

# Early methods for the surveillance and control of rabies in animals \*

J. BLANCOU \*\*

**Summary:** *From the many existing documents on the history of rabies in animals, it is possible to describe with precision the practical measures adopted for the surveillance and control of rabies in animals from antiquity until the 18th century.*

*Surveillance is based on clinical diagnosis, post-mortem examination, animal inoculation and knowledge of the conditions under which infection occurred: aetiology, pathogenesis, susceptible species, virulent material, mode of infection, incubation period, etc. The historical data are assembled and compared, with comments on each of these points.*

*Control is based on the application of general disease control measures and attempts at vaccination and treatment. A study of these procedures enables a comparison of their efficacy and a description of the major steps which led to (or delayed) the work of Louis Pasteur.*

KEYWORDS: Disease control – History – Rabies – Surveillance – Zoonoses.

## INTRODUCTION

Numerous documents exist on the history of rabies, including an entire book on the subject (7), from which the author has borrowed extensively.

The aim of the present article is not to rewrite this history, but to examine certain technical and scientific aspects of the history of rabies, and to discuss these in the light of current knowledge and interests.

This study will therefore be confined to the methods employed by various populations over the course of history to recognise rabid animals and avoid risks, and also to prevent the occurrence and spread of the disease. This analysis will reveal convergences and divergences in these topics at different periods of history.

No consideration will be given to the surveillance and control of human rabies, on which there is a particularly rich literature, and only the period up to the beginning of the 19th century will be examined. It was during the 19th century, particularly with the work of Louis Pasteur, that the control of animal diseases entered the modern period, leading to almost universal harmonisation of the methods used.

---

\* This paper was originally published in French in the *Bulletin de l'Académie vétérinaire de France* (1993), 66, 163-172.

\*\* Director General, Office International des Epizooties, 12 rue de Prony, 75017 Paris, France.

The Appendix gives the chronology of authorities cited. Throughout this article, it is assumed that mention of a century is in the period AD. An occurrence before the Christian era is designated as BC in the text.

## SURVEILLANCE OF ANIMAL RABIES

Surveillance of a disease of animals presupposes the **ability to diagnose** the disease and also **knowledge of the conditions under which infection occurs**: aetiology and pathogenesis, susceptible species, virulent materials, incubation period, etc. Surveillance also implies a **warning system** for the notification of an epidemic. As illustrated below, these three aspects have always been taken into consideration by populations under threat from rabies. These aspects will each be examined in turn.

### Diagnosis of rabies

Obviously, consideration will be given here only to the clinical diagnosis of the disease; however, ancient authors also attempted post-mortem diagnosis of rabies, and some curious procedures for experimental diagnosis were introduced.

#### *Clinical diagnosis*

There have been innumerable descriptions of the symptoms of rabies in animals since very ancient times.

The symptoms are listed in Table I. To avoid repetition, the essential features of these descriptions are summarised, with sole mention of their first occurrence in history. Table I does not provide a full description of symptoms and does not provide precise references to the original historical texts. However, references are given to the literature where a full account may be found.

Rabies was one of the first diseases of animals to be observed and described with accuracy. This is certainly due to a number of factors: the very ancient domestication of dogs and the important role of these animals in human societies; the spectacular nature of rabies symptoms; and, above all, the transmissibility of this disease to human beings.

#### *Post-mortem diagnosis*

The post-mortem examination of rabid dogs does not seem to have been attempted until very late in history, and the first genuine report of an autopsy is found in the work of the British author Richard Mead in 1709 (7), who described ulcerative meningitis in a rabid (?) dog. However, at various times in history, certain peoples have claimed a link between rabies and the presence of 'small worms' in rabid dogs. According to the Greeks, this small worm (*lytta, lussa*) was found under the tongue of dogs, and removal of the worm was supposed to protect the animal against rabies (see below). Attempts were made to discover the seat of the 'animalcule' responsible for the disease in the mouth of a biting animal. Arabian and Persian writers, followed by those of the Middle Ages in Europe, believed that they had found such worms in the saliva or urine of rabid animals. In some cases the 'animalcules' resembled 'little dogs' (6, 7). A French writer (P. Desault) described them anew in 1733, while Marochetti (1821) also described 'vesicles' under the tongue of rabid dogs (1).

