Foot and Mouth Disease:

Signs and symptom



Ruptured blisters on the feet of a pig

The incubation period for foot-and-mouth disease virus has a range between one and 12 days.[[9]](https://en.wikipedia.org/wiki/Foot-and-mouth_disease#cite_note-9)[[10]](https://en.wikipedia.org/wiki/Foot-and-mouth_disease#cite_note-10) The disease is characterized by high [fever](https://en.wikipedia.org/wiki/Fever) that declines rapidly after two or three days, blisters inside the mouth that lead to excessive secretion of stringy or foamy saliva and to drooling, and blisters on the feet that may rupture and cause lameness.[[4]](https://en.wikipedia.org/wiki/Foot-and-mouth_disease#cite_note-sciencedirect.com-4)[[11]](https://en.wikipedia.org/wiki/Foot-and-mouth_disease#cite_note-11) Adult animals may suffer weight loss from which they do not recover for several months, as well as swelling in the testicles of mature males, and cows' [milk](https://en.wikipedia.org/wiki/Milk) production can decline significantly. Though most animals eventually recover from FMD, the disease can lead to [myocarditis](https://en.wikipedia.org/wiki/Myocarditis%22%20%5Co%20%22Myocarditis) (inflammation of the heart muscle)[[12]](https://en.wikipedia.org/wiki/Foot-and-mouth_disease%22%20%5Cl%20%22cite_note-12) and death, especially in newborn animals. Some infected ruminants remain [asymptomatic](https://en.wikipedia.org/wiki/Asymptomatic) carriers, but they nonetheless [carry](https://en.wikipedia.org/wiki/Asymptomatic_carrier) the virus and may be able to transmit it to others. Pigs cannot serve as asymptomatic carriers.[[13]](https://en.wikipedia.org/wiki/Foot-and-mouth_disease#cite_note-13)

Cause

Of the seven serotypes[[14]](https://en.wikipedia.org/wiki/Foot-and-mouth_disease%22%20%5Cl%20%22cite_note-14) of this virus, A, C, O, Asia 1, and SAT3 appear to be distinct lineages; SAT 1 and SAT 2 are unresolved clades.[[15]](https://en.wikipedia.org/wiki/Foot-and-mouth_disease#cite_note-15) The mutation rate of the protein-encoding sequences of strains isolated between 1932 and 2007 has been estimated to be 1.46 × 10−3 substitutions/site/year, a rate similar to that of other RNA viruses. The most recent common ancestor appears to have evolved about 481 years ago (early 16th century). This ancestor then diverged into two clades which have given rise to the extant circulating Euro-Asiatic and South African. SAT 1 diverged first 397 years ago, followed by sequential divergence of serotype SAT 2 (396 years ago), A (147 years ago), O (121 years ago), Asia 1 (89 years ago), C (86 years ago), and SAT 3 (83 years ago). Bayesian skyline plot reveals a population expansion in the early 20th century that is followed by a rapid decline in population size from the late 20th century to the present day. Within each serotype, there was no apparent periodic, geographic, or host species influence on the evolution of global FMD viruses. At least seven genotypes of serotype Asia 1 are known.[[16]](https://en.wikipedia.org/wiki/Foot-and-mouth_disease#cite_note-16)

**Transmission**

The FMD virus can be transmitted in a number of ways, including close-contact animal-to-animal spread, long-distance aerosol spread and [fomites](https://en.wikipedia.org/wiki/Fomite%22%20%5Co%20%22Fomite), or inanimate objects, typically fodder and motor vehicles. The clothes and skin of animal handlers such as farmers, standing water, and uncooked food scraps and feed supplements containing infected animal products can harbor the virus, as well. Cows can also catch FMD from the semen of infected bulls. Control measures include quarantine and destruction of both infected and healthy (non-infected) livestock, and export bans for meat and other animal products to countries not infected with the disease.

