

Rabies and how to prevent it : a paper read before the American Social Science Association, Saratoga, September 8, 1886 / by Valentine Mott, M.D., New York.

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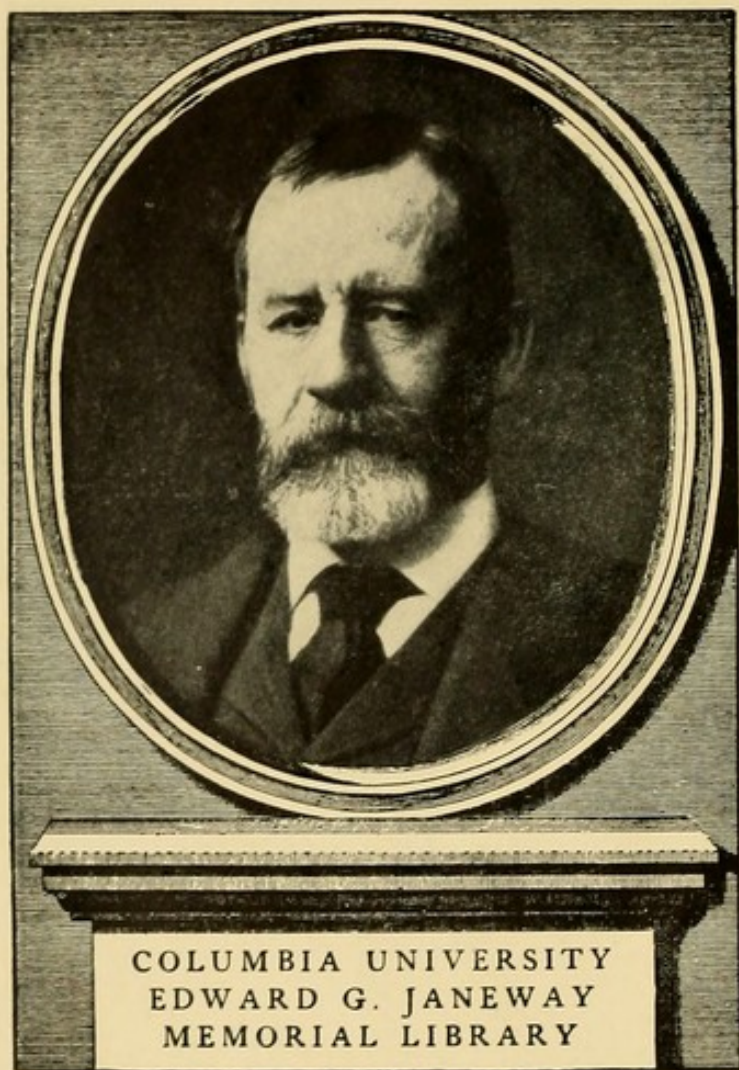
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RABIES AND HOW TO PREVENT IT