#### *Experimental diagnosis*

Although quite groundless, the first experimental diagnosis of animal rabies proposed by Aetius of Amida (6th century) had the advantage of simplicity. According

TABLE I

*The principal symptoms of rabies in animals*

Symptom	History	Ref.
<b>Aggressiveness and biting</b>	These symptoms have always been associated with rabies. In the Indian text <i>Susrutashamitâ</i> (1st century) the rabid dog is described as a 'bearer of crazed and venomous fangs'	(8)
<b>Change of voice</b>	The 'raucous and inaudible' bark of rabid dogs was described in the Talmud (4th-5th centuries), later by Pietro d'Albano and the Persian Gorgani (12th century), and by Albucasis and Serapion the Younger (13th century), who referred to 'raucous barking' and a 'hoarse voice'. The dumb form of rabies was described by Paul of Aegina (7th century) and Ambroise Paré (16th century). The bitonal barking characteristic of rabies was described by James (1733)	(1, 5, 7, 8, 10)
<b>Madness</b>	This is mentioned as a symptom of rabies in the <i>Eshunna</i> Code of the 23rd century BC in Mesopotamia. A characteristic symptom of canine rabies, implying unpredictable, not necessarily aggressive behaviour. The Babylonian word <i>segû</i> signifies both 'being mad' and 'being rabid'. The French term for rabies ( <i>rage</i> ) comes from the Latin <i>rabere</i> (to be mad), while the Latin term (and the English <i>rabies</i> ) comes from the Sanskrit <i>rabhas</i>	(7, 8)
<b>Open jaws and salivation</b>	Being open-jawed was already described as a symptom by the Babylonians, for whom the word <i>kaduhhu</i> (to have an open mouth) was associated with rabies. These two symptoms, often concomitant (and of reciprocal causation), are also described in the <i>Susrutashamitâ</i> , which mentions 'the dog, jackal, hyaena and tiger [...] the tail, jaw and shoulder dropped, salivating greatly...' and in the life of St Tarabo (Egypt, 4th century), who encountered a rabid dog 'which was dribbling from the mouth and walking sideways'. They were also mentioned by Gorgani and the monk Bartholomew Glanville in the 12th and 13th centuries	(2, 7, 8)
<b>Hydrophobia</b>	Hydrophobia, a symptom of rabies peculiar to human beings, was described before the Christian era. Some authors also erroneously described the symptom in dogs, notably Aetios of Amida (6th century). By contrast, Paul of Aegina (7th century), Serapion (9th century) and John Hunter (1793) stressed the complete absence of hydrophobia in dogs	(6, 7)
<b>Locomotor incoordination</b>	This symptom has been mentioned above (cf. 'open jaws'). Locomotor incoordination may lead to complete paralysis, as described amply in works of the 8th century; this symptom was also reported by Gorgani and Glanville	(7)
<b>Protrusion of the third eyelid</b>	This phenomenon may have been observed by Glanville, who mentioned 'eyes overturned'	(2)
<b>Other symptoms</b>	Less constant and less characteristic symptoms were reported by Avicenna and Sidi Siouti (attacks on inanimate objects), the Italian Girolamo Fracastoro or 'Fracastor' (fever), Ambroise Paré (fever), etc.	(2, 3)

Note: The development of hunting led to better observation and comparison of rabies symptoms in different individuals. Thus, in 1379, French huntsmen distinguished a dumb form (*rage cordiale*) and a mad form (*rage enrageante*) of the disease (9) and, in the 16th century, 'hot and desperate' rabies (*rage chaude et désespérée*) and running rabies (*rage courante*). British huntsmen distinguished six types of rabies: desperate, running, 'dumme' (dumb), falling, sleeping and lank, illustrating the behaviour and attitude of affected dogs (7). These different types of rabies are now known to be caused by the same virus, which produces different symptoms according to random localisation and replication in the brain

to Aetius, it was sufficient to place crushed nuts on the wound caused by a dog bite, and to offer these nuts to fowl the following day. If the latter ate the nuts and survived, the dog was not rabid.

