

Observations on the prevention and cure of hydrophobia : according to the latest popular publications in Germany / read before the New-York Medical and Philosophical Society by Joseph Leo-Wolf.

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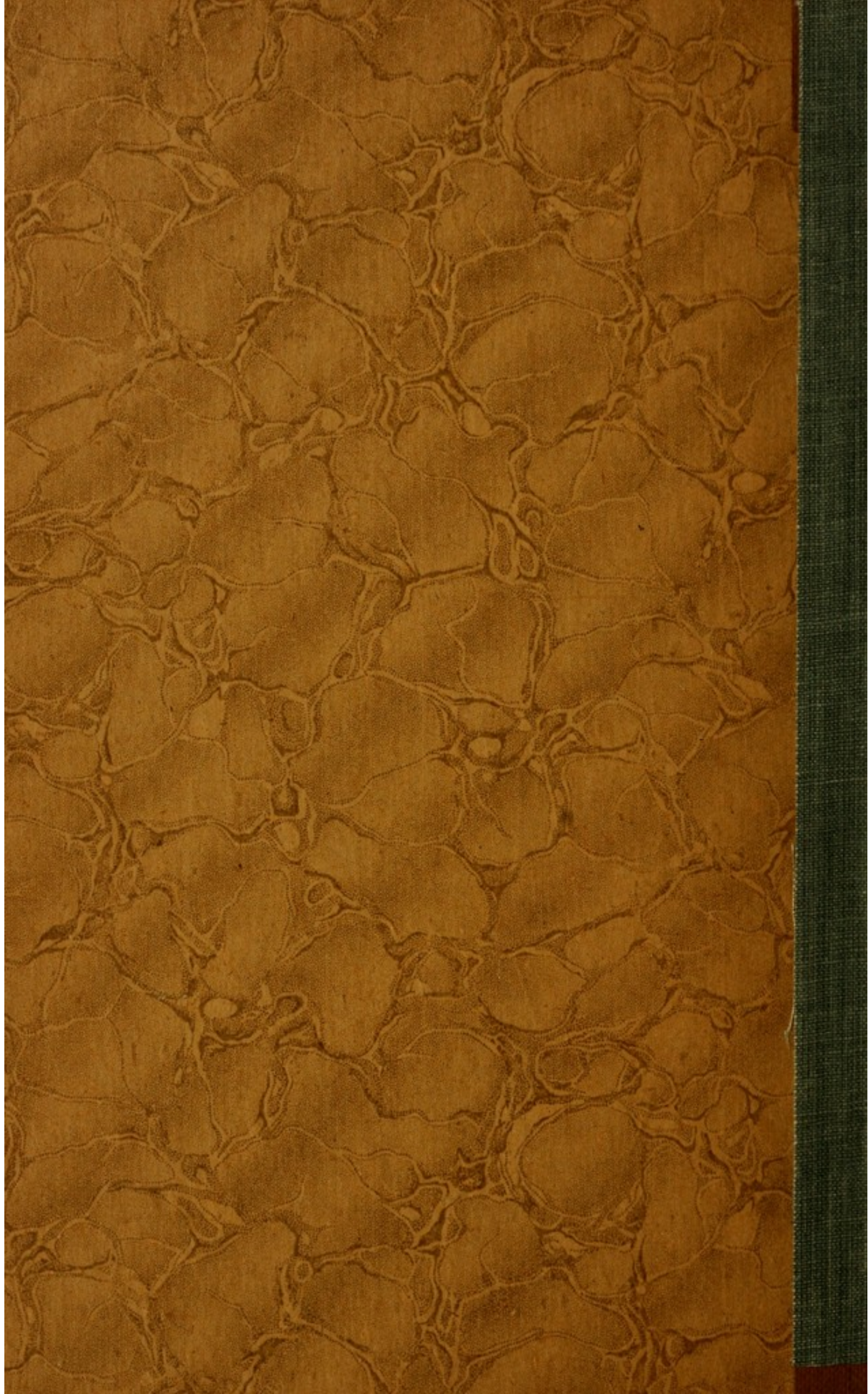
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1831

OBSERVATIONS

ON THE

PREVENTION AND CURE

OF

H Y D R O P H O B I A .

According to the latest popular publications in Germany.

READ BEFORE THE NEW-YORK MEDICAL AND PHILOSOPHICAL SOCIETY,

By **JOSEPH LEO-WOLF, M.D.,**

Physician in the City of New-York.

Non ex vulgi opinione, sed ex sano iudicio.

BACON.

NEW-YORK:

G. & C. & H. CARVILL.

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1831.

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OBSERVATIONS, &c.

THE annexed pages contain a true translation of the regulations, just published by the *Prussian Government*, respecting *canine madness*, and the safest means of obviating its melancholy consequences in men. It must be admitted that the *Prussian Government* stands preeminent in the liberality with which it supports literary institutions of all kinds, and *Berlin*, in particular, may justly be considered the *Athens of Germany*. Among the great number of its literary institutions, its veterinary school flourishes as one of the first in Europe. At a great expense, and attended with much trouble and danger, many rabid or suspicious dogs have been kept there in separate cells, and have been watched and observed by the meritorious director of the school, *Professor Hertwig*, even at the risk of his life. He continued his experiments and observations for years, before the annexed conclusions were drawn and published.

To the great detriment of mankind, from ignorance, carelessness, or prejudice, we have hitherto known but a few unimportant and uncertain symptoms of the earlier stages of this shocking disease. We are chiefly indebted to these late and careful observations for the facts, that this disease of animals often appears under trifling or contradictory symptoms, and that we have to apprehend danger, in cases in which, heretofore, we considered ourselves secure, and thus missed the only important time for its prevention.

We must regret, that all our experiments, however carefully they have been made, compel us to consider the *complete hydrophobia* as a disease, which the healing art is yet entirely unable to mitigate, and still less, to cure. This will convince us of the great importance of such measures, as have been approved of as

the safest to obviate the developement of the disease, in cases where, unhappily, the infection could not be avoided.

In a country like the *United States*, these pages are of peculiar interest, as, in the solitary settlements of the interior, the dog certainly is a highly useful domestic animal, and as in such districts the aid of physicians for so urgent cases, comes often too late. To these causes we may partly attribute the great number of melancholy cases of hydrophobia which have occurred in the *United States*, and which, according to its population, exceed those of any country in Europe. It is, therefore, in this country particularly of importance, that every one should know how to adopt the most approved treatment, in cases of the most slightly suspicious character, because often medical aid cannot be procured at once. Still, the importance of the subject before us, and of the powerful treatment recommended to obviate them, will convince us of the value of a physician's assistance, and of the necessity of applying to him immediately, if possible. The measures, contained in the annexed advice, must only be considered as an immediate barrier to an evil, which otherwise would spread its poisonous effects progressively, with the lapse of each moment, throughout the body.