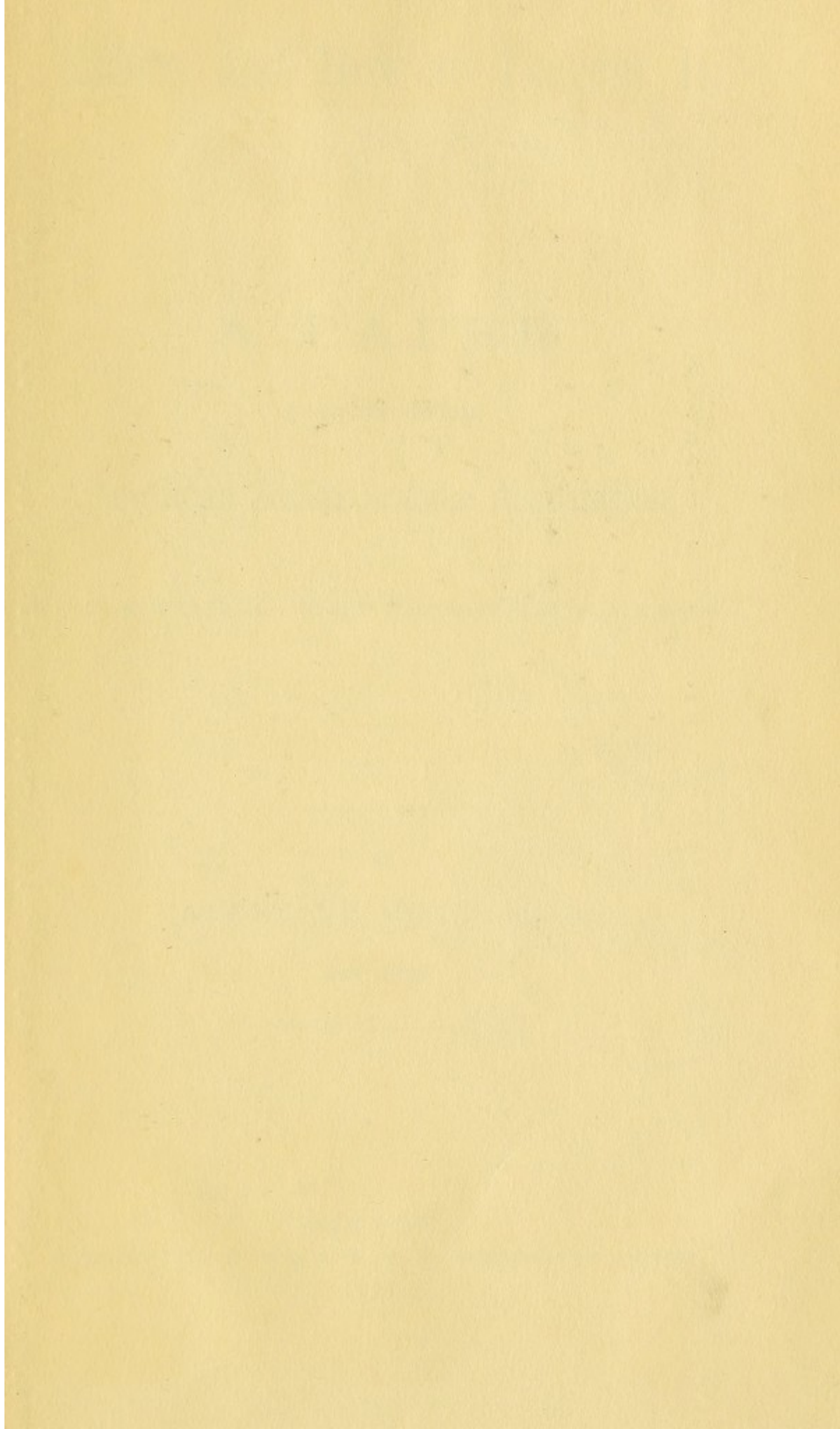
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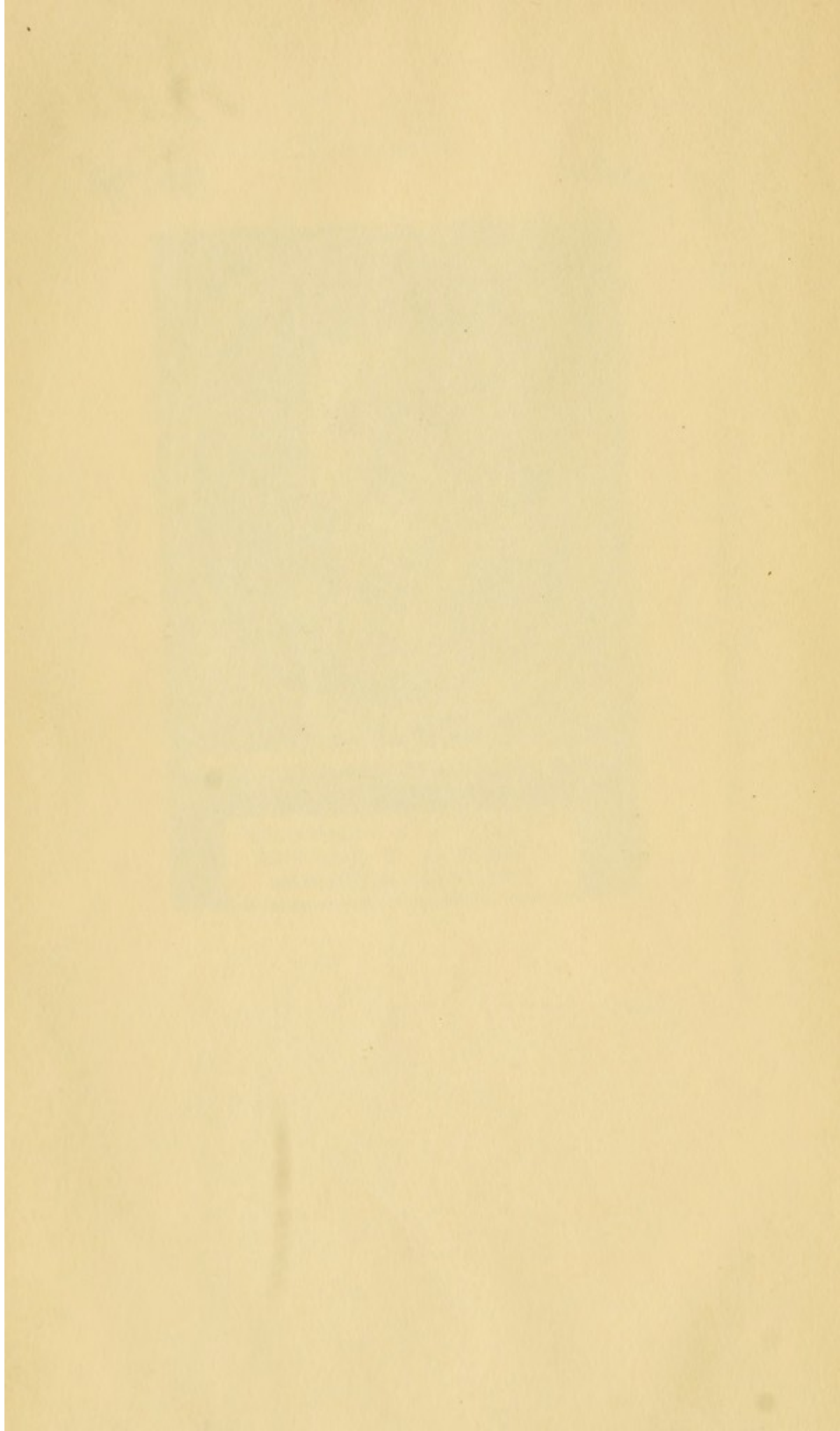
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Rabies and How to Prevent It.

A PAPER

READ BEFORE THE

American Social Science Association,

SARATOGA, SEPTEMBER 8, 1886.

BY

VALENTINE MOTT, M. D.,

NEW YORK.

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RABIES AND HOW TO PREVENT IT.

BY VALENTINE MOTT, M. D., OF NEW YORK.