This principle was subsequently restated many times. Thus, in Tunisia, Ibn-al-Jazzar (10th century) proposed offering to a healthy dog a piece of bread soaked with blood from a suspect bite wound: if the dog ate the bread, the suspicion of rabies was lifted (7). Gaston de Foix ('Phébus') proposed a more elaborate test in 1387: 'place the backside of a cockerel on the wound opening; if the dog was rabid, the cockerel will swell up and die' (7). The Russian Samoilovich (1783) proposed that the person bitten rub his teeth with a portion of grilled flesh from the suspect dog, then offering this to a healthy dog; if the latter refused the meat, the suspicion of rabies was confirmed (7).

All of these tests had a common aim: to detect the presence of 'poison' remaining in the bite wound, by using a live animal as an indicator of the poison.

Other tests were based on the pain experienced following a dog bite: this was supposed to be greater if the dog was rabid (Constantine of Africa in the 11th century, Nicolas Bertruccio in the 14th century [1, 7]).

In fact, it was not until 1804 that Zinke in Jena (Germany) succeeded in developing a diagnostic test and reproducing the disease experimentally by swabbing an incision made in the paw of a healthy dog with saliva from a suspect dog (6).

### **Conditions under which infection occurs**

This heading includes a somewhat arbitrary selection of all the facts mentioned in historical texts which, at the time, established and predicted the conditions under which rabies infection took place: the cause of rabies (aetiology and pathogenesis), susceptible species, virulent materials, mode of infection, incubation period, etc.

#### *Aetiology and pathogenesis*

There is no evidence that a precise aetiology was discovered before the 19th century, even though Democritus (4th century BC) believed that rabies was a 'burning of the nerves'. It is interesting to note the relationships which were believed to have been discovered between rabies and parasitism by the 'small worm' mentioned above, or the existence of a 'poison' (virus) in the mouth of the dog. The latter explanation, provided by Aurelius Cornelius Celsus (1st century) was subsequently adopted for an entire class of pathogens.

Four theories were held in antiquity, with regard to the supposed seat of the illness: 'nervous', 'anginous', 'diaphragmatic' and 'mixed' (3).

In fact, over the centuries, many hypotheses have been propounded on the origin of rabies, very often based on humoral theories, i.e. spontaneous appearance of the disease under the influence of extrinsic physiological disturbances (heat, cold, etc.) or intrinsic factors (sexual excitement, melancholy, psychological shock, etc.). The most perspicacious hypotheses, in view of their bearing on live pathogenic agents, were without doubt those of the following authors:

- the Greek physician Galen (2nd century) described 'the diathesis originating in a very small amount of saliva, augmented within the body';
- the monk Bartolomew Glanville (13th century) referred to a 'poison which grows and multiplies' (2);

– most significantly, the Italian Girolamo Fracastoro ('Fracastor', 16th century), the pioneer of *contagium vivum*, attributed rabies to the presence in saliva of minuscule grains (*seminaria*) 'which may be hidden in small openings' and pass into the blood of persons bitten. The 'viscous and thick' nature of these *seminaria* precluded penetration of the healthy skin, hence the need for a wound.

### *Susceptible species*

The early descriptions of rabies did not recognise natural resistance to the disease in any species of mammal, although Aristotle (4th century BC) wrote that human beings were not susceptible to the disease (although this was perhaps an error by a copyist). In fact, Aristotle specified that 'if a rabid dog bites, all animals bitten become rabid'. He described rabies in camels and horses, but it was not until later that cases in other species were described, notably by Avicenna (11th century) in the mule, wolf, jackal, fox and beech marten, and by Gorgani (12th century) in the hyaena and ferret. Thomas Spackman (1613) stated that fowl were resistant to rabies (2).