It is, therefore, desirable, that these pages, intended as a public benefit, should be known to all heads of families. It is to be wished that they might consider them important enough to read them frequently in the circle of their families, to have them present in their memories in the hour of necessity.

According to the latest observations, the *spontaneous hydrophobia* (not caused by infection) is not peculiar to the dog and cat species, as has heretofore been erroneously asserted; but other animals also, even cattle, according to the statement of *Professor Capello*, are equally liable to it. Their poison has upon men the same effect as that of dogs, and may be communicated in the same manner from one person to another, without losing any of its poisonous and destructive qualities.

Providence has graciously supplied us with the kinepock as a safeguard against one of the most destructive epidemics among mankind. This discovery must confirm our opinion of the intimate relation between many diseases of men and those of animals. Many infectious complaints, under which we are now suffering,

may, perhaps, be traced to a similar origin. The eminent naturalist, *Dr. Pallas*, never heard of a mad dog in *Kamtschatka*, although cold may cause madness as well as heat; but he has often observed the "*scab*" among them; this disease appears peculiar to that class of animals, as it has also often been noticed among foxes, and is therefore called "*Alopecia*." In *Germany*, the very important observation has lately been made, that the scab of dogsoften creates madness, when it suddenly disappears.

Late years have also proved, principally in *Germany*, that men become infected by murrain,* and die under the most shocking sufferings, after having been in contact with cattle suffering under that disease. Not merely the use of the meat of such animals, but even a drop of their blood, when coming in contact with a person's skin, or the preparation of the hides of such sickly animals; nay, even the bite of an insect, having previously been in contact with them, may cause a similar disease in men, which, although not quite as incurable as hydrophobia, still, is not less shocking and painful.

The glanders of horses often cause a similar and highly dangerous and painful disease in men. Although many have doubted this, yet it has of late been proved by several cases in *England, Ireland, Germany*, and other countries. One of the latest instances of this kind was observed, with all its melancholy consequences, in a young man of seventeen years, who was under the charge of *Dr. John Elliotson*, in the *St. Thomas Hospital at London*. (*Medico-Surgical Transactions*, vol. xvi., p. 1, London, 1830.) This young man died under the same symptoms observed in horses.

The greatest care should be taken when a person is nursing diseased animals. Where touching their diseased parts, their blood or their excretions, cannot be avoided, such remedies should at once be used, as, according to modern discoveries, are the most capable of destroying the infecting power of animal miasms. We owe many important discoveries to modern chemistry, by the aid of which we may, perhaps, soon be enabled to secure the human constitution against any animal poison. The preparations of *chlorine* furnish us already with powerful remedies of this kind. According to the late discoveries of the celebrated *Dr. Pariset*, who

* For the disease, here alluded to, I know no better English term than murrain; in *Germany* it is called *Milzbrand*, *Carbunculus Polonicus*.

has observed the plague in *Egypt*, and of *Dr. Wagner*, who has examined the same disease at *Odessa*, during the late war between *Russia* and *Turkey*, in the fall of the year 1829, baths of *chlorate of lime* have proved a valuable safeguard even against this shocking disease. Of all the remedies that have been recommended, none appears as yet more capable of destroying animal poison than a wash made of a solution of chlorate of lime in water. Half an ounce of this remedy, dissolved in a quart of rain water, should therefore always be kept ready made in the house of every farmer, and should be used repeatedly as a wash in cases of the slightest suspicion; particularly, if an itching sensation is felt on the skin, after having touched those suspicious animals, or their blood, &c. If this should have been neglected, or have proved useless, and the infection from the murrain has taken place, then we observe small pimples, with a more or less deep-red and inflamed circumference. These pimples itch excessively, are filled with a yellowish thin fluid, grow rapidly in size, burst, assume a putrid deep-brown colour, and discharge a bad matter, highly offensive to the smell. These places must now be immediately extirpated with a sharp knife, or be totally destroyed by a white-hot iron; the knife is, however, better. The wounds must then be dressed with warm cataplasms of bread, milk, and sweet oil, or with others of a similar kind; and the patient must observe a light diet, and remain in bed until the wounds have nearly healed up, and until all fever has subsided. *Dr. Hoffman*, of *Bernburg*, in *Germany*, who has had much experience in these complaints, also recommends the use of the knife, of diaphoretics internally, and of caustic solutions, applied to the wound after the excision, in order to have all malignant matter discharged. He also recommends dry cups, scarifications, cupping, and aromatic and acidulous fomentations. When absorption of the poison has already taken place, he recommends a weak solution of chlorate of lime internally. But he has neglected to recommend calomel and emetics, although their good effects have been confirmed by other writers on this subject.

Professor Kluge, in his experiments at the *Charité Hospital*, of *Berlin*, has, in hospital gangrene, derived much benefit from the use of fomentations with a solution of chlorate of lime. From these remarks, we may infer, also, the beneficial effect of this remedy against the complaint before us.

After the constitution has been exposed to, or been affected by such external injurious impressions, many bad consequences may often be prevented by the uniformly warm temperature, which is created by our lying in bed, by the perspiration thus produced and supported by mild drinks, like a tea of elder-flowers, orange-leaves, &c., and by our avoiding every thing which, from indigestion, mental impressions, or otherwise, might cause an injurious re-action. The hurtful effect of poisons, deposited on the surface of the body, may principally be ascribed to their tendency to enter the system, whether this be caused by a nervous re-action, or by their actual absorption. The more speedily, therefore, we endeavour to create the reversed vital action, be it by a proper diet, or by more powerful remedies, so much the more we may expect the poison to remain on the surface of the body, until it be either assimilated or destroyed there. Upon these principles we may easily explain the bad effects of all debilitating measures and remedies, and depressing mental impressions, in cases of a similar character; and, at the same time, we thus find ourselves encouraged to hope that the early and continued use of vapour-baths may enable us, with the aid of other remedies, to prevent hydrophobia and many other diseases. The vapour-bath is certainly a powerful remedy, and at the same time it is easily applied, since we enjoy the benefit of the invention of the portable vapour-bath apparatus. This has been very generally used in *England* for years past, and may be obtained any where for a trifle.

The importance of a diaphoretic course of treatment, in preference to all others, is now also proved in the *cholera morbus*, which, at the present moment, rages to such an alarming extent in the south-easterly provinces of *Russia*. The statements of many physicians, now in attendance there, are decidedly in favour of diaphoretics. In *Japan*, where it has also been unusually prevalent for the last few years, they are of the same opinion, and I have the account of a friend in corroboration of this statement. In every town of *Japan*, many public institutions for warm, and almost hot bathing, have been established, and every body resorts to them on the slightest suspicion of an approaching cholera.

With respect to the *treatment of the complete hydrophobia*, when the necessary precautions have been neglected, or have failed, I may be permitted to suggest to my fellow-practitioners some remarks,

which may, perhaps, contribute to lead us to the desired object, yet unattained—the perfect cure of this shocking disease. The importance of this subject, and the present opportunity, induce me to trespass the narrow limits of an originally intended popular advice, which, I hope, will spread farther than a strictly scientific work, and thus also will attract the notice of a greater number of practitioners, than if strictly limited to the profession.