Just as humans may spread the disease by carrying the virus on their clothes and bodies, animals that are not susceptible to the disease may still aid in spreading it. This was the case in Canada in 1952, when an outbreak flared up again after [dogs](https://en.wikipedia.org/wiki/Dog) had carried off bones from dead animals.[[3]](https://en.wikipedia.org/wiki/Foot-and-mouth_disease#cite_note-animals-3) [Wolves](https://en.wikipedia.org/wiki/Wolves) are thought to play a similar role in the former [Soviet Union](https://en.wikipedia.org/wiki/Soviet_Union).[[17]](https://en.wikipedia.org/wiki/Foot-and-mouth_disease#cite_note-Graves-17)

[Daniel Rossouw Kannemeyer](https://en.wikipedia.org/wiki/Daniel_Rossouw_Kannemeyer) (1843-1925) published a note in the 'Transactions of the South African Philosophical Society' volume 8 part 1 in which he links saliva-covered locusts with the spread of the disease.[[18]](https://en.wikipedia.org/wiki/Foot-and-mouth_disease#cite_note-18)

**Infecting humans**

Humans can be infected with foot-and-mouth disease through contact with infected animals, but this is extremely rare.[[19]](https://en.wikipedia.org/wiki/Foot-and-mouth_disease#cite_note-19) Some cases were caused by laboratory accidents. Because the virus that causes FMD is sensitive to stomach acid, it cannot spread to humans via consumption of infected meat, except in the mouth before the meat is swallowed. In the UK, the last confirmed human case occurred in 1966,[[20]](https://en.wikipedia.org/wiki/Foot-and-mouth_disease%22%20%5Cl%20%22cite_note-20)[[21]](https://en.wikipedia.org/wiki/Foot-and-mouth_disease#cite_note-21) and only a few other cases have been recorded in countries of [continental Europe](https://en.wikipedia.org/wiki/Continental_Europe), Africa, and South America. Symptoms of FMD in humans include malaise, fever, vomiting, red ulcerative lesions (surface-eroding damaged spots) of the oral tissues, and sometimes vesicular lesions (small blisters) of the skin. According to a newspaper report, FMD killed two children in England in 1884, supposedly due to infected milk.[[22]](https://en.wikipedia.org/wiki/Foot-and-mouth_disease#cite_note-22)

Another viral disease with similar symptoms, [hand, foot and mouth disease](https://en.wikipedia.org/wiki/Hand%2C_foot_and_mouth_disease), occurs more frequently in humans, especially in young children; the cause, [Coxsackie A](https://en.wikipedia.org/wiki/Coxsackie_A) virus, is different from the FMD virus. Coxsackie viruses belong to the *[Enteroviruses](https://en.wikipedia.org/wiki/Enterovirus%22%20%5Co%20%22Enterovirus)* within the *Picornaviridae*.

Because FMD rarely infects humans, but spreads rapidly among animals, it is a much greater threat to the agriculture industry than to human health. Farmers around the world can lose enormous amounts of money during a foot-and-mouth [epizootic](https://en.wikipedia.org/wiki/Epizootic), when large numbers of animals are destroyed, and revenues from milk and meat production go down.

Prevention

Like other RNA viruses, the FMD virus continually evolves and mutates, thus one of the difficulties in vaccinating against it is the huge variation between, and even within, [serotypes](https://en.wikipedia.org/wiki/Serotype). There is no cross-protection between serotypes (a vaccine for one serotype will not protect against any others) and in addition, two [strains](https://en.wikipedia.org/wiki/Strain_%28biology%29) within a given serotype may have [nucleotide](https://en.wikipedia.org/wiki/DNA) sequences that differ by as much as 30% for a given gene. This means FMD [vaccines](https://en.wikipedia.org/wiki/Vaccine) must be highly specific to the strain involved. Vaccination only provides temporary [immunity](https://en.wikipedia.org/wiki/Immune_system) that lasts from months to years.

Currently, the [World Organisation for Animal Health](https://en.wikipedia.org/wiki/OIE) recognizes countries to be in one of three disease states with regard to FMD: FMD present with or without vaccination, FMD-free with vaccination, and FMD-free without vaccination.[[23]](https://en.wikipedia.org/wiki/Foot-and-mouth_disease#cite_note-23) Countries designated FMD-free without vaccination have the greatest access to export markets, so many developed nations, including Canada, the United States, and the UK, work hard to maintain their current status. Some countries such as [Brazil](https://en.wikipedia.org/wiki/Brazil) and [Argentina](https://en.wikipedia.org/wiki/Argentina) which have large beef exporting industries, practise vaccination in some areas but have other vaccination-free zones.

Reasons cited for restricting export from countries using FMD vaccines include, probably most importantly, routine blood tests relying on antibodies cannot distinguish between an infected and a vaccinated animal,[[24]](https://en.wikipedia.org/wiki/Foot-and-mouth_disease#cite_note-24) which severely hampers screening of animals used in export products, risking a spread of FMD to importing countries. A widespread preventive vaccination would also conceal the existence of the virus in a country. From there, it could potentially spread to countries without vaccine programs. Lastly, an animal infected shortly after being vaccinated can harbor and spread FMD without showing symptoms itself, hindering containment and culling of sick animals as a remedy.

