

Canine Valley Fever Vaccine Project

Several years ago, investigators at the University of Arizona created delta-cps1. This is a mutant strain of Valley Fever fungus that is missing a large gene. Delta-cps1 does not cause disease in several strains of mice, including those with no lymphocytes and mice that have had their bone marrow suppressed by chemotherapy. We have discovered that the delta-cps1 strain is unable to grow in the host very long and mainly dies off in the first week or two. This is a desirable feature of a “live” vaccine so dogs and people don’t get sick from getting the vaccine.

Delta-cps1 dies quickly, but not before it causes a very strong immune response in mice.

Studies have shown:

- Protection of two very susceptible kinds of mice from virulent Valley Fever strains
- Protection lasts at least 6 months (a long time in “mouse years”) between vaccination and infection
- 100% survival over 6 months of vaccinated mice that were infected with a lethal dose of *Coccidioides* spores (Valley Fever).

The vaccine has undergone extensive testing in mice and been found to be very safe in normal and immunocompromised mice.

Next-generation delta-cps1

To satisfy the requirements of the regulatory agencies, USDA and FDA, we are removing the antibiotic resistance marker and replacing it with a marker that does not involve antibiotics with human or agricultural applications. Once this new strain is available, additional studies will be done to assure that it still grows well, is safe, and protects mice from the disease just as well as the original delta-cps1 mutant strain. To clarify, the USDA regulates veterinary vaccines, and the FDA regulates human vaccines. We hope to follow licensing a vaccine in dogs with a vaccine to prevent Valley Fever in people, too.

Breakthrough for dog immune cell testing

We have just recently created a new canine T-cell antibody. This antibody is necessary in the development of a *flow cytometry* test that will help us determine how a vaccinated dog responds to the vaccine even before it gets exposed to Valley Fever spores in the environment. We can collect blood from dogs, separate the white blood cells, and determine if they have responded in an expected way to the vaccine. This test should allow us to predict that the vaccine will keep dogs from getting sick. It will also help us better understand immunology in dogs, such as why some dogs get very sick and others recover with no or minimal illness.

In the bottle

When a vaccine is packaged to sell to veterinarians (or physicians), it has to be in a formulation that maintains its ability to make the animal immune. In this case, the vaccine spores have to stay viable so they can briefly grow when given to a dog. Studies show the dead spores will not provide effective prevention of disease. To stay alive in a bottle with a shelf life, the delta-cps1 spores require some kind of protectant that improves their longevity. This critical

part of the project is just getting started and we are testing different reagents for efficacy in maintaining the crucial viability of the vaccine.

Our commercial partner

The company, Anivive Lifesciences, Inc., has signed on to help support the development of the vaccine, shepherd it through the regulatory process, and manufacture and market the vaccine. Anivive will aid in required safety studies in dogs in Arizona and California.

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1. **Narra HP, Shubitz LF, Mandel MA, Trinh HT, Griffin K, Buntzman AS, Frelinger JA, Galgiani JN, Orbach MJ.** 2016. A *Coccidioides posadasii* CPS1 Deletion Mutant Is Avirulent and Protects Mice from Lethal Infection. *Infect Immun* **84**:3007-3016.