvin S. White, State Health Officer of Oregon, for information regarding this interesting case, which shows that Oregon, as well as California, has been reached by the westward march of the disease.

The responsibility of the wild animals of California for the spread of rabies has not been clearly demonstrated. The tales of probable infections from skunks and from a mountain lion, were all, as far as I have been able to learn, unconfirmed by laboratory evidence. It is desirable that the heads of wild animals which display paralysis or ferocity unusual for their kind should be sent to the laboratory for examination in order that it may be definitely known whether these animals are playing a part in the perpetuation and spread of rabies.

The principal object in presenting this paper is to bring together for the use in the campaign against rabies a collection of reliable statistics with clear differentiation between fact and inference. The need for the dissemination of knowledge concerning rabies is indicated by the continued opposition to efficient measures for the eradication of the disease. Surprising as it may seem, the people most affected, namely the owners and lovers of dogs, through bitter opposition show a lack of appreciation of the fact that their pets are the chief sufferers from this terrible disease, as well as the means of its spread and transmission to horses, mules, cattle, pigs, sheep and human beings.

In order to combat successfully the usual opposition to the enforced muzzling of dogs, health officers should arm themselves with facts rather than opinions. To gain proof of the presence of the disease a laboratory examination of the suspected animal is imperative. A prompt and decisive laboratory examination becomes of greatest importance in those cases where human beings have been bitten, and where the patient is unwilling to spend the necessary money and time for treatment unless the need is clear. In such cases a positive report usually results in prompt and successful preventive treatment. If the report is negative, the patient is freed from the haunting fear that at any time in the ensuing months he may suddenly develop serious symptoms. Where dogs have been bitten by rabid animals, a positive laboratory report determines the advisability of having the dogs killed. It is unwise to keep infected animals about as they are apt to develop symptoms unexpectedly and spread the disease to others. The danger of keeping under observation and confinement horses or cattle which have been bitten by rabid dogs is not so great.

The routine examination of heads at the State Hygienic Laboratory consists of the careful removal of the brain, the making of smears from the hippocampus major, staining with Williams' modification of Mann's method,[4] and careful search of from one to twenty preparations for Negri bodies. If the results are negative, one or two experimental animals, usually rabbits, are inoculated subdurally with an emulsion of the brain. If diagnosis is urgent, a guinea pig is inoculated, since that animal shows a very short incubation period, frequently only ten days.

In drawing conclusions from the laboratory sta-

tistics presented in this paper it must be borne in mind that the great majority of rabid animals are not examined in the laboratory. The opinion has been published[5] that in Los Angeles not one case in ten has been reported to the Health Department. In that city 174 cases were reported between September, 1909, and April, 1911. During the same time fifty-nine positive examinations of heads from Los Angeles were made in the city laboratory. This means that approximately one-third of the reported cases received laboratory confirmation. From these statements it seems probable that the positive laboratory examinations represent less than one-twentieth of all the cases of rabies. In Stockton the proportion is more striking. We have the statement of Dr. Charles Keane, State Veterinarian, that one hundred cases have occurred in and near Stockton.[6] According to our records only three heads were sent to the State Hygienic Laboratory from Stockton. These instances show that the laboratory statistics represent only a small fraction of the total number of cases.

In the State Hygienic Laboratory between November 2, 1909, and April 1, 1911, a period of seventeen months, the heads of eighty-two animals were received. Two of the heads could not be examined owing to decomposition; thirty-six gave negative results. Of the remaining forty-four showing positive results, thirty-six showed Negri bodies and the other eight caused typical symptoms of rabies in rabbits. One of these eight heads could not be examined for Negri bodies owing to decomposition, but the brain material was used for inoculation after the activity of the putrefactive bacteria had been inhibited by emulsifying with glycerin and allowing the mixture to stand for over twenty-four hours. This substance when injected deeply in the neck caused typical symptoms of rabies to appear at the end of fourteen days. Of the forty-four positive cases, one was a cat and another a cow. The forty-two dogs examined were known to have bitten at least twelve human beings, the majority of whom received Pasteur treatment promptly. Eight of the dogs were stated to have bitten other dogs, one of them biting fifteen or twenty dogs and another biting two dogs and a mule.

