Foot-and-mouth disease virus vaccine

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Technology description

Foot-and-mouth disease affects ungulates such as cattle, sheep, deer, buffalo, buffalo and pigs. It is caused by a positive single-stranded RNA virus.

Description

Researchers at NML have developed a technique that makes it possible to produce a vaccine free of live viruses that differentiates between immunized and diseased animals. They altered part of the virus's genome, introduced the recombinant material into cells or cell lines, and produced a non-viral copy of the virus's outer shell. These tailor-made capsules do not contain any virulence factors and help activate the animal's immune system when exposed to live, toxic viruses.
During viral replication, four structural proteins (1A, 1B, 1C, and 1D) forming capsids are obtained by cleavage of a polyprotein at four specific sites by proteases. To produce the new vaccine, NML researchers are replacing viral genomic fragments encoding cleavage sites between structural proteins, preferably cellular proteases such as Furin, with genetic material encoding cleavage sites unrelated to the foot-and-mouth disease virus. These sites are cleaved by proteases produced by cells or cell lines selected to produce vaccine precursor particles. Introducing this recombinant genetic material into selected cells or cell lines produces empty, non-toxic copies of the viral capsid. Capsids are designed to integrate structural proteins from different strains or subtypes of the virus to enhance immunity to multiple strains or subtypes of the virus. Immunolabelling can also be added to the capsid, or a polymerase-free protein-encoding capsule vaccine can be used so that vaccinated animals produce only anti-capsule antibodies and not anti-polymerase antibodies, thereby distinguishing them from diseased animals.

Business Opportunities

NML foot-and-mouth disease vaccine technology will be a powerful tool to prevent foot-and-mouth disease. Because of its characteristics and potential, it represents an important step forward in the fight against this devastating economic disease. It is geared to the global market.

Challenges

The outbreak of foot-and-mouth disease has caused economic losses to livestock, animal products and export markets. There is no effective antiviral treatment for the disease. The use of live viruses in safe and effective vaccines on the market requires complex manufacturing processes in biosafe locations. Large-scale sanitary slaughtering is often used to control outbreaks of foot-and-mouth disease, a controversial practice that causes suffering to animals and humans with serious economic consequences.

Seven serotypes and dozens of subtypes of foot-and-mouth disease virus have been identified. Vaccination against specific serotypes or subtypes does not automatically prevent other serotypes or subtypes. Vaccination of animals exposed to the virus prevents symptoms, but this is not an adequate precaution because vaccinated animals may carry and transmit the virus. Because current vaccines contain live viruses, it is difficult to distinguish between vaccinated and infected animals. These and other constraints explain why routine animal vaccination as a strategy for disease eradication has not been widely used globally.

In order to alleviate the pain and economic burden caused by foot-and-mouth disease, it is necessary to develop an effective vaccine that can be easily produced under less stringent biocontainment conditions and that can distinguish treated and infected animals.

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