Providence has certainly never permitted the existence of any disease, without, at the same time, having furnished its antidote in nature, leaving its discovery, however, to our own investigations. Thus we may consider the healing art as a continually progressive revelation, received through a true study of nature, and gradually approximating the highest perfection, although we may never completely attain it while on this globe. If ever we had reason to admit this assertion, and to feel convinced of its truth, we certainly must do so still more now, since, by the rapid improvements of modern chemistry, we have learned to reduce remedies to their purest principles, and have discovered others, of whose existence and effects we had never before the slightest idea. Medicine certainly derived its existence from the use and application of domestic and popular remedies; but, with the greatest regard for them, we must confess, that they have had too much weight in the treatment of hydrophobia, and thus have impeded the progress of a rational system for its cure. A poison like that of hydrophobia, which is capable of destroying all vital action of mind and body, in young and old, in weak and strong constitutions, and which even retains its power in the dead bodies of men or animals, who have fallen its victims; such a poison cannot certainly be obviated in its effects by slight remedies. On the other hand, a violently reducing treatment, by bleeding, purging, &c., which often fearfully exhausts the vital energies, might justly have been dreaded in these cases; since, thereby, the system is quickly and fatally robbed of the vigour it so much requires to re-act against, and expel the poison. I do not mean by this, to deny the good effect sometimes obtained by a reducing system under similar circumstances, where, also, depressed vital powers constitute the characteristics of the disease. But, in such instances, this method operates indirectly, balancing the vital powers in a manner often unknown and unaccountable to us. Such a course can certainly but

be injurious, when we have to counteract a poison which increases every moment in its tendency to paralyze all vital action.

Since it would lead me too far, if I were to discuss at large all the ideas connected with the subject before us, I shall only subjoin a few remarks with respect to the treatment of hydrophobia.

If the person attacked with hydrophobia have a strong and healthy constitution, I should recommend a sufficient number of leeches to be applied to both sides of the spine, to extend from its uppermost to its lowest extremity, and to continue their effect for some time by the aid of cups. This I should particularly recommend while the disease is yet in its first stage. After the bleeding has ceased, I should apply to each side of the spine, along its whole length, a strip of blister-plaster of cantharides, about two inches in width, along the line where the leeches had been drawing. At the same time, I should try the "*endermic method of medication*:" with the aid of a white-hot iron or a vesicatory, I should make a blister on the upper part of the arm, about half an inch in diameter, remove the epidermis, and apply to the skin half a grain of *Strychnine*, covering it with adhesive plaster. This remedy should thus be applied three or four times a day. The blister along the spine must be kept open; and for the greater security of the effect of the *Strychnine*, it might, at the same time, be given internally, $\frac{1}{6}$ to $\frac{1}{4}$ of a grain every third hour, provided the patient is yet able to swallow. If the affected person have a weak constitution, or if the disease has already attained its higher degree, I should desist from applying the leeches, but apply the two blisters along the spine, keep them running, and administer the other remedies just mentioned, to a still greater extent. It is almost superfluous here to mention, that the place where the poison has originally been deposited by the bite of the rabid animal, must be treated strictly in accordance with the annexed preventive advices, however long previously the wound may have been healed. Even after all symptoms of the disease have ceased, I should still recommend the external use of the *Strychnine* to be continued, until its injurious effects should be developed. In case of imminent danger, the actual cautery, by a white-hot iron, might also be tried on both sides of the spine, in lieu of the Spanish fly blister, just mentioned; particularly as it operates so much more

quickly. We should not suffer ourselves to be deterred from the use of this powerful remedy in so urgent a case, merely on account of its violence.

In case the external and internal use of *Strychnine*, even in the greatest dose, should prove equally as unsuccessful as the *Morphine*, so much praised, I then should warmly recommend the internal use of *Cantharides*, in powder, from two to ten grains, and even more, given every other hour. I cannot conceive any cause for the discontinuance of the experiments with this important remedy, which, some twenty years ago, the meritorious *Professor Rust* found so successful in some cases of this kind, during his practice in the hospital of *Vienna*. It is certainly much in favour of this remedy, that in the cases just alluded to, the most enormous doses have been given, without creating any of those symptoms, which, under other circumstances, may be produced by a few grains. The profession should not be deterred from making further trials of this medicine on account of a few failures. It was used by the ancient *Arabians* against hydrophobia, both externally and internally, and has been often praised also by modern writers. *Rust* has, in three instances, actually cured the hydrophobia by its application. *Werlhoff* prescribed three entire Spanish flies daily, for several days in succession. *Hildenbrand* used daily two drachms in some cases, and *Rust*, in one case, thirty-seven whole *Cantharides* within sixteen days; and in another case, ninety-seven entire *Cantharides* within three weeks, without noticing any of the ordinary effects which originate from the excessive use of this remedy. In *Greece* also, it has, for a long time past, been a popular remedy. Such an intimate relation exists between the remedy and the disease, as warrants us in regarding them as mutual antidotes to each other, and we have good reason to expect that the remedy may counteract the operation of the morbid virus as well as the force of the disease seems to present an effectual barrier against the injurious effects of the remedy. The internal use of *Cantharides* appears therefore to be as consistent with sound physiological and therapeutical principles, as it must also be pleasing to those who favour the doctrines of homœopathia, considering that the increased activity of the sexual functions is also a symptom, mostly observed in hydrophobia.

As *Ammonia* constitutes the principal substance contained in

the *Cantharides*, they appear also on that account of apparent importance against hydrophobia, since *Ammonia* has proved so successful against the poison of other species of animals, the vipers, when carried under the epidermis of men through their bite. In fact, it appears that all poisons, discharged by the salivary organs of animals, have a particular tendency to affect the spinal marrow and *medulla oblongata* of the human body, and principally those branches of the nervous system which communicate more directly with them, as the *nervus vagus*, *sympatheticus*, &c. ; for, more or less, they cause tonic spasms, and, therefore, their effect appears to be such as to cause a strong contraction of the animal fibre particularly. This will explain the good effect of mercury, and of all remedies which have principally a deoxydating power, as also the less successful application of remedies of an oxydating nature. The *Cantharidine*, which, to my knowledge, has not yet been used, might, perhaps, be tried with success against hydrophobia ; for, like all other *alkaloids*, it concentrates the power of the original substance to a very great extent, and one-eighth of a grain may be as powerful as ten grains of *Cantharides*. The external application of this new remedy might also be used instead of the white-hot iron, and create the desired blister equally speedily.