Essentially an old disease, despite of what many say, since we find mention of it in old Latin and Greek authors, — it is probable that the name of none of the ills inflicted on suffering humanity strikes with such dire effect upon the ordinary mind as does this one word,—rabies or hydrophobia. For many years this last term has been applied more especially to the disease as it manifests itself in the human being, but even in this case it is a misnomer, and the sooner it is done away with and banished from both scientific and ordinary dictionaries the better. Derived from the two Greek words *hudor*, water, *phobos*, fear, it indicates a symptom found in certain cases in man, but by no means invariably, and only rarely met with in dogs and other animals. The apparent dread of all liquids in man is more especially intensified by the fact that all attempts to swallow are extremely painful, even in the case of solid food, and spasm of the larynx, pharynx and œsophagus being brought about by the attempted ingestion of liquids. There is no fear of the liquid itself; it is the paroxysm that is almost certain to follow its being swallowed or even an attempt at swallowing it, that is much feared and dreaded by the human being. Because a dog drinks water let not the mistake be made of saying that he is not suffering from rabies. During the first stages of the disease, the dog drinks water ravenously, and even after the constriction has taken place in the throat, which renders its deglutition difficult, the mad dog will push his head deep into the water and try to force it down. Dogs have been known to swim rivers during the ferocious stage, and in many cases described by the most competent authorities water has not only been drunk, but taken in such exceptionally large quantities as to cause remark. Let not, then, the fact that the suspected dog drinks water lead any one to pronounce the bitten person free from danger, and not in need of precautionary and preventive treatment, as has been done before this and serious results followed.

To this end let us do away with the word hydrophobia, and substitute the more generic term rabies. Let this term be used by all

to denote the disease caused by the specific poison generated in the dog, cat, fox, jackal, hyena and wolf, manifested by certain symptoms referable to the nervous and secretory systems, and capable of being transmitted by inoculation (more especially by the bites of these animals) to man and almost all warm-blooded animals. This disease, when once manifested, is almost invariably fatal; in fact, those cases reported as cured are to a great measure doubtful, being probably what is known as pseudo-hydrophobia — the result of an over-wrought imagination. This state undoubtedly exists, and in certain cases death results from it, so great is the power of the mind over the body. Nor is the state always recognized, and it is only by subsequent experiment, namely, the inoculation of dogs and rabbits from the brain and cord of the subject, and their becoming or not becoming affected with rabies, that a correct diagnosis of what the disease was can be arrived at.

Rabies was feared by the ancient Greeks and we find it mentioned by Aristotle and undoubtedly referred to in Homer, Euripides and Hippocrates. Celsus, the celebrated physician, who lived during the century before the Christian era, described it well in his "De Medicina," and recommends those measures which have been deemed so efficacious in modern times,—namely, caustics, burning, cupping, and the sucking of the wounds of those bitten by rabid dogs. Paulus Ægineta, in his work entitled "De Re Medicina," gives a good account of rabies in the human being, enumerating the symptoms as described by previous authors, of which there were many, and dividing it into two essential varieties, namely: That produced from the specific poison of the bite of a rabid animal and always fatal, and the purely nervous or pseudo-hydrophobia produced by other causes. Authors in various languages have followed the lead of these forefathers of medicine, and in every tongue we find descriptions of rabies, together with infallible nostrums for its cure. Not only were external remedies recommended, but also internal treatment of the most nauseous kind, and even religion itself was called to the aid of those afflicted or likely to be afflicted after bites, and the good St. Hubert was invoked, and certain ceremonies performed at his shrine in order to obtain immunity therefrom.

Many epizootics of rabies have occurred, and it may almost be said that no place is absolutely free from its ravages, though it

seems to be most frequently found in France, Germany, upper Italy and Holland. Great Britain is by no means free from it, and in Russia it is frequent, especially among the wolves that infest that country. In this country, to my mind, it undoubtedly exists at times — during the last year to a greater extent than for some time before, far more cases having been brought to the attention of the public at large through the press.

As regards the question of the spontaneous origin of rabies in the dog, no point in connection with this disease has been more thoroughly discussed, and in no case have the authorities come to so little conclusion. To me it seems still a doubtful point, with the weight of the evidence in favor of spontaneity. Undoubtedly the great majority of cases are of a traumatic origin, but the disease must at one time or another have had an origin, and we hear of a number of cases in which it is utterly impossible to trace any bite from a dog already mad. For a long time it was supposed that the season of the year had an influence in determining the existence of madness, and the term “dog-days” has become universally used in the English language to designate that hot weather during which the dog was most likely to be taken. Statistics, however, seem to point out that April and May are the months during which, perhaps, the outbreak of the disease is the most prevalent; though there is only a slight difference, and it would seem as though it were as prevalent in the winter months as in the summer, a fact startling though true. It does not seem as though warm climates tended to increase the disease; in fact, the contrary may almost be said to be true, as we find it more frequently in the temperate zone. Many have maintained that the disease only existed in the male, or, at all events, that the female was comparatively free from it. The first statement is absolutely false, in one case a whole pack of female hounds being attacked by it; and the second being well accounted for by the fact that the dogs outnumber the bitches to a great excess, there being, I believe, in the state of New York alone, seven dogs to every bitch.

We will now take up some of the more characteristic symptoms of rabies as manifested by the dog,— symptoms it would be well for every one to know and guard against, by having the suspected animal confined and carefully watched, so that any outbreak might be warded off. In case any one has been bitten it is far better

that the dog should be allowed to live, so that it might be watched and the people put out of their suspense, should the dog not be mad. Death will certainly follow inside of ten days, should the dog be suffering from rabies; in the majority of cases on the fourth, fifth or sixth day after the appearance of the first symptoms of the disease.