The laboratory of the Los Angeles Health Department presents very interesting statistics of the present epizoötic. Between September 14, 1909, and April 1, 1911, this laboratory examined 104 heads, 97 of which came from the city of Los Angeles. One of the heads could not be examined owing to putrefaction. The sixty-four heads giving positive results were divided among the various animals as follows: Fifty-nine dogs, three horses, one cow and one goat. The first five examinations in 1909 were made by inoculation of experimental animals. Since then the results have depended on microscopic search for Negri bodies alone. The horse and eleven of the dogs which proved to be rabid were reported to have bitten human beings.

The laboratory of the Health Department of Long Beach examined the heads of four dogs between July 1, 1910, and August 11, 1910, and found Negri bodies in each case. Two of these dogs had bitten human beings who received Pasteur treatment. All four were found in Long Beach.

In the pathological laboratory of Dr. Stanley P. Black in Los Angeles, between December 10, 1909, and April 1, 1911, the brains of fifty-seven animals and two human beings were examined. In both the human cases Negri bodies were found, and in one of them animal inoculation was performed and resulted in confirmation of the diagnosis of rabies. Of the fifty-seven examinations of animals' brains fifty-two revealed Negri bodies and were therefore positive, four were negative, and one was doubtful. In one of the cases animal inoculation was performed and resulted in rabies, confirming the positive diagnosis based on finding Negri bodies. Of the fifty-two animals' brains giving positive results, forty-seven were from dogs and five from cats. Thirty-seven of these rabid dogs and all five of the cats had bitten human beings. The heads came from the following counties: Los Angeles, Orange, San Bernardino and Kings.

Summing up the evidence of the four laboratories we find that out of 247 examinations of the brains of animals for rabies, 164 gave positive results. One hundred and fifty-two of the positive cases were dogs and the remaining cases were distributed as follows: Six cats, three horses, two cows and one goat. At least sixty-eight human beings were bitten by the animals which were proved to be rabid by laboratory investigation. If our previous estimate that not more than one out of every twenty cases of rabies in animals is examined in the laboratory, is true for the whole state, these positive cases would indicate that there had occurred a total number of cases in California of over 3200.

The Director of the State Hygienic Laboratory requests that, if any pathologist making examinations for rabies has been overlooked during the compilation of these figures, he will kindly furnish his totals to the laboratory in order that the statistics compiled may be kept up to date.

The geographical distribution of the cases is graphically shown on the accompanying map. In addition to the dots and circles which indicate the locality from which the heads of rabid animals were sent to the laboratories, and the figures indicating the number of heads from each county, small crosses may be seen. These represent, as nearly as could be ascertained, the locations at which fatal human cases of rabies became infected. The first case antedates the present outbreak.

A summary of the human cases follows:

1. On March 10, 1899, in Pasadena, a man (H. M. S.) was bitten in the face by his dog. Five weeks after the infection symptoms of rabies appeared, and five days later the man died (April 30, 1899). Inoculation of rabbits with the brain tissues of the patient produced rabies.[7]

The remaining cases all belong to the present outbreak.

2. On December 12, 1909, a rancher (M. E. C.) aged 30, died of rabies at Holtville, Imperial County. This man was infected through the bite of a cat.