Many early [vaccines](https://en.wikipedia.org/wiki/Vaccine) used dead samples of the FMD virus to inoculate animals, but those early vaccines sometimes caused real outbreaks. In the 1970s, scientists discovered that a vaccine could be made using only a single key [protein](https://en.wikipedia.org/wiki/Protein) from the virus. The task was to produce enough quantities of the protein to be used in the vaccination. On June 18, 1981, the US government announced the creation of a vaccine targeted against FMD, the world's first [genetically engineered](https://en.wikipedia.org/wiki/Genetic_engineering) vaccine.

**Contagious bovine pleuropneumonia** (**CBPP** – also known as **lung plague**), is a [contagious](https://en.wikipedia.org/wiki/Contagious_disease) [bacterial](https://en.wikipedia.org/wiki/Bacteria) disease that afflicts the [lungs](https://en.wikipedia.org/wiki/Lung) of [cattle](https://en.wikipedia.org/wiki/Cattle), [buffalo](https://en.wikipedia.org/wiki/American_Bison), [zebu](https://en.wikipedia.org/wiki/Zebu), and [yaks](https://en.wikipedia.org/wiki/Yak).

It is caused by the bacterium *[Mycoplasma mycoides](https://en.wikipedia.org/wiki/Mycoplasma_mycoides%22%20%5Co%20%22Mycoplasma%20mycoides)*, and the symptoms are [pneumonia](https://en.wikipedia.org/wiki/Pneumonia) and [inflammation](https://en.wikipedia.org/wiki/Inflammation) of the lung membranes.[[1]](https://en.wikipedia.org/wiki/Contagious_bovine_pleuropneumonia#cite_note-1) The incubation period is 20 to 123 days. It was particularly widespread in the United States in 1879, affecting herds from several states. The outbreak was so severe that it resulted in a trade [embargo](https://en.wikipedia.org/wiki/Embargo) by the British government, blocking U.S. cattle exports to Britain and Canada. This prompted the United States to establish the [Bureau of Animal Industry](https://en.wikipedia.org/wiki/Bureau_of_Animal_Industry), set up in 1884 to eradicate the disease, which it succeeded in doing by 1892.[[2]](https://en.wikipedia.org/wiki/Contagious_bovine_pleuropneumonia#cite_note-JAVMANews-2)

[Louis Willems](https://en.wikipedia.org/wiki/Louis_Willems), a Belgian doctor, began pioneering work in the 1850s on animal inoculation against the disease.[[3]](https://en.wikipedia.org/wiki/Contagious_bovine_pleuropneumonia#cite_note-Bazin_2011-3)

The bacteria are widespread in Africa, the Middle East, Southern Europe, as well as parts of Asia. It is an airborne species, and can travel up to several kilometres in the right conditions.

Contagious bovine pleuropneumonia came to Australia on a shipment of five head of cattle from England in 1858, imported by one of [Melbourne](https://en.wikipedia.org/wiki/Melbourne)'s earliest settlers Mr Boadle. Three weeks later, a heifer named St Bees fell ill. Boadle called in a veterinarian who diagnosed it with the disease. The heifer died three weeks later. Whilst Boadle destroyed the herd, St Bees had already infected a bullock team grazing on a neighbouring property. Pleuropneumonia spread up the overland route to [New South Wales](https://en.wikipedia.org/wiki/New_South_Wales), into [Queensland](https://en.wikipedia.org/wiki/Queensland) and across northern Australia. It later arrived in [Western Australia](https://en.wikipedia.org/wiki/Western_Australia) via a shipload of cattle. Only [Tasmania](https://en.wikipedia.org/wiki/Tasmania) was to remain free of the epidemic in Australia.[[4]](https://en.wikipedia.org/wiki/Contagious_bovine_pleuropneumonia#cite_note-CSIRO-4)

A national management strategy was implemented in 1959, inspired by the work of chief veterinary officer of the Northern Territory [Colonel Lionel Rose](https://en.wikipedia.org/wiki/Alfred_Lionel_Rose). A National Committee for the Control and Eradication of Pleuropneumonia was established, under the Chief of the CSIRO Division of Animal Health and Production, D A Gill. It defined infected, protected and disease-free areas. Once these were established, there were restrictions on the movement of cattle between zones. The national programme was empowered to employ veterinary officers, stock inspectors and police across Australia. Pleuropneumonia was announced to be eradicated in Australia by 1973.[[4]](https://en.wikipedia.org/wiki/Contagious_bovine_pleuropneumonia#cite_note-CSIRO-4)

**Tetanus in Cattle**

Tetanus is a fairly common disease occurring in all types of livestock. It is relatively rare in cattle, but outbreaks of disease can cause very severe losses.