The dog attacked with rabies in the beginning does not show any violent symptoms of madness or fury, he does not bite, but rather becomes more affectionate, licking the hands and face of those whom he has been attached to. Even at this period the saliva is poisonous, and inoculation may take place. It soon after begins to be more morose and sullen, tries to hide itself away, but not content with any one place or position, is restless and changeable, and wears a far-off look in the eyes, snaps and barks at imaginary objects. It still, however, continues obedient to its master, (and this continues to a great extent through the whole disease,) acknowledging his power and seeking to comply with his commands. The desire to bite is soon developed and manifests itself in the first place against inanimate bodies — pieces of wood, stones, matting, rugs, in fact, anything that may be near it, all of which goes to form a mass in the stomach, which is regarded as one of the post-mortem characteristics of rabies. It now, if possible, escapes from home and rushes around the country, its anger being more especially developed by the sight of other dogs, whom as a rule it immediately attacks and bites. In fact, though a rabid dog may be in the quiescent state, upon the approach of another dog access of fury will be developed and a violent onslaught will be made. The well dog, recognizing by some unknown process the presence of danger, will slink away, even though more powerful, and try to escape. Early in the disease a peculiar bark is developed, which is known as the cock-crow, resembling this in a certain way; the first note of each three successive howls remaining constant, the second notes being in an ascending scale one tone apart, the last being the octave of the first note. There is no fear of water, and although there may be foaming at the mouth it is by no means a constant symptom. A peculiar characteristic in the mad dog is the absence of the sense of pain; a red-hot poker will be grasped and held on to. Dogs will bite themselves and still utter no cry. Periods of calm succeed these accesses, the danger from inoculation still existing. Exhausted by the par-

oxysms and the fighting it has done, the dog will still continue on, in its unsteady gait, with the tail between its legs, eyes wandering, and head rolling from side to side, and the mouth open and tongue protruding, until at last, entirely gone, it will lie down to die of asphyxia and paralysis. What is known as dumb madness rarely affects dogs, though when rabies is communicated to rabbits by inoculation and introduction of rabid material under the dura mater, this variety obtains in 99 cases out of 100. Its distinctive characteristic is paralysis. In it the lower jaw hangs down, the saliva pours from the mouth, motion becomes less and less, and the animal dies a comparatively painless death, the functions of the various organs of the body gradually being suspended.

In the human being, the first symptoms of the fatal attack seem to be a peculiar itching of the old wound and the spread of neuralgic pains from it toward the nerve centres; a general feeling of malaise and an impending dread of something frightful about to happen; there is a tightness about the throat and difficulty in swallowing; breathing becomes affected and there is oppression over the whole chest. Violent paroxysms follow, showing evidently that the whole nervous system is in a most frightfully excited state — a ray of light, a breath of wind on an exposed part of the body, the sight of water sometimes, the constriction following an attempt to swallow it, greatly craved though it may be, are sufficient to determine a spasm. Ropy, viscid mucus is secreted by the salivary glands and vehemently expelled from the mouth. Violent convulsions of the larynx and pharynx take place, in many cases closing the windpipe and preventing the access of air. Hallucinations come on and sometimes wild delirium. During the interval of the attacks, the sufferer is often calm and rational, and in many cases, feeling the approaching access, begs to be restrained so that he may do no harm. Paralysis finally supervenes, and, totally exhausted, death mercifully relieves the sufferer. True rabies is necessarily fatal in the present state of our scientific knowledge. Drugs and treatment of every kind, sort and description have been tried without avail; all that can be done is to attempt to relieve the frightful symptoms as best we can; and it is certainly justifiable to try any remedy that holds out the slightest chance of affording even a minimum of relief, to say nothing of anything that might effect a cure.

The period of incubation of rabies is very variable, different

authorities giving the shortest period in the dog at from 5 to 10 days (Renault), and the longest 14 months (Haubner), the majority of cases occurring in from three to seven weeks after the bite. In the human being the ordinary period of incubation is six weeks, though cases have been noted in which the period was only two days, and others which extended over four and five years (Thamhaym). As regards the likelihood of having rabies after having been bitten by a rabid dog, the authorities are also at variance, though at the present time it is about fair to say that about 16 per cent. of those bitten are affected. (Holmes and Leblanc, a veterinary of Paris.) Others make the percentage of escape 60. Again, out of 320 cases 129 perished, making 40.31 per cent. (Bouley); in another lot 33 per cent. died (Renault); and again, in 24 cases only one died (John Hunter). Van Buren says that two out of three bitten have rabies.

As regards prevention — undoubtedly in the first place the wound should be cauterized, no matter what subsequent course is to be pursued. Let water be dashed over the wound so as to cleanse it, and apply immediately nitric acid. This, to my mind, is infinitely better than nitrate of silver, carbolic acid, or the actual cautery, any of which may be used in the absence of the first-named. To make assurance doubly sure, the part bitten may then be excised, and the wound again cauterized. I am opposed to the method of sucking the wound, as it exposes another person to danger.

For over five years experiments have been going on in the laboratory of the Ecole Normale in the Rue d'Ulm, Paris, seeking to attain this great end — the prevention of rabies — and this end has been attained. The master mind in prophylactic treatment and destruction of disease was at work, and he who discovered the principles of acetic fermentation, the cause and means of prevention of the silk-worm sickness, inoculation as a prevention of anthrax, etc., has given the world one more great gift, and put all nations in his debt. This method is no child of the moment. Pasteur has given it years of thought and rigid research, and now shines forth triumphant in its success, a blessing to humanity.

