Phage Therapy Platform For Equine Wound Infections

Lia Danelishvili, Oregon State University *– Two Year Grant*

This proposal aims to develop an innovative, targeted phage-based therapy to prevent and treat chronic, hard-to-heal wound infections in horses, ultimately improving recovery rates, reducing complications, and enhancing overall equine health outcomes.

Wounds in horses are common, often resulting from trauma or surgery, and are highly susceptible to infection due to the diverse, microbe-rich environments in which horses live. Infections caused by Staphylococcus aureus (MRSA), Pseudomonas aeruginosa, Klebsiella pneumoniae, and Enterococcus faecium are especially difficult to treat. These pathogens often resist multiple antibiotics and form biofilms, protective layers that shield bacteria from treatment—resulting in chronic, hard-to-heal infections. Such cases can have devastating consequences, sometimes forcing owners to make the difficult decision to euthanize the animal.

Guided by input from veterinary surgeons, equestrian sports teams, and equine-assisted therapy providers, this project addresses an urgent need for more effective solutions for drug-resistant and persistent infections in horses. One promising approach is bacteriophage (phage) therapy - natural viruses that selectively infect and kill bacteria. Phages can be as effective as antibiotics, and when formulated into “phage cocktails” containing multiple phage types, they provide broader coverage, effectively eliminating drug-resistant pathogens while remaining safe for the animal.

This proposal will develop a targeted phage cocktail to prevent and treat severe equine wound infections, focusing on drug-resistant cases involving deep anatomical structures such as tendons, ligaments, synovial spaces, bone, and fracture implants, as well as large incisions from colic surgeries. These complex infections are notoriously difficult to treat with conventional antibiotics and often progress to life-threatening systemic conditions such as infectious arthritis, septicemia, pneumonia, and sepsis. To address this challenge, we will develop phage libraries informed by the strain- and species-level diversity of pathogens in chronic equine wounds, with particular attention to dominant biofilm-forming and antimicrobial-resistant taxa such as Pseudomonas, Staphylococcus, Enterococcus, and Klebsiella. Advanced microbiome analysis will characterize wound microbial communities, guiding phage cocktail design, informing treatment strategies, and providing insight into factors influencing healing.

By targeting the most clinically relevant and virulent strains, these tailored phages will counteract microbial heterogeneity, overcome resistance, and improve healing outcomes. The work will progress from phage discovery and optimization to compassionate-use evaluations in horses, generating preclinical and clinical feasibility data needed for regulated veterinary trials. By advancing phage-based therapy, this project aims to reduce chronic infections, accelerate healing, and preserve the health, performance, and quality of life of horses, while equipping veterinarians with a powerful new tool against antibiotic-resistant infections.

Importance to Industry: The U.S. equine market is valued at $2.5 billion, with a compound annual growth rate (CAGR) of 6.2% projected for 2023. Despite this growth, the industry faces urgent challenges from the high prevalence of bacterial infections and the rising threat of antimicrobial resistance (AMR) in wounds caused by trauma or surgery. Such wounds are highly vulnerable to resistant pathogens like MRSA, Pseudomonas aeruginosa, and Enterococcus faecium, which can form protective biofilms that make them especially difficult to treat. These infections can become chronic and life-threatening, and current antibiotic treatments often fail—sometimes leading to the devastating decision of euthanasia.

As participation in equestrian activities and breeding increases, horse owners are becoming increasingly frustrated with the limited effectiveness of existing veterinary solutions. Many perceive a lack of reliable treatment options, compounded by high costs and a “buyer beware” approach to emerging therapies.

Funded by Grayson-Jockey Club Research Foundation

This challenge presents an opportunity to introduce innovative, evidence-based solutions such as bacteriophage therapy. Phages that specifically target and destroy pathogenic bacteria offer a promising alternative to traditional antibiotics. Developing specialized phage cocktails tailored for complex equine infections could not only accelerate healing but also protect the horse's beneficial microbiome.

By fostering collaboration between veterinarians, equestrian professionals, and researchers, these therapies can be designed with direct input from those who understand the needs of horses and their owners. Moving from laboratory development to clinical trials will help translate this science into real-world solutions. Ultimately, advancing targeted, effective treatments will improve equine health, address persistent challenges in infection management, and restore confidence among horse owners in the veterinary care system.

Funded by Grayson-Jockey Club Research Foundation