All the symptoms of hydrophobia seem to indicate, that its poison principally attacks the central organ of the sensitive sphere of the organism, and in particular that of its branches primarily, which directs the natural and animal functions ; I mean the continuation of the brain and the spinal marrow. All other symptoms may be traced to this source. Many symptoms of lockjaw unquestionably resemble those of hydrophobia ; the seat of the diseases seems to be the same, and there appears only this difference, that the former is created by mechanical irritation, the effect of which continues often, though not always, after the removal of its first cause ; while in hydrophobia, the disease is supported by the poison, either remaining in actual contact with the affected parts, or otherwise exerting its power.

If our hopes, as entertained with regard to these remedies should still fail to be realized, it might prove worth while to try the *alkaloids* of such remedies, as belong to this same class, instead of losing time by the application of remedies, which even healthy persons may take in large quantities, without perceiving any effects

from them, such as *Genista*, *Alyssa* *Plantago*, and others, which have been so frequently recommended here.* Amongst the Alkaloids, above mentioned, the *Atropine* and *Daturine*, appear particularly encouraging. The *Atropine* may produce the effects of *Atropa Belladonna*, with greater certainty, since in similar cases the latter often has failed, however much it has been recommended. The different effects of *Belladonna* may, perhaps, be owing to its different quality, caused by its place of growth, and the manner of collecting and preserving it. The *Daturine* I mention, because the effects of *Datura Stramonium* in many other chronic diseases of the nervous system, would lead us to attach considerable importance to it; moreover, its poisonous effects upon the healthy organism are characterized by a mental derangement, and by an increased activity of the sexual organs, which also appear to show a relation between the disease before us, and this remedy. Another point in favour of the use of *Stramonium* and *Belladonna*, which may contribute to show this close connexion between disease and remedy, is, that in health, they both cause an inflammation of the throat, with thirst and dryness, and the use of *Stramonium*, also a tenacious spittle; these facts prove their affecting in particular the *nervus vagus*, and its connexion with the *fifth pair of nerves*; and similar symptoms, also, partly constitute hydrophobia.

Many may be opposed to these views, because the bite of vipers has caused in men an exceedingly dissolved state of the blood, and because this, also, is probably the case in hydrophobia. This induces them to prefer the use of oxydating substances, principally, since *arsenic* has been recommended by some. But the dissolved state of the blood is certainly merely caused by the sudden and violent attack upon the centre of life, and cannot be attributed to a primary chemical decomposition, as we attempt to explain and imitate in our laboratories. Without mentioning here the many causes

* Sir Robert Ker Porter, British Consul General at Columbia, has sent a communication to the College of Physicians of London, which was read the 5th April, 1830. He states, that the inhabitants of Colombia, since the oldest times, use the juice of *Guaco* externally and internally with success against the bite of snakes, rabid dogs, and other poisonous animals. This plant grows near Caraccas. But I fear that this remedy will prove as fallacious as many others of a similar kind often recommended, and thus cause the precious time, after accidents, to be lost, which might be employed for the application of powerful remedies, in accordance with reason and experience.

which must admonish us to be cautious in drawing our conclusions concerning the living animal organism, from chemistry, we cannot easily conceive, how so small a quantity of poison as that of hydrophobia, often but an atom, should be able suddenly to alter the chemical condition of a number of pounds of blood, unless this should be done by nervous influence. How should we otherwise be able to explain similar inimical attacks upon vitality, in cases where an entirely different chemical principle, or none at all, was operating; as, for instance, in persons that have been struck by lightning, or who died suddenly after an excessive mental or corporeal excitement, such as great fear, joy, a blow on the stomach, &c. We may almost establish it as a general rule, in animals of the higher order, and in men particularly, that the decomposition of the blood, and the putrefaction of the body, will take place proportionably as fast, as the change from complete and energetic life into total exhaustion was rapid, provided there was not, simultaneously, a great loss of blood, or of other vital fluids.* These facts also tend to explain the formation of many acute epidemic diseases of a putrid nature, during wars, in which the passions of man have been greatly excited.

In favour of the use of *arsenic* against hydrophobia, we have yet but few authorities. Admitting, however, without inquiring

* Complete health, suddenly succeeded by total death, without at the same moment being accompanied by a great loss of blood, appears to cause an earlier decomposition of the dead body, than is otherwise generally the case. This appears to have escaped the notice of modern ages, but the oriental nations appear to have been well aware of it; as, in the earliest ages, since the establishment of their religions, it constitutes one of their principal religious laws, to eat the meat of such animals only, as have been slaughtered by the most rapid and perfect loss of blood. The Jews and Mahometans, for instance, strictly observe this up to the present day.

We do not notice this sudden decomposition of the blood, and early putrefaction, in the bodies of persons who have been killed by *arsenic*, but just the reverse, their bodies often assuming a mummy-like appearance. This, however, cannot refute our statement; for in such cases, a much larger quantity of the poison has been taken, than would be required to destroy life; and this surplus, operating as an antiseptic, may check the process of putrefaction in the corpse. We may compare this with similar effects of other remedies; for instance, *nitre*, unquestionably, when misapplied, promotes a decomposition of the blood in the living body; still it is well known to secure meat for domestic use, against early putrefaction.

into any theory, the propriety and expediency of using heroic medicines, be they mineral, vegetable, or animal, still we should *cæteris paribus*, always prefer the use of those of the two latter classes, since their being the products of organic bodies, seems to render them more analogous to our organization; besides, they also possess sufficient power, and operate more directly and not so insidiously, as, for instance, *arsenic*, which often does not mark its destructive qualities upon the animal body before the lapse of many years.

If, however, we conclude to resort to preparations of minerals, those of gold, in particular, ought to attract our notice, especially the *chloride of gold*, on account of its great effect upon the whole nervous system; even a very small quantity, when merely rubbed on the tongue or the gums, has that effect.*

In our attempts to cure hydrophobia, we cannot make a distinction between the immediately chemical effect of the poison, and its secondary dynamical consequences, as we do in cases where poisons have entered the stomach, which can be decomposed by the aid of chemistry. For we do not know whether the continued presence of the poison, or its secondary results, are the causes of the symptoms, nor by what chemical re-agent we might decompose it, even if we knew how to reach its seat. Therefore, we are compelled to view the symptoms of hydrophobia principally as the secondary result of the poison, and we may do so without injury to the patient, since this is more in accordance with the principles of sound physiology.

* I may be permitted to subjoin here a remark, with regard to the efficacy of powerful remedies against dangerous diseases. We never shall attain the desirable result, if we continue to apply remedies at certain intervals, without at the same time watching their progressive effect from the commencement. The application of a remedy is a physical experiment, like any other, which should be closely observed every moment in its effects, otherwise we may be misled, and draw wrong conclusions. Our progress in the physical and chemical sciences would have been exceedingly trifling, if, after the mode of physicians, we had been contented to watch the progress of experiments merely two or three times a day, and had neglected to observe it also during these intervals. It must therefore be of the greatest consequence, during the treatment of hydrophobia, that the physician should spend most of his time with the patient, in order to watch closely the effect of the remedies from their first application throughout, and to alter their use accordingly.