On the 30th of May, 1881, Pasteur, in conjunction with his assistants, Chamberland, Roux and Thuillier, made a report to the Academy of Sciences, that, despite of previous experiments to the

contrary, the spinal chord, and more especially the medulla oblongata, contained the specific rabic poison, and that in order to render the inoculation more certain, the poison should be injected under the dura mater, by means of trepanation and not subcutaneously. At the same time, by this method the period of incubation became more fixed, not exceeding three weeks. More than a year afterward, December 11, 1882, Pasteur and his collaborateurs made a further announcement, in which they promulgated the following facts:—

I. Dumb madness and furious rabies, in fact all kinds of rabies, proceed from the same virus.

II. The symptoms of rabies are infinite in variety. Each case has its own, and their character depends on the nature of the points of the nervous system,—brain, spinal cord—at which the virus localizes itself and is cultivated.

III. As in the rabic saliva the virus is found associated with different microbes, its inoculation may give rise to death in three ways:—

1. Death by rabies.

2. Death by (pyæmia) excessive development of pus.

3. Death by reason of the microbes which he had made known as the saliva microbes. In December, 1880, he had inoculated two rabbits from the saliva of a child who had died mad in the hospital Saint Eugénie. These rabbits died in 36 hours; others inoculated from these died, and so on through several series. A microbe was discovered in the blood. Subcutaneous injections of this blood failed to produce madness in dogs. He first supposed this to be the microbe of rabies, but soon determined that this was not the case, as it was found in the saliva of a healthy man, and rabbits inoculated by M. Vulpian with it died.

IV. The medulla oblongata of people and animals who have died of rabies is always virulent.

V. Rabic virus is found not only in the medulla, but also in the whole or part of the encephalon. It is found localized in the cord and often in all parts of the cord. The virulence in the cord equals that of the medulla or portion of the encephalon. Virulence remains as long as putrefaction does not set in. The virulence of a rabic brain was kept for three weeks at a temperature of 12 degrees c.

VI. To develop rabies certainly and rapidly, inoculation must

be made on the surface of the brain under the dura mater by means of trepanation. These results are also obtained by intravenous injection. Madness often declared in six or seven days.

VII. Rabies brought on by intravenous injection differs from that produced by bites or trepanning. It is possible that many cases of this silent madness have been passed over. In these cases [of medullary rabies, prompt paralysis is frequent, fury often absent, rabic howling rare, while on the other hand, frightful itching and tearing take place. Our experiments have led us to the conclusion that in intravenous inoculation, as far as we can determine, the spinal marrow is first attacked; that is to say, the rabic virus first fixes itself there and is propagated.

VIII. Inoculation of rabic saliva or blood not followed by death, in intravenous injection in the dog, does not protect against subsequent madness and death, upon a fresh inoculation of pure rabic material introduced by trepanation or intravenous inoculation.

IX. Cases of spontaneous cure are met with after the appearance of the first symptoms, never after the severe symptoms have appeared. In certain cases the severe symptoms appeared much later and were followed by death.

X. In one case, out of three dogs inoculated in 1881, two died shortly of rabies, and the third, after having shown the first symptoms, got well. This dog, although reinoculated by trepanation twice in 1882, did not become mad.

XI. Three other dogs could not be made rabid even with the strongest virus. Did these become refractory by reason of a mild rabies cured? or is it that some are naturally so?

These propositions are the result of over 200 experiments on dogs, rabbits and sheep. In this report Pasteur first propounds the idea: It is possible to render man refractory to rabies.

In his communication to the Academy of Sciences, dated February 25, 1884, Pasteur reaffirms his statements made December 11, 1882, and amplifies them, giving the results of various experiments verifying them. He announced that he had succeeded in rendering dogs refractory to rabies. The virus was found located also in the nerves of the periphery, as well as in the central nervous system and salivary glands. He said that different quantities of virus inoculated gave rise to different symptoms; a small quantity to furious rabies, a larger quantity to dumb rabies. Attention is then called to the fact that the discovery of the attenua-

tion of a virus and the application made of this fact to prophylaxis in certain diseases, had brought to light this fact of the possible experimental production of the different grades of virulence of a virus. Rabies is essentially a disease produced by a virus. Can different degrees of a rabic virus be obtained? The answer is yes. In different animals the virulence varies, and passing it from one animal to another of the same species it finally becomes of fixed strength.

On May 19, 1884, the following fact was announced: In passing the rabic virus from monkey to monkey it gradually becomes lessened in strength, so that finally it is incapable of giving rabies to a dog by hypodermic injection. With rabbits, on the contrary, the virus increases in strength in passing from one to another, and finally it reaches a fixed period of incubation of seven days. Pasteur now declared that he had arrived at a principle of rendering dogs refractory to madness, and asked the minister of public instruction to appoint a commission to examine and report. The commission was appointed as follows: Messrs. Beclard, P. Bert, Bouley, Tissorand, Villemin, Vulpian. They reported, August 6, as follows: Of the 19 dogs experimented on, three out of six bitten by rabic dogs died; six out of eight subjected to intravenous inoculation of rabic material died; five out of five inoculated by trepanation died. Of the 25 vaccinated dogs (rendered refractory by Pasteur) none were attacked by rabies. One died of diarrhœa on the seventh day; however, to be certain that it had not died of rabies, three rabbits and a guinea-pig were inoculated from its cord and did not become mad.

On the 25th of October, 1885, Pasteur made the report to the Academy in which he announced his treatment as applied to human beings and its application to the case of Joseph Meister some time previous. In addition to the principles mentioned above the following are intimately connected with this process:—

The inoculation under the dura mater of a rabbit by means of trepanation of the rabic cord of a dog dead of ordinary rabies, produced rabies in about 15 days. If the virus of this rabbit is passed to a second and from this to a third and so on, there soon is a decided tendency for the period of incubation to shorten. After 25 passages the period of incubation becomes eight days, and finally, after 25 more passages seven days; here it remains fixed. (After 110 passages some showed signs in six days.) These cords are virulent in their whole extent.