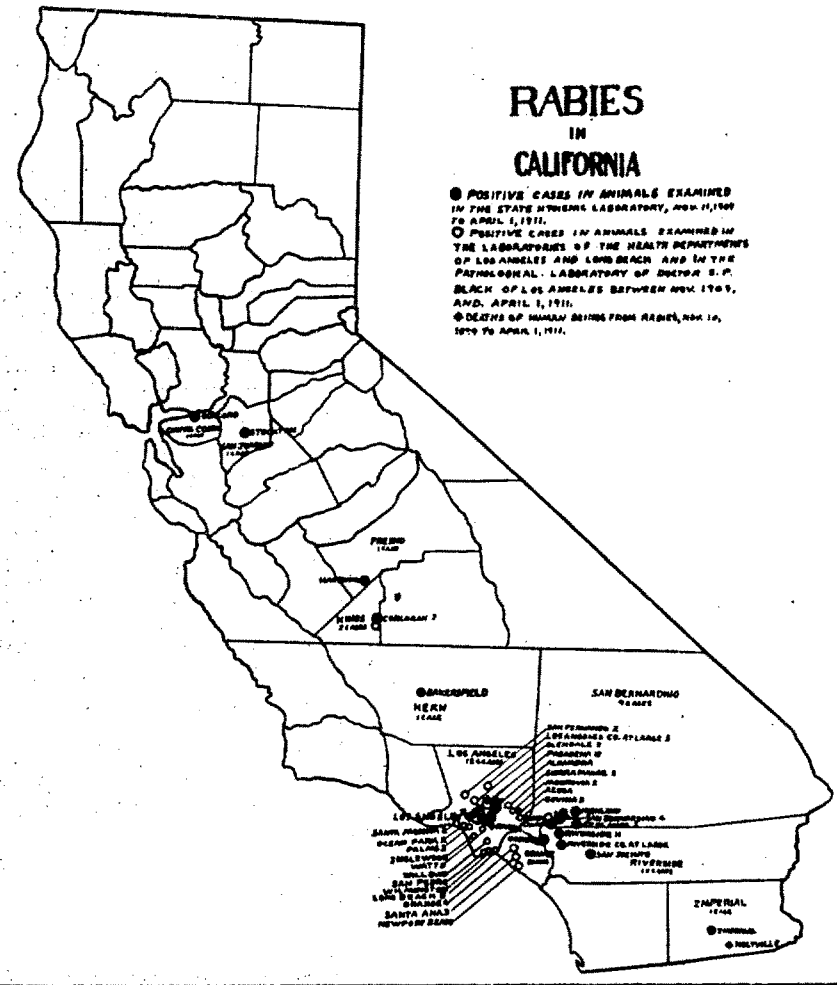
3. About December 17, 1909, in Los Angeles, a boy (J. S.) aged 10 years, was bitten in the leg by a stray dog. Nine weeks later symptoms appeared and death came three days afterward (February 21, 1910). Negri bodies were found in the brain of this patient.[8]

4. On May 2, 1910, a rancher (J. B.), aged 62, died of rabies at Rivera, Los Angeles County. He had been bitten in the face by his own dog.

5. On November 15, 1910, in Los Angeles, a girl (E. L.) of 6 years was bitten through the lip and on the nose by a dog. Intensive Pasteur treatment was instituted the next day, but symptoms of rabies appeared sixteen days after infection and death occurred two days later (December 2, 1910). Negri bodies were demonstrated in the child's brain.[9] A rabbit inoculated with some of the brain tissue showed the paralyses of rabies on the nineteenth day.

The last of these cases was a patient of Dr. David D. Thornton of Los Angeles, and with his consent I will present a short account derived from the full report which he sent me:

In the morning of November 15, 1910, a little girl of six years was sent by her mother to a neighboring grocery store. While she was in the store a small, wet and dirty dog entered and sprang upon her, biting through her upper lip and scratching her nose with his teeth. The dog then bounded through the door and ran away. Later in the day the same dog bit another child in the leg, about a mile from the store where Dr. Thornton's patient had been attacked. The dog was examined in the Los Angeles City Laboratory and Negri bodies were demonstrated. The next morning, thirty hours after the biting, the Pasteur treatment was instituted by Dr. Stanley P. Black and was continued systematically through November 30, the fifteenth day



of the treatment, when the litle girl was noticed to be peevish and irritable. On the way home from the doctor's office her mother bought her some soda water, but the child complained that it tasted hot. On setting the glass down on the counter a sudden jerking of her hand overturned it and she became alarmed and cried violently. On reaching the street she became nauseated and vomited, and later she had another severe crying spell. As she seemed ill, she was put to bed. Food was repugnant and she ate no supper. During the night the child awakened at intervals and talked rapidly. At midnight she asked for a drink of water and the mother observed that her daughter had some difficulty in swallowing. The following morning the child arose as usual, and asked for water. Upon attempting to drink she experienced great pain in her throat and was unable to swallow. She became very irritable and extremely sensitive to noises. A window shade slipped from her mother's hand and went up with a sudden noise. This excited the child so that it could not be quieted for a long time. In the afternoon she rolled from side to side in bed and spoke rationally although she had been delirious at times during the day. The mere suggestion of drinking seemed to produce pain and there was fear of being touched or handled in any manner. The pupils were dilated. Chloral and bromides were given by rectum in an attempt to quiet the child. At about two o'clock in the morning she began having one convulsion after another. The pupils were dilated, the pulse was rapid, and signs of exhaustion were apparent. Chloroform inhalations gave only temporary relief. Any slight irritation as wiping the saliva from her lips would precipitate a convulsive seizure. The convulsions grew weaker and weaker and further apart until death ended the suffering at six o'clock in the morning.

