

# FOOT AND MOUTH DISEASE



**Foot-and-mouth disease** (FMD, *Aphthae epizooticae* in Latin), sometimes called **hoof-and-mouth disease**, is a highly contagious and sometimes fatal viral disease of cattle and pigs. It can also infect deer, goats, sheep, and other animals with cloven hooves, as well as elephants, rats, and hedgehogs. Horses are not susceptible to FMD. Humans are affected only very rarely. The cause of FMD was first shown to be viral in 1897 by **Friedrich Loeffler**. He passed the blood of an infected animal through a fine porcelain-glass filter and found that the fluid that was collected could still cause the disease in healthy animals.

## Virus classification

Group:	Group IV ((+) ssRNA)
Family:	<i>Picornaviridae</i>
Genus:	<i>Aphthovirus</i>
Species:	<i>Foot-and-mouth disease virus</i>

FMD occurs throughout much of the world, including parts of Europe, Africa, Asia, and South America. While currently (July 2001) some countries, including Australia, Canada, and the United States have been free of FMD for some time, eradicated from the U.S. in 1929, its wide host range and rapid spread represent cause for international concern. There was an outbreak of FMD in Britain in 2001 which resulted in the slaughter of many animals. Many sporting events and leisure activities like Ten Tors were cancelled. (see 2001 UK foot and mouth crisis for details).

Foot-and-mouth disease, after World War II, was widely distributed throughout the world. In 1996, endemic areas were Asia, Africa, and parts of South America. In South America, Chile is free, and Uruguay

and Argentina have not had an outbreak since April 1994. Most European countries have been recognized as free. Countries belonging to the European Union have stopped FMD vaccination. North and Central America, Australia, New Zealand, and Japan have been free of FMD for many years. A serious breakout occurred in 2001 covering all of the United Kingdom and parts of Europe. Due to strict government policies on sale of livestock, disinfection of all persons leaving and entering farms and the cancellation of large events likely to be attended by farmers, a potentially economically disastrous epidemic was avoided in the Republic of Ireland, with just 1 case recorded in Proleek, Co. Louth.

There are seven different FMD serotypes - O, A, C, SAT-1, SAT-2, SAT-3 and Asia-1. These serotypes show some regionality, and the O serotype is most common.

## **Symptoms**

Foot-and-mouth disease is characterized by high 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. 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 in cows, milk production can decline significantly. Though most animals eventually recover from FMD, the disease can lead to myocarditis (inflammation of the heart muscle) and death, especially in newborn animals. Some infected animals remain asymptomatic, that is, they do not suffer from or show signs of the disease; but they are carriers of FMD and can transmit it to others.

Infection with foot-and-mouth disease tends to occur locally, that is, the virus is passed on to susceptible animals through direct contact with infected animals or with contaminated pens or vehicles used to transport livestock. 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 infected livestock, and export bans for meat and other animal products to countries not infected with the disease.

Foot-and-mouth disease is caused by an Aphthovirus of the viral family Picornaviridae. The members of this family are small (25-30 nm),

nonenveloped icosahedral viruses that contain single-stranded RNA (ribonucleic acid, the viral genetic material). When such a virus comes in contact with a host cell, it binds to a receptor site and triggers a folding-in of the cell membrane. Once the virus is inside the host cell, its protein coat dissolves. New viral RNA and components of the protein coat are then synthesized in large quantities and assembled to form new viruses. After assembly, the host cell lyses (bursts) and releases the new viruses.

Humans can be infected with foot-and-mouth disease through contact with infected animals, but this is extremely rare. Because the virus that causes FMD is sensitive to stomach acid, it cannot spread to humans via consumption of infected meat. In the UK, the last confirmed human case occurred in 1967, and only a few other cases have been recorded in countries of 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.

There is another viral disease with similar symptoms, commonly referred to as “hand, foot, and mouth disease,” that occurs more frequently in humans, especially in young children; this disease is caused by a different virus of the family Picornaviridae, namely, an Enterovirus called Coxsackie A.

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 billions of dollars a year during a foot-and-mouth epidemic, when large numbers of animals are destroyed and revenues from milk and meat production go down.

## **Vaccination**

One of the difficulties in vaccinating against FMD is the huge variation between and even within serotypes. There is no cross-protection between serotypes (meaning that a vaccine for one serotype won't protect against any others) and in addition, two strains within a given serotype may have nucleotide sequences that differ by as much as 30% for a given gene. This means that FMD vaccines must be highly specific to the strain involved. Vaccination only provides temporary immunity that lasts from months to years.

Currently, the OIE recognizes countries to be in one of three disease states with regards to FMD - FMD present with or without

vaccination, FMD free with vaccination, and FMD free without vaccination. Countries that are designated FMD free without vaccination have the greatest access to export markets, so many developed nations, including Canada, the United States, and the UK, currently have FMD free without vaccination status.

Many early vaccines used dead samples of FMD virus to inoculate animals. However, those early vaccines sometimes caused real outbreaks. In the 1970s, scientists discovered that a vaccine could be made using only a single key protein from the virus. The task was to produce such quantities of the protein that could be used in the vaccination. On June 18, 1981, the U.S. government announced the creation of vaccine targeted against FMD, which was the world's first genetically engineered vaccine. More than two decades later, FMD is still around.

The North American FMD Vaccine Bank is housed at the Department of Agriculture's (USDA) Foreign Animal Disease Diagnostic Laboratory (FADDL) at Plum Island Animal Disease Center. The Center, located 1.5 miles off the coast of Long Island, NY, is the only place in the United States where scientists can conduct research and diagnostic work on highly contagious exotic animal diseases such as FMD.

Cited from (Wikipedia)