**Cause**

Tetanus is caused by toxins produced by the bacterium Clostridium tetani. This bacterium is found in the soil and the guts of animals and humans.

The disease starts when the organism gets into wounded or damaged tissue as a result of contamination. In the absence of oxygen the bacteria multiply and produce a local infection.

As they grow, the bacteria produce toxins, which spread along the nerves to the brain and cause the clinical signs of tetanus.

The time between infection and disease can be very short (two or three days) or quite long (four weeks or more), depending on how long it takes for the contaminated area to develop a low level of oxygen (such as by a wound healing over sealing off the tissue from the outside).

The disease is seen in all ages of stock. Calving and castration seem to be the most common procedures linked to the development of tetanus.

**Clinical signs**

* Stiffness and reluctance to move are normally the first signs
* Twitching and tremors of the muscles
* Lockjaw
* Prominent protruding third eyelid
* Unsteady gait with stiff held out tail
* Affected cattle are usually anxious and easily excited by sudden movements or handling.
* Bloat is common because the rumen stops working
* Later signs include collapse, lying on side with legs held stiffly out, spasm and death.

**Treatment**

Cattle with early tetanus probably respond to treatment better than most other livestock. Antitoxin is of very little use unless given in the very early states of infection.

In some cases sedatives and relaxants have been known to aid recovery.

It is not worth treating cattle with fully developed tetanus.

**Prevention**

Undertaking surgical procedures (such as castration) properly, in a clean environment, with disinfected instruments and surgical area, will significantly reduce the risk of tetanus. The same rules apply to calving, be as clean as possible and minimise contamination.

Antitoxin can be useful as a short-acting (up to 21 days) preventative if used at high risk times, however on some farms vaccination may be better, as a three dose course of vaccination can result in protection for over three years.

**POX**

Pox diseases are acute viral diseases that affect many animals, including people and birds. Some poxviruses also cause zoonoses. Typically, lesions of the skin and mucosae are widespread and progress from macules to papules, vesicles, and pustules before encrusting and healing. Most lesions contain multiple intracytoplasmic inclusions, which represent sites of virus replication in infected cells. In some poxvirus infections, vesiculation is not clinically evident, but microvesicles can be seen on histologic examination and, in some, proliferative lesions are characteristic.

Infection is acquired either by inhalation or through the skin (eg, sheeppox). In certain instances (eg, fowlpox, swinepox), the virus is transmitted mechanically by biting arthropods. Infection may be followed by generalized lesions (eg, sheeppox) or remain localized (eg, pseudocowpox). Strains of poxvirus with reduced virulence are used to immunize against some infections, the classic example being the global eradication of smallpox in people by immunization with strains of live vaccinia virus.

Poxviruses can be classified according to their physicochemical and biologic properties. Immunologically, the viruses of smallpox, cowpox, monkeypox, etc, are closely related to vaccinia virus and are classified within the genus *Orthopox*. The avian poxviruses, the myxoma viruses, and some of the other poxviruses (eg, swinepox) are species-specific. The viruses of orf, pseudocowpox, and bovine papular stomatitis are parapoxviruses. It has been recognized that several orthopoxvirus infections of domestic animals and people, notably cowpox and monkeypox, are acquired from rodent reservoir hosts. Many of these rodent hosts have not been unequivocally identified. Thus, although the use of adjectives such as "cowpox" and "monkeypox" to describe these viruses may be epidemiologically inaccurate and misnomers, their retained use reflects both historical association and, until a better nomenclature evolves, pragmatism (see [Cowpox Virus Infections in Cats and Other Species](https://www.msdvetmanual.com/integumentary-system/pox-diseases/cowpox-virus-infections-in-cats-and-other-species)).

Poxvirus infections can be confirmed in the laboratory using several diagnostic techniques. The orthopoxviruses can usually be isolated in cell culture and by inoculation of embryonated eggs. Examination of clinical samples by negative-staining electron microscopy is frequently used to visualize virus particles. PCR is widely used to further characterize virus isolates.