This case is a striking example of an extremely short incubation period, due in large part to the nearness of the wound in the face to the central nervous system. About two-thirds of the Pasteur treatment had been given and consequently the immunity was far from being established. Usually the incubation period is between forty and seventy days, which allows sufficient time for immunization.

In order to prevent the recurrence of these horrible cases of rabies in man until the disease shall have been eradicated among dogs, it is necessary that the Pasteur treatment should be given as promptly as possible wherever a patient has been bitten by an animal proved to have had rabies or strongly suspected of the disease. The importance of treatment is apparent to any one who considers that approximately fifteen per cent of all untreated persons who have been bitten by rabid animals develop the disease and die, while only 1.3 per cent of those treated die.[10] Almost half of the failures are in cases like one of those reported above, where the nearness of the wound to the central nervous system and the virulence of the infection so shortened the incubation period that there was insufficient time for the Pasteur treatment to establish an immunity before the onset of symptoms.

An example of very short incubation periods in animals has come recently to the attention of the State Hygienic Laboratory. A man living in one of the suburbs of Los Angeles reported to the laboratory that on November 24, 1910, his pet dog had

been bitten in the inner corner of the eye by a strange dog or coyote. Fourteen days later the dog became restless and the next day it was excessively playful and noisy. It refused to eat or drink, and it bit the man and his child on their hands. The dog died the following morning causing suspicion that it had been afflicted with rabies, and its head was sent to the State Hygienic Laboratory in Berkeley. Pending the arrival of the head, the Director of the Laboratory, influenced by the history of the case, telegraphed that he advised beginning treatment without delay. The Pasteur treatment was begun immediately. The dog's head was carefully examined but Negri bodies were not found. A rabbit was inoculated subdurally and in nine days it came down with typical symptoms and it died three days later. Negri bodies are said to be better developed in the slower cases, and in the rapidly developing case of this dog they were not discovered. In this case, the dog received a particularly virulent inoculation in a situation which permitted a quick spread of the infection up the nerves through the short distance between the eye and the brain. Usually the incubation period in inoculated rabbits is seventeen days or more. Dogs who have become rabid from bites usually have an incubation period of from fifteen to sixty days. Fortunately there was no delay in the treatment of the people bitten.

Those who have observed the symptoms of rabies in human beings, the anxiety and mental excitement, the painful spasms of the throat preventing swallowing, the convulsive seizures, and the final paralysis, are impressed with the horror of this agonizing disease. Inasmuch as the individual who has been bitten is seldom to blame, it seems only right that the community which has failed to suppress the disease among dogs should do everything within its power to enable the human victims to receive Pasteur treatment promptly and with moderate expense. I am of the opinion that there should be at least one place in California where a salaried officer of the state will administer the Pasteur treatment for a moderate set fee. This will not prevent the treatment being given by physicians to patients who desire to be treated at home and prefer to pay a higher fee, rather than to interrupt their work and travel to the Pasteur Institute of the State Hygienic Laboratory, wherever the State Board of Health might see fit to establish such an institution. An Institute is needed immediately for the administration of the free virus furnished by the United States Public Health and Marine-Hospital Service pending the beginning of the production of our own virus as soon as such a course will seem wise. The demand for Pasteur treatment is indicated by the fact that the Hygienic Laboratory of the United States Public Health and Marine-Hospital Service sent, previous to April 1, 1911, the virus for 141 Pasteur treatments to California. In addition to this virus the material for many treatments has been obtained by physicians of California from other sources.

Most of the cases given in California have been administered by Dr. Stanley P. Black and Dr. D. D. Nice of Los Angeles, who have kindly furnished me with brief reports of the extent of this work.

Dr. Nice has treated twenty cases of which three came from Arizona, where they had been bitten by skunks. No reports of rabid skunks in California have been received and it is to be regretted that the heads in the Arizona cases were not examined. Seventeen of Dr. Nice's cases came from Southern California; sixteen of these were bitten by dogs and the remaining case received the saliva of a rabid cow in a cut of the hand. Eleven of the dogs showed Negri bodies on examination and the remaining animals were not investigated in the laboratory. None of the twenty cases developed rabies. Treatment was begun from one to six days after the bite, except in one case when it was instituted eleven days after.

