



# Kansas State University Research Foundation TECHNOLOGY LICENSING PROFILE

## Cattle Liver Abscess Vaccine; Cattle & Sheep Foot Rot Vaccine

Inventor: T.G. NAGARAJA, GEORGE STEWART, SANJEEV NARAYANAN, M.M. CHENGAPPA, AMIT KUMAR

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**Description:** Researchers at Kansas State University have identified several antigens that could be the basis of developing vaccines to prevent liver abscesses caused by *Fusobacterium necrophorum*, the primary causative agent. These antigens could be combined with whole cell bacterin or pyolysin of *Trueperall (Actinomyces) pyogenes*, the secondary causative agent. The two organisms are normally present in the rumen of cattle, and under certain conditions, they cross the ruminal wall and reach the liver to cause abscesses.

Leukotoxin (Lkt) is the major virulence factor of *F. necrophorum* and antileukotoxin antibodies have been shown to protect against *F. necrophorum* infection.

A recombinant protein of Lkt has been developed and shown to induce protective immunity in a mouse model. The recombinant Lkt will considerably decrease the cost to vaccine production. Two truncated polypeptide regions of the full length of *F. necrophorum* Lkt have been identified to produce Lkt neutralizing antibodies and induce protection in mice.

Another potential antigen is an outer membrane protein (OMP) of *F. necrophorum* that may play a critical role in the bacteria's binding to the host cell surfaces. A recombinant OMP has also been developed. Researchers at K-State hypothesize that this outer membrane protein may serve as an effective antigen at inhibiting fusobacterial attachment to host cells and may be an effective strategy to prevent fusobacterial infection. An effective vaccine may be based on a combination of Lkt and OMP with and without *T. pyogenes* antigens.

Abscessed livers in slaughtered feedlot cattle generally are recognized as part of aggressive feeding programs. The incidence in most feedlots averages 12% to 32%. Liver abscesses are significant liabilities to the producer and the packer. Abscesses are the major cause of liver condemnation in the United States. Besides loss of liver, carcass trimming is often necessary, which costs packers and producers money. However, the greatest economic impact of liver abscesses is from the reduced animal performance. A number of studies involving

2005 Research Park Circle, Manhattan, KS 66502  
785.532.3924  
bretford@ksu.edu

Bret Ford  
Director of Business  
Development, Animal Sector

comparison of cattle with or without abscesses have documented that cattle with abscessed livers have reduced feed intake, reduced weight gain, decreased feed efficiency, and decreased carcass yield.

Liver abscess has been shown to have the following negative impacts on cattle:

- 11% decrease in performance
- 9.7% decrease in feed efficiency
- Reduced feed intake
- Reduced carcass dressing percentage

### **Advantages of Technology:**

- **Performance gains:** Improved feed efficiency and feed intake
- **Efficacy** - Proven effective in real-world feedlot conditions
- **Safe**
  - Purification process removes all residual toxins and bacterium
  - Large-scale implementation has proven the vaccine to be well tolerated at injection site
- **Convenience**
  - Complies with Beef Quality Assurance standards

### **Applications of Technology:**

- Vaccine to prevent liver abscesses and foot rot in feedlot cattle
- Potential vaccine to prevent foot rot in sheep

### **Patent Status:**

- US Patent 10,220,085 Composition and Methods for Detecting, Treating, and Protecting Against Fusobacterium Infection
- US Patent 10,010,598 Composition and Methods for Detecting, Treating, and Protecting Against Fusobacterium Infection
- US Patent 9,884,102 Composition and Methods for Detecting, Treating, and Protecting Against Fusobacterium Infection
- US Patent 9,308,247 Composition and Methods for Detecting, Treating, and Protecting Against Fusobacterium Infection
- US Patent 7,449,310 Recombinant Fusobacterium Necrophorum Leukotoxin Vaccine and Preparation Thereof

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785.532.3924  
bretford@ksu.edu

**Bret Ford**  
Director of Business  
Development, Animal Sector

- US Patent 6,669,940 Recombinant *Fusobacterium Necrophorum* Leukotoxin Vaccine and Preparation Thereof

2005 Research Park Circle, Manhattan, KS 66502  
785.532.3924  
bretford@ksu.edu

**Bret Ford**  
Director of Business  
Development, Animal Sector