# Rabies in animals

***Rabies***

 is a [viral](https://en.wikipedia.org/wiki/Virus_%28biology%29) [zoonotic](https://en.wikipedia.org/wiki/Zoonotic%22%20%5Co%20%22Zoonotic) [neuroinvasive](https://en.wikipedia.org/wiki/Neurotropic_virus%22%20%5Co%20%22Neurotropic%20virus) disease which causes inflammation in the brain and is usually fatal. Rabies, caused by the [rabies virus](https://en.wikipedia.org/wiki/Rabies_virus), primarily infects mammals. In the laboratory it has been found that birds can be infected, as well as cell cultures from birds, reptiles and insects.[[1]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-1) Animals with rabies suffer deterioration of the brain and tend to behave bizarrely and often aggressively, increasing the chances that they will bite another animal or a person and transmit the disease. Most cases of humans contracting the disease from infected animals are in developing nations. In 2010, an estimated 26,000 people died from rabies, down from 54,000 in 1990.[[2]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-Loz2012-2)

## Stages of disease[[edit](https://en.wikipedia.org/w/index.php?title=Rabies_in_animals&action=edit&section=1" \o "Edit section: Stages of disease)]

Three stages of rabies are recognized in dogs and other animals.

1. The first stage is a one- to three-day period characterized by behavioral changes and is known as the [prodromal stage](https://en.wikipedia.org/wiki/Prodrome%22%20%5Co%20%22Prodrome).
2. The second stage is the excitative stage, which lasts three to four days. It is this stage that is often known as *furious rabies* due to the tendency of the affected animal to be hyperreactive to external stimuli and bite at anything near.
3. The third stage is the paralytic or dumb stage and is caused by damage to [motor neurons](https://en.wikipedia.org/wiki/Motor_neuron). Incoordination is seen due to rear limb [paralysis](https://en.wikipedia.org/wiki/Paralysis) and drooling and difficulty swallowing is caused by paralysis of facial and throat muscles. This disables the host's ability to swallow, which causes saliva to pour from the mouth. This causes bites to be the most common way for the infection to spread, as the virus is most concentrated in the throat and cheeks, causing major contamination to saliva. Death is usually caused by [respiratory arrest](https://en.wikipedia.org/wiki/Respiratory_arrest).[[3]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-Ettinger_1995-3)

## Mammals[[edit](https://en.wikipedia.org/w/index.php?title=Rabies_in_animals&action=edit&section=2" \o "Edit section: Mammals)]

### Bats[[edit](https://en.wikipedia.org/w/index.php?title=Rabies_in_animals&action=edit&section=3" \o "Edit section: Bats)]

Bat-transmitted rabies occurs throughout North and South America but it was first closely studied in [Trinidad](https://en.wikipedia.org/wiki/Trinidad) in the [West Indies](https://en.wikipedia.org/wiki/West_Indies). This island was experiencing a significant toll of livestock and humans alike to rabid bats. In the 10 years from 1925 and 1935, 89 people and thousands of livestock had died from it—“the highest human mortality from rabies-infected bats thus far recorded anywhere.”[[4]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-4)

In 1931, Dr. [Joseph Lennox Pawan](https://en.wikipedia.org/wiki/Joseph_Lennox_Pawan) of [Trinidad](https://en.wikipedia.org/wiki/Trinidad) in the [West Indies](https://en.wikipedia.org/wiki/West_Indies), a government bacteriologist, found [Negri bodies](https://en.wikipedia.org/wiki/Negri_bodies%22%20%5Co%20%22Negri%20bodies) in the brain of a bat with unusual habits. In 1932, Dr. Pawan discovered that infected [vampire bats](https://en.wikipedia.org/wiki/Vampire_bats) could transmit rabies to humans and other animals.[[5]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-5)[[6]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-6) In 1934, the Trinidad and Tobago government began a program of eradicating vampire bats, while encouraging the screening off of livestock buildings and offering free vaccination programs for exposed livestock.

