

Winn Feline Foundation Progress Report

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A Study of Healthy Carriers of Feline Coronavirus and Viral Transmission

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Feline coronavirus (FCoV) is a common infection of cats, especially in multi-cat environments. FCoV has a high degree of genetic variation (i.e., the virus readily mutates). Until recent scientific advances, defining how the virus persists and transmits among cats was very difficult because FCoV is not easy to grow in cell cultures. The development of polymerase chain reaction (PCR) technology has allowed researchers to detect small amounts of virus in blood, fluids, and feces. PCR is proving to be an effective tool to gain the knowledge we need to develop effective FCoV management strategies.

Previous research demonstrated that about 13% of cats exposed to FCoV become lifelong carriers, and continually shed virus in their feces. Most other cats are only transiently infected, and after a period of months, they eliminate infection and stop shedding virus. A small number of cats appear to be resistant and never become infected. A small proportion of FCoV-infected cats (usually estimated at 5-10%) develop the lethal, immune-mediated disease called feline infectious peritonitis (FIP).

There are two types of FCoV. Type I virus is totally feline in origin, is most difficult to grow in cell culture, and represents about 90% of the field-virus isolates in America. Type II viruses arise by recombination between type I FCoV and canine coronavirus. Type II viruses are easier to grow in cell culture and are commonly used in laboratory research for this reason. Information on the impact of virus type on outcome of infection in cats has been very limited until now. It is also not known if type II FCoV strains are transmitted naturally among cats.

Dr. Addie and her colleagues have been studying the ways in which FCoV persists in populations of cats. Three main research objectives were planned for this project:

- 1) Development of a PCR test that could identify different FCoV isolates by examining a region of the S gene. This would enable differentiation between type I and type II virus in infected cats.
- 2) Development of a method to produce a characteristic genetic fingerprint for each FCoV strain to determine the degree of variation of virus strains and how they are related to each other. This will then enable the researchers to determine if new viral strains within a household emerge from the existing viral strains or if they

- are introduced from other sources and to study transmission patterns within a household.
- 3) Investigation of whether a transiently infected cat can be re-infected with the same viral strain or whether re-infection can only occur with a different viral strain.

Type I versus type II FCoV

PCR was used to differentiate type I from type II FCoV in 106 samples from 43 cats in 23 different households in the United Kingdom. Ninety-seven percent of the strains were classified as type I. This suggests that type I is the predominant FCoV in the UK as it is in Japan and America. While most households had only one viral strain present, in three of the households, more than one strain of FCoV was found.

Examination of viral strains

Two households with endemic FCoV infections for up to 6 years were studied in detail. In these two households, there were cats identified as either persistently infected or transiently infected. A “family tree” of virus strains was developed to study the relationships among viral strains.

Five cats known to be persistently infected over a period of up to 6 years were studied. The variation of viral strains within a given persistently infected cat was low. It appears that persistently infected cats maintain the same virus strain over a long period of time, rather than experiencing re-infection by different FCoV strains.

Re-infection of recovered cats

Transiently infected cats that subsequently recovered from infection were studied to determine the source of their new infections. The results showed that re-infection of recovered cats could be due to the same FCoV strain they had before, or due to a new virus strain. Another outcome of the research was the finding that most (but not all) cats are only infected with one FCoV strain at a time. Two cats in this study from two different households appeared to be infected with two different virus strains.

We do not fully understand the factors that determine whether a cat will become a persistently infected carrier versus a transiently infected cat. However, it appears from this research that it is probably not due to the virus strain involved, but rather due to factors inherent within the cat itself.

For more information:

Addie, D., I. Schaap, et al. (2003). “Persistence and transmission of natural type I feline coronavirus infection.” *J Gen Virol* **84**(Part 10): 2735-2744.