If short pieces of cord are taken and suspended in sterilized jars in which the air has been rendered dry by means of small pieces of caustic potash placed in the bottom, the virulence will disappear little by little until it is entirely extinct, depending upon the length of time kept, the temperature and the thickness of the cord. These results constitute the scientific point of the method. The cord is dissected each day from a rabbit dead that day and carefully put away in jars. Each day fresh rabbits are inoculated with the virus taken from rabbits dead that day so as to keep up the series. In order to induce the refractory state in man or animals, successive inoculations are made, beginning with a virus sufficiently old to have lost all its strength, and day by day increased till that which is finally given if it had been first given would have produced rabies. In order to introduce the poison into the system a very small piece is rubbed up with sterilized broth and introduced under the skin by means of a hypodermic syringe in the hypochondriac region.

Originally Pasteur began with virus 15 days old,—that is having been kept in the desiccating jar that length of time,—and finished with virus one day old, given 13 inoculations in 10 days; now he begins with 14-day-old virus and ends with five-day-old, one inoculation being given each day.

The claim on which the treatment of those bitten is maintained is as follows: The ordinary period of incubation after the bite of a rabid dog being about six weeks, if we can before that time institute a refractory state in man the poison will not act. Inoculations with the strong virus taken from the rabbit do this in a shorter time, so the rabies produced by the dog-bite is warded off. The system has become accustomed to the poison by the gradually increasing strength of the dose thereof. This foundation principle is sound, and the application is possible so long as we are able to get a diminution in the strength of the virus. These problems have been worked out by Pasteur and practically applied with success.

Let us look for a moment at some statistics given by Dr. Grancher, who has performed Pasteur's inoculations on human beings for him. The report was made in June, but the period of incubation in rabies derived from the dog-bite being long, only the cases up to April 22 were taken. The cases were divided into three classes. First-class—Those bitten by dogs proved to be mad

by inoculation of rabbits or subsequent development of rabies in animals bitten by them—96 cases, one death.

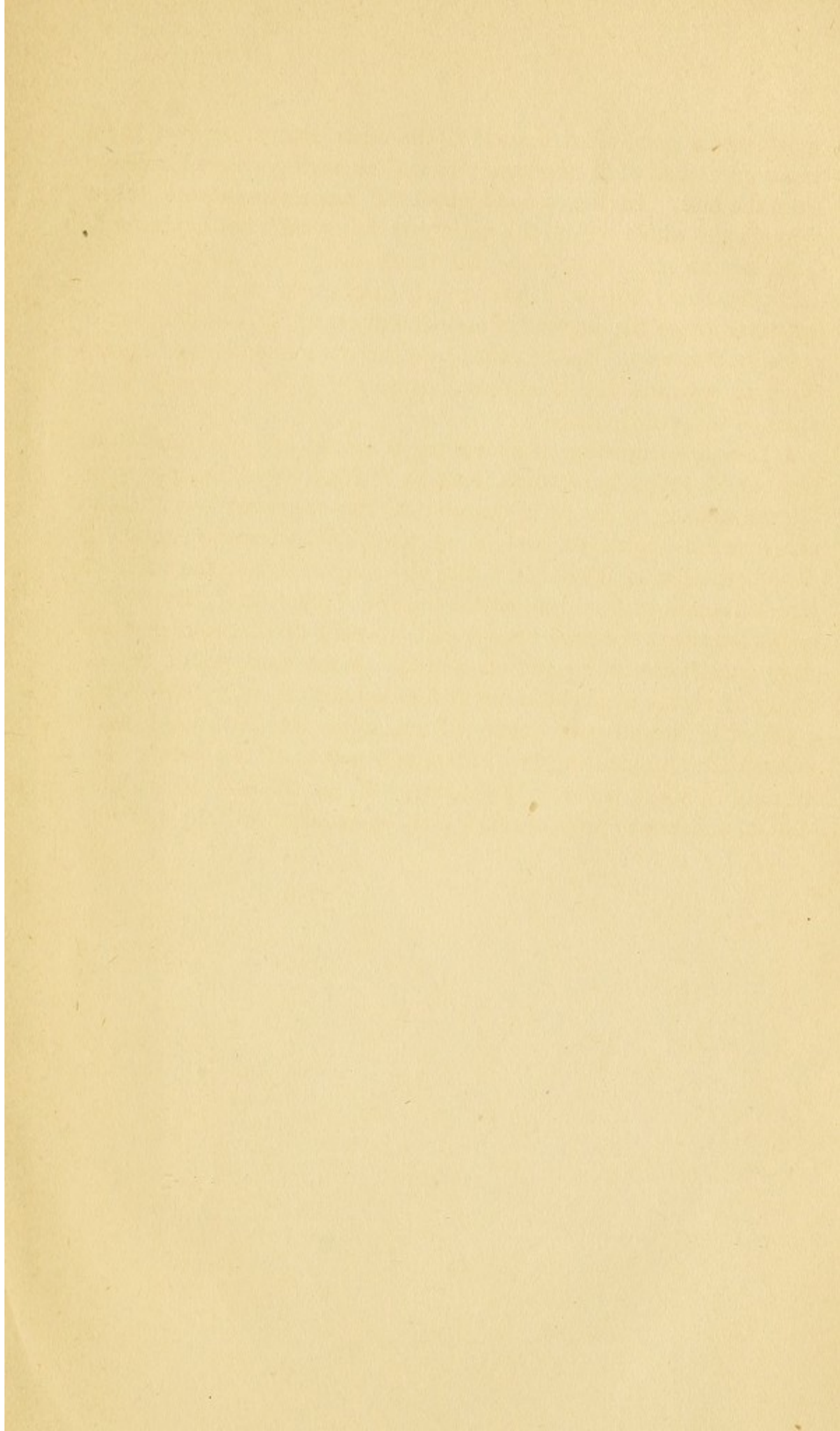
Second-class—Patients bitten by dogs certified to be rabid by the veterinary practitioners of the locality,— 644 cases, three deaths.