After the opening of the [Trinidad Regional Virus Laboratory](https://en.wikipedia.org/wiki/Trinidad_Regional_Virus_Laboratory) in 1953, Arthur Greenhall demonstrated that at least eight species of bats in Trinidad had been infected with rabies; including the [common vampire bat](https://en.wikipedia.org/wiki/Common_vampire_bat), the rare [white-winged vampire bat](https://en.wikipedia.org/wiki/White-winged_vampire_bat), as well as two abundant species of fruit bats: the [Seba's short-tailed bat](https://en.wikipedia.org/wiki/Seba%27s_short-tailed_bat%22%20%5Co%20%22Seba%27s%20short-tailed%20bat) and the [Jamaican fruit bat](https://en.wikipedia.org/wiki/Jamaican_fruit_bat).[[7]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-7)

Recent data sequencing suggests recombination events in an American bat led the modern rabies virus to gain the head of a G-protein [ectodomain](https://en.wikipedia.org/wiki/Ectodomain%22%20%5Co%20%22Ectodomain) thousands of years ago. This change occurred in an organism that had both rabies and a separate carnivore virus. The recombination resulted in a cross-over that gave rabies a new success rate across hosts since the G-protein ectodomain, which controls binding and pH receptors, was now suited for carnivore hosts as well.[[8]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-8)

### Cats[[edit](https://en.wikipedia.org/w/index.php?title=Rabies_in_animals&action=edit&section=4" \o "Edit section: Cats)]

In the United States, domestic cats are the most commonly reported rabid animal.[[9]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-Merck-9) In the U.S., as of 2008, between 200 and 300 cases are reported annually;[[10]](https://en.wikipedia.org/wiki/Rabies_in_animals%22%20%5Cl%20%22cite_note-%3A0-10) in 2017, 276 cats with rabies were reported.[[11]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-11) As of 2010, in every year since 1990, reported cases of rabies in cats outnumbered cases of rabies in dogs.[[9]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-Merck-9)

Cats that have not been vaccinated and are allowed access to the outdoors have the most risk for contracting rabies, as they may come in contact with rabid animals. The virus is often passed on during fights between cats or other animals and is transmitted by bites, saliva or through mucous membranes and fresh wounds.[[12]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-:1-12) The virus can incubate from one day up to over a year before any symptoms begin to show. Symptoms have a rapid onset and can include unusual aggression, restlessness, lethargy, anorexia, weakness, disorientation, paralysis and seizures.[[13]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-13) Vaccination of felines (including boosters) by a veterinarian is recommended to prevent rabies infection in outdoor cats.[[12]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-:1-12)

### Cattle[[edit](https://en.wikipedia.org/w/index.php?title=Rabies_in_animals&action=edit&section=5" \o "Edit section: Cattle)]

In cattle-raising areas where vampire bats are common, fenced-in cows often become a primary target for the bats (along with horses), due to their easy accessibility compared to wild mammals.[[14]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-14)[[15]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-Carey-15) In Latin America, vampire bats are the primary reservoir of the rabies virus, and in Peru, for instance, researchers have calculated that over 500 cattle per year die of bat-transmitted rabies.[[16]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-Peru-16)

Vampire bats have been extinct in the U.S. for thousands of years (a situation that may reverse due to climate change, as the range of vampire bats in northern Mexico has recently been creeping northward with warmer weather), thus U.S. cattle are not currently susceptible to rabies from this vector.[[15]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-Carey-15)[[17]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-USGS-17)[[18]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-18) However, cases of rabies in dairy cows in the U.S. has occurred (perhaps transmitted by bites from [canines](https://en.wikipedia.org/wiki/Canis)), leading to concerns that humans consuming [unpasteurized](https://en.wikipedia.org/wiki/Unpasteurized) dairy products from these cows could be exposed to the virus.[[19]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-19)

Vaccination programs in Latin America have been effective at protecting cattle from rabies, along with other approaches such as the culling of vampire bat populations.[[16]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-Peru-16)[[20]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-20)[[21]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-21)

### Coyotes[[edit](https://en.wikipedia.org/w/index.php?title=Rabies_in_animals&action=edit&section=6" \o "Edit section: Coyotes)]

Rabies is common in [coyotes](https://en.wikipedia.org/wiki/Coyote), and can be a cause for concern if they interact with humans.[[22]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-22)

### Dogs[[edit](https://en.wikipedia.org/w/index.php?title=Rabies_in_animals&action=edit&section=7" \o "Edit section: Dogs)]

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Rabies has a long history of association with [dogs](https://en.wikipedia.org/wiki/Dog). The first written record of rabies is in the [Codex of Eshnunna](https://en.wikipedia.org/w/index.php?title=Codex_of_Eshnunna&action=edit&redlink=1) (ca. 1930 BC), which dictates that the owner of a dog showing symptoms of rabies should take preventive measure against bites. If a person was bitten by a rabid dog and later died, the owner was fined heavily.[[23]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-23)

Almost all of the human deaths attributed to rabies are due to rabies transmitted by dogs in countries where dog vaccination programs are not sufficiently developed to stop the spread of the virus.[[24]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-24)