With the views established in the foregoing pages, we may deem ourselves privileged to attach, in the cure of hydrophobia, a particular hope of success to all such remedies as are known to have the most powerful effect upon the spinal marrow. The latest discoveries furnish us with such remedies, principally in the *alcaloids* already mentioned. These, and the late experiments of the powerful effects of medicines, applied to the skin after the removal of the epidermis, are two important considerations. By the aid of this method, we are no longer under the necessity of forcing medicines into the throats of hydrophobic patients, as they are mostly unable to swallow, and fall generally into convulsions at the mere idea of fluids.

J. LEO-WOLF.

ON THE
SYMPTOMS AND PREVENTION
OF
CANINE MADNESS,
AND
ON THE COURSE NECESSARY TO BE PURSUED WITH MEN
WHO HAVE BEEN BITTEN BY MAD DOGS.

(A Circular published by the Prussian Department of Ecclesiastical and Medical Affairs and Education.)

A great number of experiments place it beyond any doubt, that among all diseases, none is more terrible, and causes a death so positive and horrible, as *hydrophobia*, produced by the bite of a mad animal, and particularly of a mad dog. No class of society, no sex, no age, no constitution is secure against this shocking disease; and among all the methods recommended, or even praised for the cure of hydrophobia, when perfectly established, none, of whatsoever kind, affords any security against the fatal consequences of this disease. On the other hand, however, it is not difficult to secure, by preventive means, persons against such a result, who unhappily have been bitten by a rabid dog. For this purpose it is necessary to know, what ought to be done with a person, thus wounded, and at the same time it is of the last importance to understand how the madness of dogs manifests itself. The following pages contain the information necessary on this subject, and every body who cares for himself, and feels an interest in the welfare of his fellow men, will endeavour to become perfectly acquainted with it.

CHAPTER I.

Symptoms of Madness in Dogs.

The madness of dogs, called canine madness, or hydrophobia, may be divided into three grades or stages, and according to them it is preceded, or accompanied by different symptoms.

The first stage, which precedes the real madness, has the following symptoms :

The dog loses his usual attachment and kindness, becomes melancholy, seeking solitude, and shows at intervals a certain kind of uneasiness ; now quietly hiding himself in his lodgings, and then again unsteadily running about. He loses his appetite.

He listens still to the call of his master, knows him, wags his tail at him, suffers him to touch his ears and tail, or to be flattered and taken on the arm, and may even yet be used for hunting or droving ; but he does all with laziness, morosity, or through mere coercion.

He becomes more quiet, seeking dark places without sleeping, and snarls, without barking, at those who may endeavour to elicit him from his retreat, be it even his former friend.

His eyes are dim and red, or running.

His ears and tail are hanging, and finally he jumps at every thing he meets with, or that may be offered to him.

He bites when in the least degree irritated.

These symptoms generally form the first stage of madness, but they do not with certainty predict it, because other diseases to which dogs are liable, may cause similar symptoms.

Even when in this first stage of madness, the bite of a dog may instil a fatal poison. It is therefore of the greatest importance to be cautious of the slightest sign of sickness in a dog, and not suffer any licking from him. The above mentioned symptoms must increase the suspicion of a dog's madness, if additional circumstances co-operate, and particularly if those symptoms appear during dry weather and great heat, or during great cold ; if the dog lived on bad or putrid food, and was in want of drink ; and finally, if there exists any probability that he has been bitten by a mad dog, or another mad animal, as a mad wolf, fox, &c.

This stage is called the *quiet madness* ; it lasts not always an equal length of time, sometimes only from 12 to 24 hours, and sometimes longer.

During the *second stage* all the symptoms increase rapidly :

The dog shows a constant want of appetite, or an inclination to eat unusual things, such as wood, turf, straw, wool, leather, glass, &c. ; he is still more melancholy and morose, his eyes become still more dim and he shuns every body.

He is troubled with thirst ; his tongue hangs out of his mouth ; he laps the water placed before him, swallowing it however with difficulty or not at all. There is not that aversion to water, which was formerly thought to be the case, and it may therefore prove a very unhappy error, to believe a dog not to be mad, merely because he laps or drinks water, although he may have manifested the other symptoms of madness.

He suffers no one to come near him, barks seldom, and if he does, it is with a hoarse voice, and in a howling tone. Every body, who approaches him, is injured by his poisoning, infecting, and fatal bite.

He chews much, and a glutinous spittle is dropping from his tongue, the mouth being constantly open.

He runs from his master, and attacks every body he may meet in his path.

He first runs slowly, and with increasing madness faster, his head and ears hanging downward, and often, but not always, with the tail drawn between his legs.

He runs irregularly, sometimes straight forward for a while, but then suddenly turning about, and running to the right or left, according to the objects which may attract his attention, as other dogs, &c.

During *the third and last stage of madness*, his eyes become still more dim, and are either staring or wildly rolling about in his head.

His tongue, hanging out of the mouth, is of a leaden colour.

Healthy dogs, meeting him on his way, do not bark at him, or at least do not persecute him, and will have no kind of intercourse with him.

By degrees he becomes fatigued and runs but slowly, slinking, and finally almost giddy, being paralyzed in his legs.

Tears run profusely out of his eyes, his hair bristles, and his head hangs still more downward.

He throws himself to the ground, or falls with fatigue, rising again with difficulty, and breathing uneasily.

Finally he is seized with convulsions, falls and dies.

It ought, however, to be remembered, that this disease may not always pass through all these grades. Dogs often are affected merely by the quiet madness, and may often die during the first stage of the disease, on the second, third, or fourth day.

The above mentioned symptoms are the only ones by which we may judge of a dogs madness; all others are either the productions of superstition, or uncertain and of no value, as has been confirmed by many experiments. Even the saliva of a suspicious dog, swallowed by a healthy one on a piece of meat or bread, is an unsafe proof. Many misfortunes, caused by mad dogs, might have been prevented, if less reliance had been placed upon such fallacious symptoms, and if instead of them, the true signs of canine madness, as they are explained in this chapter, had been looked for.

CHAPTER II.

Symptoms of hydrophobia of men after the bite of a mad dog.

Every wound, be it ever so small, inflicted by a rabid animal upon men, may cause the unfortunate disease of hydrophobia. Even being licked by such an animal on a scratched or wounded part, or on one, which is covered with a thin skin, but still more a bite, however small, may have this effect.

The slightest injury by a mad dog, or another mad animal, should therefore be considered as of the greatest importance, and every thing recommended in the following chapter to obviate its effects, should be done. The place of the wound, be it in the head, belly, arms, legs, fingers, or toes, makes no difference; neither does age or sex afford any security. All kinds of dogs are equally liable to this disease, and are equally able to infect and poison men. The infection from the bite of a rabid animal is manifested at different times; some persons may be attacked by hydrophobia within a few days, others within some months, and others even not before some years have elapsed.