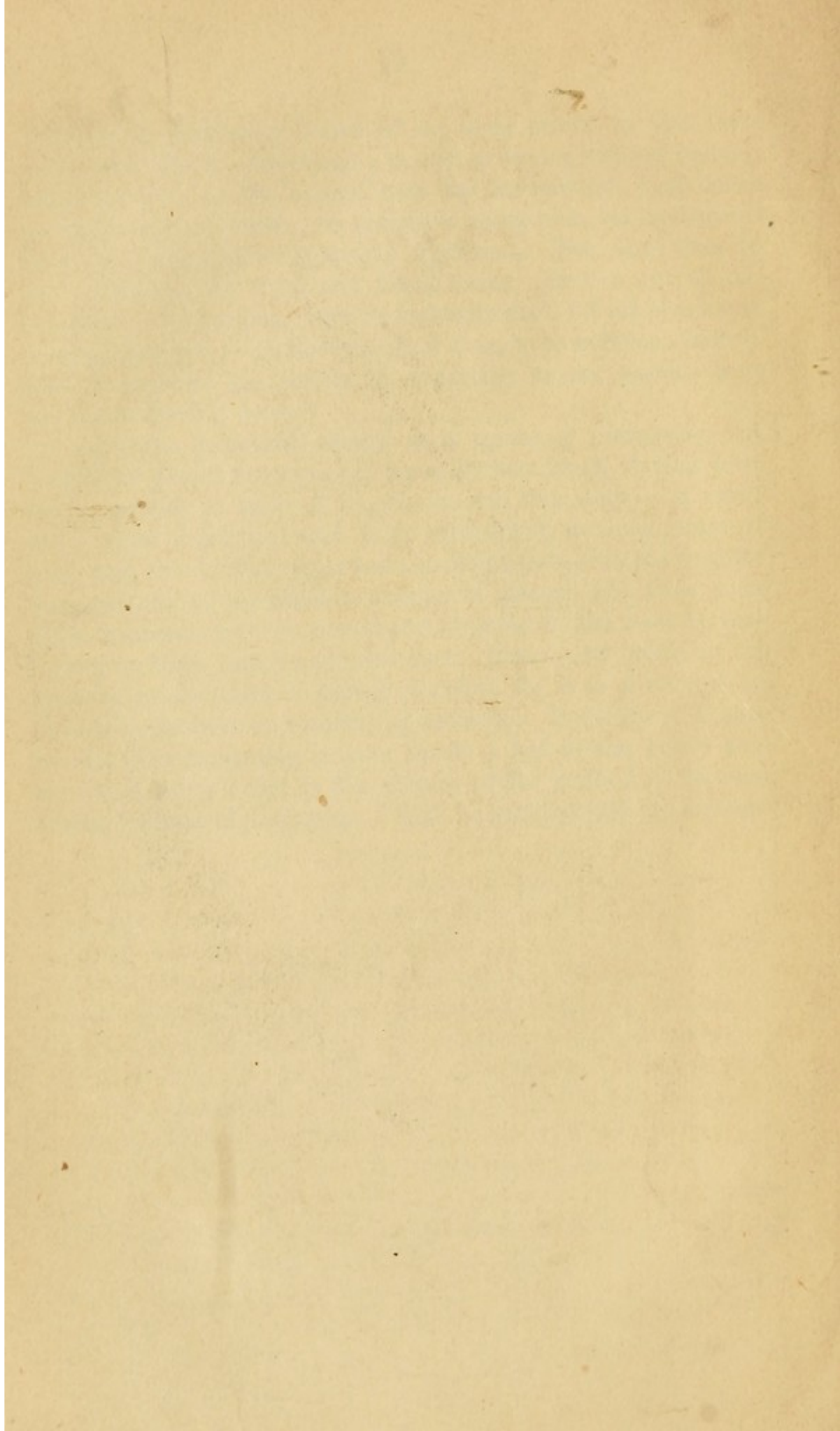
Third-class—Those bitten by dogs who had run off and not been seen again — 232 cases, no deaths.