Dr. Black has given Pasteur treatment to 102 people from Southern California. Most of these patients came from Los Angeles, San Bernardino and Orange counties, but one came from each of the following: Kings, Riverside and Ventura. Dogs were the source of infection in 93 of the cases, cats in 5, horses in 4. The diagnosis of rabies in the infecting animal depended on the discovery of Negri bodies in 77 cases (73 dogs, 3 cats, 1 horse), and in two additional cases on animal inoculation. One of the cases showing Negri bodies was confirmed by inoculation. The remaining 23 infecting animals (18 dogs, 2 cats, and 3 horses) were considered rabid owing to symptoms which they presented, or to the circumstances of the biting. The great majority of the people treated had been bitten, but in a few cases the virus had entered wounds otherwise inflicted. Three physicians took the treatment after receiving wounds while making post-mortem examinations of rabid animals. One of the 102 patients died of rabies long before the treatment could be completed, as has been already reported in this paper, and therefore this case cannot be looked upon as a failure of the method. Another patient showed some paralysis. With these two exceptions, no symptoms in any way referable to rabies developed during or after the treatment. The time elapsing between infection and the beginning of treatment averaged 5.7 days.

In Berkeley treatments have been given since November, 1909, by the writer to a helper in the State Hygienic Laboratory, who cut himself while opening the skull of a rabid dog, and also to a boy who was bitten by a rabid dog in Concord, California. This dog's brain showed Negri bodies. Neither case showed any symptoms.

A man who had been bitten while visiting in Missouri by a dog suspected of rabies, received treatment in San Francisco from Dr. Raymond Russ.

There are many persons who do not understand the best procedure to be followed when a person has been bitten by a dog suspected of rabies. The animal should be captured, if this can be safely done, and should be shut in a pen where he should be well cared for during a period of ten days. If the animal is alive and well at the end of that time, rabies may be excluded. If the dog dies, or if it is killed at the time of the biting, the head should be carefully removed by a physician or veterinarian, should be packed in ice in a large can or bucket, and should be sent by express to the State Hygienic Laboratory, Berkeley. The wounds inflicted on the person bitten should be promptly cauterized with nitric acid by the nearest physician. If there is little doubt of the presence of rabies in the dog, or if the wounds are about the face, there must be no delay in beginning Pasteur treatment. Otherwise it may be safe to wait twenty-four to forty-eight hours for a telegraphic report of the microscopic examination of the laboratory. All dogs and cats bitten by rabid dogs should be killed, for they would be apt to spread the disease should they develop it. As soon as it is known that the disease is present in the community, the health authorities should be notified and support should be given to the establishment and enforcement of ordinances compelling the destruction of ownerless dogs and the muzzling of all dogs until six months after the disease will have disappeared. If a neighboring community contains rabies and is not properly handling the situation, steps should be taken to prevent dogs from entering from the vicinity where rabies prevails.

The proper application of the precautions which have been outlined will diminish rabies to a minimum, and possibly entirely free our state from the disease. This would prevent a great deal of suffering among dogs and cattle, and would annually keep a few human beings from the tortures of a horrible death.

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Discussion.

Dr. Wm. Ophuls: I have listened with interest to Dr. Sawyer's splendid presentation of the subject. I examined the cerebellum of a girl who was killed by a mountain lion in the Santa Clara Valley; the lion was suspected to have had rabies, but in spite of careful examination we were unable to discover Negri bodies in the brain. I have not known of any cases which occurred in San Francisco. At the hospital a few months ago we had a dog which behaved as if he had rabies, but it turned out that our fears were without foundation of fact. Certainly sooner or later the disease is going to come to San Francisco, and it would be better to take time by the forelock and prepare an ordinance and enforce it in case of need.

Dr. W. A. Sawyer: The geographical distribution of the disease is interesting. Around Los Angeles, where the population is crowded and where there are many dogs, the disease is found prevalent over a fairly large area. Around San Francisco Bay, where the disease has not yet broken out, there is a distinct need for the authorities to prevent the disease from slowly working its way into that densely populated region. Over a year ago the disease was in Stockton and a single case has been found as near as Concord. If we can only keep rabies from getting into the Bay region we will be doing a distinct service to that community.