### Horses[[edit](https://en.wikipedia.org/w/index.php?title=Rabies_in_animals&action=edit&section=8" \o "Edit section: Horses)]

Rabies can be contracted in horses if they interact with rabid animals in their pasture, usually through being bitten (e.g. by vampire bats)[[17]](https://en.wikipedia.org/wiki/Rabies_in_animals%22%20%5Cl%20%22cite_note-USGS-17)[[15]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-Carey-15) on the muzzle or lower limbs. Signs include aggression, incoordination, head-pressing, circling, lameness, muscle tremors, convulsions, colic and fever.[[25]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-:2-25) Horses that experience the paralytic form of rabies have difficulty swallowing, and drooping of the lower jaw due to paralysis of the throat and jaw muscles. Incubation of the virus may range from 2–9 weeks.[[26]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-26) Death often occurs within 4–5 days of infection of the virus.[[25]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-:2-25) There are no effective treatments for rabies in horses. Veterinarians recommend an initial vaccination as a foal at three months of age, repeated at one year and given an annual booster.[[25]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-:2-25)

### Monkeys[[edit](https://en.wikipedia.org/w/index.php?title=Rabies_in_animals&action=edit&section=9" \o "Edit section: Monkeys)]

[Monkeys](https://en.wikipedia.org/wiki/Monkey), like humans, can get rabies; however, they do not tend to be a common source of rabies.[[27]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-27) Monkeys with rabies tend to die more quickly than humans. In one study, 9 of 10 monkeys developed severe symptoms or died within 20 days of infection.[[28]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-28) Rabies is often a concern for individuals travelling to developing countries as monkeys are the most common source of rabies after dogs in these places.[[29]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-29)

### Rabbits[[edit](https://en.wikipedia.org/w/index.php?title=Rabies_in_animals&action=edit&section=10" \o "Edit section: Rabbits)]

Despite natural infection of [rabbits](https://en.wikipedia.org/wiki/Rabbits) being rare, they are particularly vulnerable to the rabies virus; rabbits were used to develop the first rabies vaccine by Louis Pasteur in the 1880s, and are continued to be used for rabies diagnostic testing. The virus is often contracted when attacked by other rabid animals and can incubate within a rabbit for up to 2–3 weeks. Symptoms include weakness in limbs, head tremors, low appetite, nasal discharge, and death within 3–4 days. However, there are currently no vaccines available for rabbits. The [National Institutes of Health](https://en.wikipedia.org/wiki/National_Institutes_of_Health) recommends that rabbits be kept indoors or enclosed in hutches outside that do not allow other animals to come in contact with them.[[10]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-:0-10)

### Skunks[[edit](https://en.wikipedia.org/w/index.php?title=Rabies_in_animals&action=edit&section=11" \o "Edit section: Skunks)]

In the U.S., there is currently no [USDA](https://en.wikipedia.org/wiki/United_States_Department_of_Agriculture)-approved vaccine for the strain of rabies that afflicts [skunks](https://en.wikipedia.org/wiki/Skunk). When cases are reported of [pet skunks](https://en.wikipedia.org/wiki/Pet_skunk) biting a human, the animals are frequently killed in order to be [tested for rabies](https://en.wikipedia.org/wiki/Rabies_testing). It has been reported that three different variants of rabies exist in striped skunks in the north and south central states.[[10]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-:0-10)

Humans exposed to the rabies virus must begin post-exposure prophylaxis before the disease can progress to the central nervous system. For this reason, it is necessary to determine whether the animal, in fact, has rabies as quickly as possible. Without a definitive quarantine period in place for skunks, quarantining the animals is not advised as there is no way of knowing how long it may take the animal to show symptoms. Destruction of the skunk is recommended and the brain is then tested for presence of rabies virus.

Skunk owners have recently organized to campaign for USDA approval of both a vaccine and an officially recommended quarantine period for skunks in the United States.[*[citation needed](https://en.wikipedia.org/wiki/Wikipedia%3ACitation_needed%22%20%5Co%20%22Wikipedia%3ACitation%20needed)*]

### Wolves[[edit](https://en.wikipedia.org/w/index.php?title=Rabies_in_animals&action=edit&section=12" \o "Edit section: Wolves)]