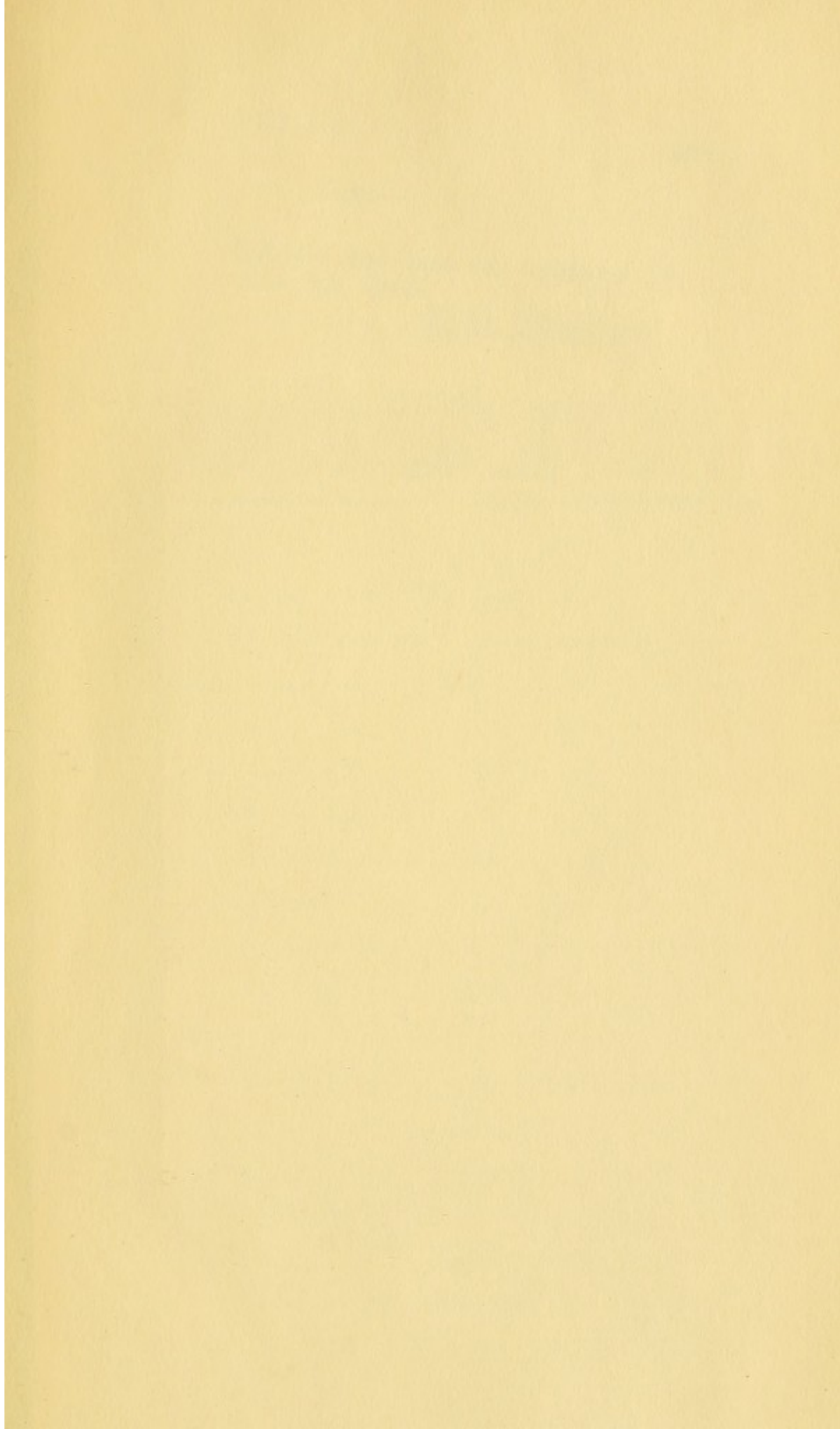
In the first two classes 740 cases with three deaths, not quite one-half per cent. of those bitten ; while the ordinary statistics of like cases given by M. Leblanc, veterinary surgeon of the city of Paris, give 16 per cent. as the number of deaths. Dr. Brouardel has calculated that no less than 80 per cent. of those bitten by rabid dogs on exposed parts of the body die. Of the 84 cases of wolf-bite, not included in the above, seven died. Ordinarily, 66 per cent of those bitten by rabid wolves died, and here the percentage is 6. Looking at these, shall we not say the principles and methods are a success? During the month of April last I visited Pasteur's laboratory, as the representative of the American Pasteur Institute. I was kindly received by him and his assistants, and everything in the process of his method of inoculation shown me, from the primary trepanation and introduction of the virus under the dura mater of a well rabbit, to the inoculation of a human being with the spinal cord of a rabbit which had died with rabies. All the steps were shown me ; nothing was concealed. Upon leaving Paris, a rabbit inoculated that day was given me. This rabbit was my constant care for the next nine days, when it died, having developed signs of paralysis two days before. I immediately placed the body on ice, and on the next day, having arrived here, the spinal cord was dissected out, and the work of propagating the virus begun. Rabbits were inoculated every day for several days, the cord being kept in carbonic acid gas at a low temperature. Those rabbits developed rabies in due course, and after a time a series was established and the work was begun on the human being. In the first case, unfortunately, the patient's health was such that his parents discontinued the inoculations, after the fourth. The trouble did not arise from the inoculations, but from a series of accidents which happened to the lad (who was only seven years old) immediately before the beginning or during the time of the inoculations — he having been hit with a stone and badly cut ; having fallen down the Elevated railroad stairs, which was followed by severe epistaxis ; having cut his

wrist, and a good-sized branch of the ulnar artery, so that there was a great deal of hemorrhage ; as well as having suffered severely from the bite. In the second case, the inoculations were taken through the whole series, the patient is doing well, not having suffered any inconvenience from the treatment. The same may be said concerning the third and fourth cases. In two out of the last three cases the dogs were undoubtedly mad, all the symptoms pointing that way. In the other case there were sufficient indications to warrant the treatment, especially as the parents were anxious to have it done.

I have also inoculated myself as a means of prevention. A number of people have come to me at various times, having been bitten, wishing to know if inoculation was necessary — in many cases much frightened and in an excessively nervous state. I have been able to allay their fears, assuring them from the detailed circumstances of the absolute absence of danger, and after some slight treatment for their nerves and dressing of the wounds, they have gone home happy and contented. Many more points in the study of rabies might be brought forward, for it is a subject replete with interest and worthy of research. If, however, I have succeeded in implanting in your minds a few of the points concerning it, and a belief in the efficacy of the method of inoculation as a means of prevention, I shall be satisfied with my success.







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