No one therefore, who has been wounded by a mad dog, or by a dog merely suspected of being mad, should consider himself secure against this fatal disease, unless he has pursued all measures necessary after the bite, even if months and years should have already expired since he received the wound.

The following symptoms prove the actual infection, and indicate the poison of the dog to be assimilated with the fluids of the human body:

The spot, originally injured by the dog, begins to be painful; this pain soon increases and spreads all over the part.

The inflicted wound, which often heals within a few days, and without any remedies, assumes a red appearance, and becomes inflamed, and sometimes covered with small pimples. It not unfrequently re-opens with the discharge of a thin and corroding matter.

The patient shows a remarkable change of his spirits and is either unusually happy and gay, or displeased to work, uneasy, gloomy, sighing, &c.

He loses his appetite, sleeps restless, is disturbed by frightful dreams, and complains of chills and heat.

His uneasiness gradually increases, and he has a distressing appearance. He suffers violent thirst, but detests all kinds of fluids which may be offered to him, and all things which have the least resemblance to them, such as polished or shining cups, &c. This symptom always increases with the disease.

He soon is unable even to swallow dark fluids, for instance beer, which, at the time of his shunning the water, he felt yet inclined to take, and at last he even cannot swallow dry and solid food.

A draft of air now causes an unpleasant sensation, and therefore he even dislikes to have the door of his room opened, or to see people approach his bed.

He breathes with difficulty, is asthmatic, and groans in a manner, which has been considered similar to the barking of a dog, although quite superstitiously.

His saliva becomes tenacious, and he casts it out with great difficulty, although large quantities of it collect in the mouth and run out of it. After he loses his mind, he spits at all persons who approach him.

He now becomes delirious, his eyes look wild and staring, and he rages furiously at intervals.

Finally he is seized with convulsions, and thus, generally within three days, expires in a most miserable and lamentable condition.

CHAPTER III.

Treatment of persons who have been bitten by a mad dog.

All the shocking sufferings, heretofore mentioned, may happily be prevented, if the necessary precautions are immediately taken

with such persons as have been bitten or injured by a rabid animal, or by one suspected of being so. Every body will conceive the importance of immediately pursuing these measures without delay, with a person thus wounded. The most important step is to send immediately for a physician or surgeon, and every one, who feels for his fellow-men, will do so, in order to save the sufferer from an imminent and shocking death. Every physician or surgeon is legally bound to offer his assistance instantly, as there are but few cases, where an immediate medical assistance can be of greater importance with regard to the hope of a happy result, than in this.

Meanwhile it is necessary to inform the authorities of the accident as early as possible, to enable them to make such arrangements as to prevent further accidents. All the annexed mentioned measures should however be followed, without frightening or alarming the patient, and every thing should be done to comfort him by friendly conversation, consolation, &c.

The prevention of hydrophobia from those persons who have been injured by a mad dog, depends principally upon removing the poison out of the wound and to obviate its spreading through the body from thence. *Therefore the only secure way of saving the patient from a miserable death, consists in an early and persevering external treatment of his wounds.* If this is neglected, no internal remedy can prevent hydrophobia, whatever may be its name, and however great its reputation may be. The most melancholy cases have long ago convinced all experienced physicians of the truth of this assertion. Whoever therefore induces such patients, to use those remedies, which have formerly been considered popular or secret, and have been respected as such by a few credulous persons; and to neglect the only safe external treatment of the wound: such a one has to experience the consciousness and mortification of having essentially contributed to the patient's death.

But as the poison often spreads from the wound rapidly over the body, and then, generally, no further help is possible; therefore even the time, while the physician is called, should not pass without service to the patient. The following course should be pursued under such circumstances:

If the injured part have been covered with clothes, they must

be taken off, but cautiously ; for the slaver of the dog, attached to them, may act as a poison, if coming in contact with a sore finger or another wounded part, nay even, if touching the skin. Such clothes should instantly be burnt, or hidden deep under ground.

The wound must bleed well, and nothing should be done to staunch it suddenly ; therefore no bandages or compresses, no pressure, &c. On the contrary, it ought to bleed for some time, and must be washed or bathed with warm water, to assist the discharge of blood. In case the wound should have dried already in some places, it must be lanced* to cause a new discharge of blood.

If a person is bitten in the field, in the woods, or in any other solitary place, he must instantly wash the wound with water, or in want of it with his own urine, and must support the bleeding as much as possible ; this will be partly aided by pressing the blood towards the wound.†

Then the patient must walk to the nearest dwelling, or be carried there, but slowly, as it is injurious to him to be excited. The wounds and the most trifling scratches must now be washed carefully with ley or warm water saturated with salt.

If no physician has yet arrived, from one to four drachms of Spanish fly powder are sent for, according to the number and size of the wounds ; all of them must be covered with it, and then a linen bandage is to be applied.

Where no Spanish flies can be had, ashes or quick-lime or at least common salt must be used in their stead. The trifling pain in the wound, caused by these remedies, has no bad consequences and is necessary, as they destroy the poison deposited there, and cause by its inflammation and suppuration the only safety against the eruption of hydrophobia.

* The incision should be made from the circumference at a distance to the centre, and not from the centre, by which manner the poison would be made mechanically to spread ; also dry cups should be applied to the wound, in order to extract the poison with the blood.

J. L.-W.

† If the bitten wound is in a limb, a strong ligature round it, by the aid of a handkerchief, string, &c. may be very useful, if applied above the wound. The absorbing vessels being mostly near the skin, such a ligature may prevent the momentary absorption of the poison, and may thus forward its removal out of the wound.

J. L.-W.

All rags, linens, bandages, sponges &c. which have been in contact with the wound, must be burnt immediately after being used, else the poison might thereby yet infect other persons.

This being all done, the patient may compose himself. He should however not see many persons, nor should he hear of any disasters, caused by mad dogs. All kinds of heating fluids must be avoided, such as brandy, wine, coffee, &c. His room ought not to be too warm, and constant consolation and encouragement is necessary, that he may compose himself and recover both in mind and body.

When the physician or surgeon has arrived, the patient should with firmness, patience, and perseverance, submit to his prescriptions, of whatever kind they may be, recollecting that every thing is intended for his good and the preservation of his life.

If any of the precautions, before mentioned, have been neglected or not sufficiently long continued, the patient cannot be considered as safe; for within a longer or shorter period the fatal disease of hydrophobia may still appear. Its symptoms are faithfully laid down in the second chapter.

In such a case no time should be lost and every thing should still be done with the same precision as if just at that moment he had been bitten.

As soon as a person, who has been wounded at any time previous by a mad dog or another animal, suspected of being rabid, begins to complain of fresh pain in the injured part, either suddenly without apparent cause or after having been angry, frightened, excited, heated, &c.; or if the cicatrix of the old wound assumes an unusually red appearance; or if the spirits of the person change either into liveliness or uneasiness and anxiety, with a difficult respiration, unnatural lust, and frightful dreams and imagination; then a physician or surgeon should immediately be sent for and all circumstances mentioned to him.