Under normal circumstances, wild [wolves](https://en.wikipedia.org/wiki/Gray_wolf) are generally timid around humans, though there are several reported circumstances in which wolves have been recorded to act aggressively toward humans.[[30]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-Attacks-30) The majority of fatal wolf attacks have historically involved rabies, which was first recorded in wolves in the 13th century. The earliest recorded case of an actual rabid wolf attack comes from Germany in 1557. Though wolves are not reservoirs for the disease, they can catch it from other species. Wolves develop an exceptionally severe aggressive state when infected and can bite numerous people in a single attack. Before a vaccine was developed, bites were almost always fatal. Today, wolf bites can be treated, but the severity of rabid wolf attacks can sometimes result in outright death, or a bite near the head will make the disease act too fast for the treatment to take effect.[[30]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-Attacks-30)

Rabid attacks tend to cluster in winter and spring. With the reduction of rabies in Europe and North America, few rabid wolf attacks have been recorded, though some still occur annually in the Middle East. Rabid attacks can be distinguished from predatory attacks by the fact that rabid wolves limit themselves to biting their victims rather than consuming them. Plus, the timespan of predatory attacks can sometimes last for months or years, as opposed to rabid attacks which end usually after a fortnight. Victims of rabid wolves are usually attacked around the head and neck in a sustained manner.[[30]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-Attacks-30)

### Other mammals[[edit](https://en.wikipedia.org/w/index.php?title=Rabies_in_animals&action=edit&section=13" \o "Edit section: Other mammals)]

The most commonly infected terrestrial animals in the U.S.A. are raccoons, skunks, foxes, and coyotes. Any bites by such wild animals must be considered a possible exposure to the rabies virus.

Most cases of rabies in rodents reported to the [Centers for Disease Control and Prevention](https://en.wikipedia.org/wiki/Centers_for_Disease_Control_and_Prevention) in the U.S. have been found among [groundhogs](https://en.wikipedia.org/wiki/Groundhogs) (woodchucks). Small rodents such as squirrels, hamsters, guinea pigs, gerbils, chipmunks, rats, mice, and [lagomorphs](https://en.wikipedia.org/wiki/Lagomorphs) like rabbits and hares are almost never found to be infected with rabies, and are not known to transmit rabies to humans.[[31]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-31)

Rabies is [endemic](https://en.wikipedia.org/wiki/Endemic_%28epidemiology%29) to many parts of the world, and one of the reasons given for [quarantine](https://en.wikipedia.org/wiki/Quarantine) periods in international animal transport has been to try to keep the disease out of uninfected regions. However, most developed countries, pioneered by [Sweden](https://en.wikipedia.org/wiki/Sweden),[*[citation needed](https://en.wikipedia.org/wiki/Wikipedia%3ACitation_needed%22%20%5Co%20%22Wikipedia%3ACitation%20needed)*] now allow unencumbered travel between their territories for pet animals that have demonstrated an adequate immune response to rabies vaccination.

Such countries may limit movement to animals from countries where rabies is considered to be under control in pet animals. There are various [lists of such countries](https://en.wikipedia.org/wiki/Lists_of_countries_where_rabies_in_pet_animals_is_under_control). The United Kingdom has developed a list, and France has a rather different list, said to be based on a list of the *Office International des Epizooties* (OIE).[*[citation needed](https://en.wikipedia.org/wiki/Wikipedia%3ACitation_needed%22%20%5Co%20%22Wikipedia%3ACitation%20needed)*] The European Union has a harmonised list. No list of rabies-free countries is readily available from OIE.[[*original research?*](https://en.wikipedia.org/wiki/Wikipedia%3ANo_original_research)]

In recent years, canine rabies has been practically eliminated in [North America](https://en.wikipedia.org/wiki/North_America) and [Europe](https://en.wikipedia.org/wiki/Europe) due to extensive and often mandatory [vaccination](https://en.wikipedia.org/wiki/Vaccination) requirements.[[32]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-32) However it is still a significant problem in parts of [Africa](https://en.wikipedia.org/wiki/Africa), parts of the [Middle East](https://en.wikipedia.org/wiki/Middle_East), parts of [Latin America](https://en.wikipedia.org/wiki/Latin_America), and parts of [Asia](https://en.wikipedia.org/wiki/Asia).[[33]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-33) Dogs are considered to be the main [reservoir](https://en.wikipedia.org/wiki/Natural_reservoir) for rabies in [developing countries](https://en.wikipedia.org/wiki/Developing_country).[[34]](https://en.wikipedia.org/wiki/Rabies_in_animals#cite_note-34)

However, the recent spread of rabies in the northeastern United States and further may cause a restrengthening of precautions against movement of possibly rabid animals between developed countries