### *Virulent materials and modes of contagion*

As mentioned above, most of the ancient authors (particularly the Roman Cardano) established a link between rabies, a bite wound and a 'venom' present in the mouth of the biting animal. However, apart from saliva, some ancient authors also incriminated other sources: the urine of rabid animals 'on which one must not walk, particularly with abraded soles' (Pliny, 1st century); the breath of such animals (Soranus, 1st century – refuted by Aretaeus in the following century), or even simply the air breathed (Virgil in the *Georgics*, 1st century BC); aerosols (Gariopontus, 10th century); or a mere glance from a rabid animal (Gorgani, 12th century). The source of the contagion was also to be found in cadavers or in water contaminated by rabid animals (Avicenna), in the blood of such animals (Arnau de Vilanova, 13th century) and in their meat (Divesus, 16th century) (6, 7).

Interestingly, Le Roux claimed in 1783 that the saliva of rabid animals was not invariably virulent, thus confirming the initial claim of Fracastor (6).

### *Incubation*

Most of the statements regarding the incubation of rabies concern human beings, and the findings vary enormously (4, 5, 6): between 6 weeks and 12 months according to Dioscorides (1st century), between 40 days and 7 years (Philumenos, 3rd century), between 7 and 100 days (Sun Si Miao of China, 6th century), approximately 40 days (Aetios of Amida, 6th century), between 9 days and 7 years (Bernard de Gordon, 13th century), between 7 and 180 days (Gorgani, 12th century), between 20 days and several years (Fracastor, 16th century), between 31 days and 17 months (John Hunter, 18th century), etc.

Presumably, it was the difficulty in establishing the day on which an animal was bitten and in following its subsequent movements which prevented the compilation of similar data in veterinary medicine. The only precise information from early times is provided by Glanville, who wrote (between 1231 and 1281) that 'the venom [from a dog bite] is dangerous because it can remain hidden for a long time and unrecognised until a year has elapsed' (2). Later, French hunters kept any of their dogs which had been 'bitten or attacked by a rabid dog' in isolation for thirteen months because 'in the rabies of 1763, a dog became rabid after the thirteenth moon' (9).

### Warning system

Contrary to many diseases of animals, which had to be reported when the first case occurred, there does not seem to have been any system of reporting and alerting for rabies, no doubt because the disease posed no threat to livestock.

## CONTROL OF RABIES IN ANIMALS

Control of rabies is the most interesting aspect of the disease for veterinarians. Although detailed research into the aetiology of infectious diseases could not commence until the modern discoveries of microbiology, there is no reason why effective means could not be found at any stage of history to protect against such diseases.

The means of protection specified for rabies will be examined below. Rabies has proved particularly stimulating to human inventiveness in view of the danger to human beings presented by this disease. This study will first consider the two conventional ways of protecting against contagious diseases (hygienic preventive measures and immunisation), and will then examine proposed treatment measures.

### General disease control measures

These measures involve hygienic precautions and elimination of the causal factor. Some of the measures proposed for rabies are presented below.

#### *Wearing of muzzles*

This practice was recommended for the first time in the Avesta, a code enshrining the doctrine of Zarathustra (or Zoroaster), who lived in Persia in the 7th-6th centuries BC: 'a piece of shaped wood is attached to the collar [of a biting dog] to which the jaws are tied; the pieces of wood on each side are joined together'. This procedure applied to biting dogs in general, but was no doubt particularly applicable to animals 'without voice and of aggressive nature', which were probably rabid (7).

The practice of wearing muzzles, although well known in Greco-Latin antiquity, does not seem to have been made obligatory anywhere in Europe until the 18th century.