Until the arrival of the physician, the shavings of horseraddish or crushed onions must be applied to the cicatrix.

Still better is it to lance it carefully by a few cuts, and, in case of its bleeding, to support and increase this by bathing the part in warm water.

After the wound has ceased bleeding, and the physician has not yet arrived, it must be dressed with Spanish fly powder or with

powdered quick-lime or common salt, as has been stated before. In short, such a person should be treated as if he had just been wounded by the dog.

After the symptoms of hydrophobia have appeared and the patient is deranged and rages as such, he should never be left alone or without help, but neither be imprisoned, as ignorant or cruel persons would advise; but he should be nursed by judicious and courageous men, who may compose him by friendly treatment, and obey the physicians prescriptions. But if he has lost all reason and is unmanageable, they may tie him with handkerchiefs, so that he cannot do any injury.

Those, who attend a hydrophobic patient, need not to apprehend any danger. If the patient spits at them, they must wash it off instantly, and unless they eat or drink out of the same spoon, glass, plate, &c. with him, they may attend without fear to their duties in assisting their unfortunate fellow-man, and in mitigating his shocking sufferings as much as is within their power.

After the patient has died of hydrophobia, all parts of his bed and every thing which has been infected with his saliva, as handkerchiefs, glasses, plates, &c. must be burnt in a remote spot, or must be interred six feet below ground and covered with quick-lime. Metal utensils, as knives, spoons, &c. which have been in contact with him, must be thoroughly heated or should likewise be interred.

CHAPTER IV.

Advice how to prevent the madness of dogs, and how to act, in case a dog has run mad.

Although we possess no remedy or method by which positively to prevent a dog from getting mad, and although many suggestions to this purpose have long ago proved unsuccessful and even dangerous in spite of their celebrity; still every owner of dogs may do a great deal, by a good and careful treatment, to keep them healthy and to secure them in some way against running mad.

It is for this purpose necessary, to avoid exposing them to too much heat or cold, and still more, not to expose them to sudden change of heat or cold.

During the winter-season it is therefore necessary to give them a good shelter, particularly for the night.

They must have a sufficient quantity of fresh and pure water, principally in summer.

They should have plenty of good and healthy food, to satisfy their appetite. Salted or seasoned food, putrid meat, blood, fat, skins, intestines, or any other putrid stuff, are highly injurious.

They must be kept cleanly, and their stalls should be covered with clean and dry straw.

During the summer they ought not to be exposed to great exercise for a long time in succession.

They ought not to be irritated or exposed to ill-treatment, nor set to fight and bite other dogs; for even an irritated dog may become very dangerous.

Whilst they are in the rut, they should not be confined and locked up, and thus be prevented from satisfying the instinct of nature.*

Old dogs, who have lost their strength and spirits, and those, who are malignant and biting, had better be killed at once.

For preventing, as much as possible, all accidents from mad dogs, it would be best to do away with all those, which are kept for mere pleasure, and to limit their number to only so many as are necessary. Whoever considers the subject seriously and calmly, that his life and that of his fellow-men may be endangered at any moment by dogs, must feel inclined to sacrifice the pleasure of keeping them, particularly as it is always connected with many inconveniences.

* The observation appears to have escaped notice, that a misproportion exists between male and female dogs; the latter are more frequently killed, when young, and this may be another cause of the frequency of hydrophobia. It might prove very advisable to have nearly an equal number of both sexes, and particularly to have female dogs where dogs are mostly kept chained, and therefore cannot have intercourse with those in their neighbourhood.

The laws and practice of some towns, to apply muzzles to the dogs during hot weather, appears also to contribute to the production of hydrophobia, as such unaccustomed and troublesome bandage may irritate them and prevent them from satisfying their thirst or appetite with ease. If heat should be the only or principal cause of hydrophobia, rather than the disproportion between the different sexes of dogs and the other causes mentioned, we should see it principally in the tropic regions; which is not the case, but just the contrary.

J. L.-W.

It is also well to state, that the owner of a dog is liable to a lawful fine, if by his carelessness any person should be injured.

Although it is necessary, always to watch a dog, we should be still more attentive if a dog suddenly, without any cause, changes his temper and becomes quiet and melancholy. As soon as any such symptoms appear, he should be locked up, to prevent him from hurting men or animals.

As soon as the first degree of madness (as described in the first chapter) becomes manifest in a dog, he should be killed instantly, without any further consideration. It is only by such a measure, that every danger, arising from him, can be safely obviated. No attachment for the dog ought to prevent any reasonable person from killing him, particularly, as such an animal, if once rabid, must certainly die within a short time of a tormenting death.

It is an equally urgent duty to kill any dog we may know or even suspect to have been bitten by a mad one. Every attempt to cure such a dog is useless and wrong, unless it is done with great care by a physician.

In case a mad dog, or one suspected of being so, has already bitten one or several persons, he ought not to be killed immediately; for it has often happened, that persons have been seized with a disease similar to hydrophobia, merely from fear that the dog, by which they have been bitten, was mad. This can be prevented by ascertaining by close observations, whether the dog, that inflicted the bite, was mad or not. In the latter case the patient is at once relieved of all apprehensions.

If a dog therefore has bitten a person, be it even yet doubtful whether he was mad, it is necessary to catch him carefully, to chain him safely in a solitary place, and to inform the police of the accident, to have such dog regularly watched.

Wherever a rabid animal is observed, it is important, immediately to inform the police of it, in order to see the necessary measures devised; but at the same time every body is bound to neglect nothing, by which he might apprehend or kill such animal.

As soon as a rabid animal has been killed, it must be interred immediately, in a retired spot, and at least five feet below ground. The body must be covered with lime to at least five inches height, or be entirely covered with stones.

The instruments, which have been used for touching and removing the dead animal, must be well heated, as the smallest quantity of saliva, remaining on such instrument, might infect a man and create many misfortunes.

Every metal utensil which has been soiled by the mad dog's saliva, or out of which he had been eating or drinking, must be thoroughly heated; or if they are of other materials, they must be burned or otherwise destroyed, to remove every trace which could cause accidents.

APPENDIX,

Containing the Prussian laws relative to this subject.

Every body is bound, strictly to comply with the laws for the prevention of madness of dogs, under the penalty of fine or punishment, as contained in these laws.

Prussian State Laws, Part II. Title 20. § 734.

Nobody is permitted to instigate a dog towards a man, and even if no accident happens from it, he is liable to a fine or other punishment.

Ibid. § 755.

If a person knows his animal to be dangerous or bad-natured, and still neglects the necessary precautions, he shall indemnify those fully, who have suffered by it.

Ibid. Part I. Title VI. § 74.

Moreover the owner of such dangerous animal, who, on hearing of its disposition, neglects the necessary precautions, shall be fined from twenty to fifty dollars.

