

# Lumpy Skin Disease Virus Vaccine and Vector

A platform vector that enables the delivery and expression of single or multivalent recombinant proteins vaccines in cattle

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## Background

Lumpy skin disease virus (LSDV) is the causative agent of Lumpy Skin Disease (LSD) in cattle. Lactating cattle are the most susceptible to the disease and the morbidity rate can be as high as 85% during an outbreak.

LSD in cattle ranges from subclinical to an acute infection and usually lasts for 2-5 weeks. The acute infection is characterized by fever and localized or disseminated nodules developing on the skin, where lesions are often found in the upper respiratory tract and a secondary bacterial infection often occurs. Nodules have been reported to occur on the skeletal muscles and the mucosa of the oral and upper respiratory tract. They are also found on the skin causing damage to the hides.

Cows may lose reproductive ability and milk producing capacity for several months. Fever, anorexia and abortions are also common. The drop in milk production in lactating cows along with temporary or permanent infertility in cows and bulls, and skin lesions caused by the virus, all impact on the economic effects of the disease. Eradication campaigns and imposed trade restriction on live animals and animal products add to the financial toll of an outbreak.

LSD is an emerging crisis in the cattle industry and has gone from being an African disease which spread to the Middle East. It has now spread further to parts of Europe and across Asia. The incidence of LSD in cattle populations varies depending on geographical location and the presence of appropriate vectors for transmission. In areas where the disease is prevalent, it can have a significant impact on the local cattle industry, leading to decreased production and decreased market prices for cattle and beef products.

Preventative measures include vaccination, improved animal husbandry practices, and controlling the insect vectors that spread the disease. Effective control and management of LSD is important for the livelihoods of farmers and the sustainability of the cattle industry. This has resulted in the World Organization for Animal Health (OIE) recognizing LSD as a notifiable agricultural disease.

There is a need for vaccines against Lumpy Skin Disease (LSD), which affects cattle in most African countries as well as the Middle East and the Gulf Peninsula. It is spreading at an alarming rate and has recently entered Europe and Asia.

Commercially available vaccines are based on the attenuated Neethling strain of LSDV and are largely regarded as effective if readily available.

Researchers at The University of Cape Town have modified the LSDV into a clonal, recombinant vector capable of acting as a standalone candidate vaccine against LSDV; and as a vaccine development platform to enable the expression of other candidate vaccines in cattle and sheep.



# Technology Overview

The technology presented here is a recombinant LSDV virus nucleic acid with a modified Super Oxide Dismutase (SOD) gene, that enables its stability and performance as a vaccine candidate against LSD.

The resultant is a recombinant vaccine candidate against LSDV which has been proven to be safe and immunogenic. Furthermore, the technology presents itself as a candidate recombinant vaccine delivery tool against cattle diseases. To demonstrate this, the inventors have used the vector to develop dual vaccines Bovine Ephemeral Fever, East Coast Fever, Rabies, Bovine Coronavirus, and Foot and Mouth Disease virus. These constructs serve as stand-alone inventions and are at various stages of development.

## Benefits

The benefits of the modified LSDV vaccine and expression tool include:

- **Reduce the morbidity rate caused by LSDV.** This invention could reduce the morbidity rate associated with LSDV infections in cattle if used as a prophylactic vaccine.
- **Immunogenicity.** Rabbit experiment data to date indicated that the modified LSDV vaccine is immunogenic. Recombinant viral vaccines could provide a long-lasting and durable immunity against LSDV, which can help to reduce the risk of outbreaks and maintain the health and productivity of cattle populations.
- **Clonal.** The clonal nature of the modified vector enables a vaccine developer to obtain a homologous culture of recombinant vaccine for the target animal. This enables the standardization of the candidate vaccine and allows for further development of multivalent vaccines against the same disease.
- **Potentially reduced costs:** Recombinant poxviral vaccines are regarded as more cost-effective than traditional viral vaccines, especially in large-scale vaccination programs, as they can be produced using recombinant DNA technology, which is a highly efficient and cost-effective method of vaccine production. Poxvirus based-vaccines can be heat stable which is important for veterinary vaccines.
- **Multivalent vaccine development.** As a development tool and expression platform, the recombinant LSDV vaccine offers vaccine developers an opportunity to clone additional disease targets, and deliver them to the target animal.

## Applications

The recombinant LSDV vaccine can have a significant impact on the health, productivity, and welfare of cattle and other bovines, and can contribute to global food security and economic development.

The recombinant LSDV vaccine has several potential applications in the field of veterinary medicine:

1. **Control of Lumpy Skin Disease:** LSD is a highly contagious viral disease that affects cattle and other domesticated bovines. A recombinant LSDV vaccine can help prevent the spread of the disease and reduce the number of outbreaks.
2. **Increased livestock production:** By preventing LSD, the vaccine can help improve the health and productivity of cattle and other bovines, leading to increased livestock production.
3. **Improved food security:** By controlling LSD, the vaccine can help ensure a stable food supply and contribute to global food security.
4. **Restored trade:** By controlling LSD, the vaccine can help open up new markets for livestock products and increase trade opportunities for farmers.
5. **Improved animal welfare:** By reducing the incidence of LSD, the vaccine can help improve the overall welfare of cattle and other bovines, reducing the suffering and death of affected animals.

## Opportunity

The University of Cape Town is in licensing discussions with a South African animal health sales and distribution company and a manufacturer, who are interested in licensing the LSDV-BEF vaccine. The University of Cape Town will therefore be keen to enable introductions to these companies to anyone interested in engaging with them.

The University of Cape Town are looking for similar partnerships with suitable animal pharmaceutical companies, animal health development agencies and funders who may be interested in the East Coast Fever, Bovine Coronavirus, Rabies and Foot and Mouth Disease candidate vaccines. Partners for these technologies should ideally have access to manufacturing facilities with the relevant compliance standards, access to animal trial facilities; and sales and distribution capabilities.

The University of Cape Town would also like to license the access to the LSDV vector as a vaccine delivery and expression tool to any researchers keen on evaluating its use.

### Patents

- South African patent application 2020/07263
- Israeli patent application number 278767
- European patent application 21185987.1
- ARIPO patent application AP/P/2020/012867
- Russian patent application number 2020141192
- Kuwait application number 2020/000383
- Saudi Arabia application number 522440508

### IP Status

- Patented
- Know-how based
- Patent application submitted

### Seeking

- Development partner
- Commercial partner
- Licensing

- Provisional patent

- Seeking investment