#### *Destruction of carrier animals*

The slaughter of biting dogs was also recommended in the Avesta. However, this was to be performed progressively: for after successive bites, an ear, then the other ear, followed by the right paw, left paw and tail were amputated! Practice was more expeditious and systematic in China at the time of the Western Zhou (7th-6th centuries BC), where rabid dogs were chased and beaten to death. In ancient times, special days were reserved for the destruction of dogs, the *kynophantes* of Argos (Crete) and the *dies caniculares* of Rome. In the latter case, the appearance of the dog-star constellation (Sirius) signalled the start of the hunt because, for the Romans – as for the Greeks and the Egyptians – this star was reputed to favour rabies epidemics (related to rutting periods?). The Talmud (sacred book of Jewish law, 4th-5th centuries) stipulates that rabid dogs should be put to death 'by throwing objects against them', and that this could take place 'even on the Sabbath day' (2, 5). In the 10th century, a Welshman was permitted to kill a dog provided that he could prove it to be rabid 'by showing that he saw [the dog] fighting with dogs or men, or that he saw him with his tongue greatly inflamed' (2). By the 18th century, many European countries (Germany, Spain, France, etc.) had

passed legislation for the destruction of stray dogs. In France, between 1719 and 1746, 'specialists' were responsible for killing stray dogs by bludgeoning, shooting or poisoning. The extensive slaughter of dogs in London following rabies outbreaks in 1759 and 1760 was criticised by the general public. A bounty of five shillings was paid for each dog killed in London in 1774, and paupers were not permitted to keep a dog. In 1785, the citizens of Avignon were allowed to kill stray dogs using stones or sticks. During the 1862 rabies epidemic in Ethiopia, dogs were rounded up and thrown by their owners into burning huts. In England in 1870, contaminated dogs were either killed or kept in confinement by their owners for ten months (6).

#### *Prohibition of straying*

Stray dogs were specifically outlawed by the Talmud, the sages instructing owners of town dogs to keep them chained permanently, and owners of rural dogs to keep them chained during the day (5). Prohibition of stray dogs was incorporated into the legislation of many European cities, notably Nancy (1701), London (during the major rabies outbreak of 1759-1760, dogs were to be kept indoors for one month), Paris (stray dogs could be stoned to death in 1785) and Liege (a fine of three gold florins in 1791). In Strasbourg in 1778, a dog collar was given to the owner upon payment of an annual tax (1).

#### *Quarantine*

In 1793, Samuel Argent Bardsley (9) proposed 'to eradicate rabies' from the British Isles by the use of quarantine. Bardsley proposed 'the establishment of an universal quarantine for dogs within the Kingdom, and a total prohibition of importation of these animals during the existence of such quarantine'. Unfortunately, this fine idea was not implemented until a century later, although it was also recommended by William Youatt in 1851, who proposed that quarantine should last for eight months. Pasteur suggested a test of this strategy (coupled with vaccination and muzzling) in an isolated country, Mauritius (9).

#### *Observation procedures*

In 1766, Dr Guillotin proposed that rabid dogs should be placed under observation for fifteen days in solid iron cages, to discover whether they were really ill (1). Although the other celebrated invention of Dr Guillotin is no longer in use, observation procedures are still used in France and in many other countries to ascertain whether the saliva of a biting dog was infective on the day of the bite.

#### *Annulment of sale*

There seems to be no historical record of rabies being considered a breach of warranty, probably because the disease rarely affected livestock.

### **Medical prophylaxis**

The numerous 'recipes' for preventing rabies could fill a whole book. However, most of these measures were confined to human beings, and were rarely considered for infected animals. Among the most ancient recipes was ablation of the above-mentioned 'small worm' situated under the tongue of pups (the lingual raphe?) and amputation of the tail forty days after birth (Columella, 1st century). A century later, Galen asserted that dogs could be protected against rabies by feeding them a mixture of 'Lemnos soil' and well-crushed juniper berries (3). The first genuine experimental treatment for rabies appears to have been performed by Eusebio Valli in Italy (18th century), who claimed to have successfully 'vaccinated' human beings and infected dogs with saliva

from a rabid dog previously exposed to the gastric juice of frogs. Such contact might well have reduced the virulence of saliva, and some believe that Valli thus discovered the first rabies vaccine (7).