Ibid. Part II. Title 20. § 753.

Every body who neglects to kill a dog that he knows to be in the first stage of madness, shall pay a fine of twenty dollars if the dog escapes, although he may not yet have done hurt; and if he is unable to pay, he shall be imprisoned for four weeks.—*Prussian Decree with reference to mad dogs, published the 20th of February, 1797. § 2.*

The same fine or punishment shall be inflicted on such person as knows his dog to have been bitten by a mad one, and neglects

to kill him at once, before having injured a person. If he gives such dog over to another person, he shall be liable to treble the fine or punishment. *Ibid.* § 3.

The cure of mad dogs is forbidden under the same penalty, on account of the dangers connected with it. Physicians alone may try such experiments, but they should lock the dog in a strong iron cage, and they are responsible for all accidents, that may happen by it. *Ibid.* § 4.

As soon as a person has been injured by a mad dog, or by a suspicious one, the county physician or surgeon, or the physician who lives nearest, shall be informed of the accident by the friends or relatives of the patient, or by any one, who first witnessed the misfortune. The persons, guilty of neglecting this, shall be punished according to the extent of injury, sustained or caused by their carelessness.* *Ibid.* § 6.

* Although these laws and several other remarks are entirely local and refer to the kingdom of Prussia, still I thought it proper to mention them, in order to give a true translation of the original document. J. L.-W.

CIRCULAR

OF THE PRUSSIAN DEPARTMENT FOR ECCLESIASTICAL AND MEDICAL AFFAIRS AND EDUCATION RESPECTING THEIR PUBLICATION,

On the Prevention of Hydrophobia.

Many methods have of late been published to prevent the eruption of hydrophobia after the bite of rabid dogs. Each of the methods recommended claims to have the test of experience in its favour. Among them, those of *Kruttge*, *Schneemann*, *Locher-Balber*, *Von Schallern*, and *Urban*, have attracted particular attention. As these methods may not yet have become so generally known, as the importance of the subject must make it desirable, it is thought proper to communicate them to the medical profession at large.

Kruttge's method has proved successful at *Breslau*, during a period of twenty years, in two hundred cases, where persons had been wounded by rabid animals. He recommends the application of Spanish fly powder to the bitten wound and to cover it with a plaster of cantharides. This method to be continued for six weeks, dressing the wound in the same manner twice a day. At the same time, every third or fourth hour, from half a grain to one grain of *Calomel* internally, and the external use of the blue mercurial ointment, as in the cure of syphilis, so as to produce a profuse salivation for six weeks continually. Previous to healing the wounds, a seton is applied to the arm or leg, which must suppurate for a full year.

Schneemann recommends to wash the bitten wound with warm ley, in order to increase the bleeding, to press the blood out of the wound, or to draw it from there by the aid of cups or leeches. He recommends then emetics and diaphoretics, and in particular *Ipecacuanha* and *Spiritus Mindereri*, and also to keep up a profuse suppuration of the wound for three or four weeks and longer by the aid of the red mercurial precipitate ointment. *Dr. S.* thinks it important that the patient should, during this treatment,

lay constantly on his abdomen, in order to cause the saliva to run freely out of his mouth and to prevent it from being swallowed.

Locher Balber's methods has been practised for upwards of forty years at *Zurich*. He lances the bitten wound, and then applies Spanish fly powder to it, and creates another blister in its vicinity; both places must suppurate for six weeks. In the mean time the blue mercurial ointment is rubbed on the limbs, until it will produce salivation, and internally a powder of five grains of *Radix Belladonnae* is administered before breakfast daily or every other day, to which *Calomel* may be added, in case the salivation cannot easily be produced. The perspiration must carefully be supported. The patient must keep his bed for at least four weeks and abstain during this period from all meat.

Von Schallern recommends to lance the bitten wound and to let it bleed freely; he then applies the white-hot iron to it, in case the wound is new; but if this should be impracticable on account of its place, or if it has been inflicted some time previous, he uses the *Butter of Antimony* in place of the white-hot iron, and then dresses the wound with an irritating ointment of *Camphor*, *Oil of Turpentine*, *Red Mercurial Precipitate*, *Spanish fly powder*, and *Basilic Ointment*. This ointment is applied twice a day for the first fourteen days, and afterwards once a day until the twenty-eighth day, in order to cause a constant suppuration. Under this external treatment, according to age, the patient takes the *Radix Belladonnae*, together with *Calomel* and *Oleum Cajeput*. A grown person of about thirty or forty years receives on the first day at once from twelve to fourteen grains of Belladonna with two grains of Calomel and two drops of Oleum Cajeput. The use of this mixture, with a gradual increase of the dose of Belladonna, is continued, until its known effects upon the nervous system are observed. This dose is then continued for fourteen days, and then it is again diminished gradually. The whole time of the use of the Belladonna extends at least to the twenty-eighth day. The patient, at the same time, must principally use a decoction of diaphoretic roots, barks, and herbs.

Dr. Urban's method is the last published. He presses the blood out of the wound and uses luke-warm water for washing; then he bathes the wounded part in a solution of common salt in water, in order to clean it and to promote its bleeding. This being

done, the wound is cupped repeatedly in different directions, and then covered with lint, which is moistened with the solution of common salt. This dressing is renewed twice a day for from fourteen to twenty-one days. It is thought very necessary, that the wound should never get dry, and should be always kept moist with the solution of salt. *Dr. U.* when dismissing his patients, recommends to them, to watch the scar of the former wound, and he agrees with *Professor Rust's* statement, that the poison may remain deposited near the healed wound, and may only manifest itself, previous to the eruption of hydrophobia, by an inflamed state of the cicatrix, or by forming in its vicinity one or more small pimples. They contain a fluid of a redish or bluish colour, which is said to be equally as poisoning, as the spittle of the mad dog. At however late a period the formerly wounded person shall observe these symptoms and painful sensations, or even the pimples, *Dr. U.* recommends to treat them on the same principle, as if the bitten wound should have just been inflicted. *Rust* considers the red and painful scar as a symptom almost constantly succeeded by the eruption of hydrophobia within two or three days, and he recommends in such case deeply to cauterise the scar of the former wound with a white-hot iron.

However much these modern methods may differ in their particulars, still it is apparent, that all agree upon a powerful local treatment of the bitten wound, although they recommend different measures to attain this object.

The old approved methods, which had principally in view, to remove, by a chemical or mechanical process, the poison deposited in the wound, have thus now been re-confirmed.

The first part of the paper is devoted to a general
 consideration of the subject, and to a discussion of the
 various methods which have been proposed for the
 determination of the specific heat of gases. The
 author then proceeds to a detailed description of the
 apparatus used in the experiments, and to a
 description of the method of observation. The
 results of the experiments are then given, and
 compared with the results of other observers.
 The author concludes by a discussion of the
 theoretical considerations which apply to the
 subject, and by a summary of the results.



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