### Treatment

Almost all civilisations have believed rabies to be certainly fatal, although some authors (notably Fracastor) stated that not every bite of a rabid dog was inevitably fatal.

In the light of this poor prognosis, every conceivable treatment has been tested in the course of time.

The multitude of proposed treatments for rabies in human beings falls into three broad groups: cauterisation of the wound, systemic treatment with a drug mixture of mineral, vegetable or animal origin, and balneotherapy. Fewer proposals were made for animals. Hippocrates (the veterinarian) and Eumelos both advocated the bleeding of rabid horses, while Eumelos added firing of the belly and the temples, inhalation of hemlock seeds and even castration!

In *Historia naturalis*, Pliny the Elder (1st century) recommended protecting a bitten dog by mixing poultry droppings in its feed, followed by hellebore if symptoms developed. Philumenos (3rd century) recommended the administration of a decoction of calcined shrimp powder and gentian root dissolved in old wine. More effectively, he advised debridement of the wound with cauterisation, and keeping the wound open for forty days by applying a plaster containing garlic, onions and wheat grains (2). In the same era, Vegetius Renatus recommended that cattle bitten by a rabid dog could be protected by making them swallow the boiled liver of the dog.

In the 14th century, great care was taken of hunting dogs, especially when they had been wounded or bitten by another animal (Fig. 1).

In 1766, Matthieu (a 'master surgeon' in Perigord, France) claimed to have cured a rabid sow with turpeth mineral, etc. (7). In 1767, Dr Busson treated animals with Paulmier powder ('antibysus'), already in use in the 16th century (4). This powder was composed of twelve plants and was to be taken with milk (for dogs) or wine (for others). Later, the Court physician Chirac devised an 'anti-rabies omelette' made from eggs and dog-rose root (*Cynorrhodon*), which had previously been employed to treat bitten dogs and pigs (4).

## CONCLUSION

An analysis of the various procedures for the surveillance and control of rabies in animals over more than forty centuries of history is particularly instructive for veterinarians, confirming the weight of tradition and ideas borrowed from the treatment of animal diseases in general. For many centuries, the humoral theories of Hippocrates hampered research into an extrinsic cause of rabies and ways of eliminating the disease.

Whereas certain authors (e.g. Democritus, Galen, Fracastor and Valli) had accurate presentiments on the real nature of the contagion, and consequently about ways of preventing it, they were unable to verify or apply their theories.



## LES ANCIENNES MÉTHODES DE SURVEILLANCE ET DE CONTRÔLE DE LA RAGE ANIMALE \*. – J. Blancou.

**Résumé :** *A partir des nombreux documents existants sur l'histoire de la rage animale il est possible de décrire avec précision quelles ont été, de l'Antiquité au XVIII<sup>e</sup> siècle, les modalités pratiques de surveillance et de contrôle de la rage animale.*

*La surveillance est basée sur un diagnostic clinique, nécropsique et expérimental de la maladie ainsi que sur la connaissance des conditions de l'infection : étiologie, pathogénie, espèces sensibles, matières virulentes, mode de contagion, durée d'incubation, etc. Les données historiques sont rassemblées, comparées et commentées pour chacun de ces points.*

*Le contrôle est fondé sur l'application des mesures de prophylaxie sanitaires ou médicales : tentatives de vaccination et de traitement. L'étude de ces méthodes permet de comparer leur efficacité et de décrire les grandes étapes qui ont préparé, ou retardé, les travaux de Louis Pasteur.*

MOTS-CLÉS : Histoire – Prophylaxie – Rage – Surveillance – Zoonoses.

\* La version française complète de cet article a été publiée dans le *Bulletin de l'Académie vétérinaire de France* (1993), **66**, 163-172.

\*  
\* \*

## ANTIGUOS MÉTODOS DE VIGILANCIA Y CONTROL DE LA RABIA ANIMAL. – J. Blancou.

**Resumen:** *La existencia de numerosos documentos sobre la historia de la rabia animal nos permite hacer una descripción precisa de las distintas modalidades prácticas que tuvieron la vigilancia y el control de esta enfermedad desde la Antigüedad hasta el siglo XVIII.*

*La vigilancia se basa en el diagnóstico clínico, necroscópico o experimental de la rabia animal, así como en el conocimiento de las condiciones en que se producía la infección: etiología, patogenia, especies susceptibles, materias virulentas, modo de contagio, período de incubación, etc. Los hechos históricos agrupados por el autor son comparados y comentados en cada uno de los citados aspectos.*

*El control se fundamenta en la aplicación de medidas de profilaxis sanitarias o médicas: intentos de vacunación y tratamientos. El estudio de estos métodos permite comparar su eficacia respectiva y describir las grandes etapas que fueron preparando (o retrasando) los trabajos de Louis Pasteur.*

PALABRAS CLAVE: Historia – Profilaxis – Rabia – Vigilancia – Zoonosis.

\*  
\* \*

## Appendix

## Selective chronology of authorities cited

Author/work cited	Dates
Avesta (code of the doctrine of Zoroaster)	7th-6th centuries BC
Hippocrates	463-377 BC
Democritus	460-370 BC
Aristotle	384-322 BC
<i>Susrutashamitâ</i> (India)	1st century
Pliny the Elder	23-70
Aretaeus	120-200
Galen	131-201
Celsus	2nd century
Talmud (sacred book of Jewish law)	late 4th century (Jerusalem edition) 5th century (Babylonian edition)
Vegetius	450-510 (?)
Paul of Aegina	625-690
Avicenna	980-1037
Gorgani	1042-1136
Fracastor	1478-1558
Eusebio Valli	1755-1816

\*  
\* \*

## REFERENCES

1. ARDOIN P. (1984). – Historique de la rage jusqu'à Pasteur. *Méd. mal. infect.*, **14** (4), 154-158.
2. LECLAINCHE E. (1936). – Histoire de la médecine vétérinaire. Office du Livre, Toulouse, 812 pp.
3. MOREAU R. (1985). – La rage de l'Antiquité au siècle des lumières. *Infos tech. Serv. vét.*, **92-95**, 19-28.
4. OGER Y. (1985). – Comment préservait-on les animaux de la rage en Bretagne au XVIII<sup>e</sup> siècle. *Infos tech. Serv. vét.*, **92-95**, 29-35.
5. SHOSHAN A. (1971). – Animals in Jewish literature: relations between the Jews and their animals [in Hebrew]. Shoshanim, Rehovot, 372 pp.
6. STEELE J.H. & FERNANDEZ P.J. (1991). – History of rabies and global aspects. In *The natural history of rabies*, 2nd Ed. (G.M. Baer, ed.). CRC Press, Boca Raton, Florida, 1-24.
7. THEODORIDES J. (1986). – Histoire de la rage. Cave canem. Fondation Singer Polignac Masson, 289 pp.

8. THIERRY B. (1992). – Les connaissances sur la rage en Asie Centrale et au Moyen Age. *Bull. mens. Rage anim. Fr.*, **22** (7), 1-3.
  9. TOMBAL A. (1985). – La rage, la chasse et la forêt. *Infos tech. Serv. vét.*, **92-95**, 37-40.
  10. WILKINSON L. (1988). – Understanding the nature of rabies: an historical perspective. *In Rabies* (J.B. Campbell and K.M. Charlton, eds). Kluwer Academic Publishers, Boston, Dordrecht & London, 1-23.
-