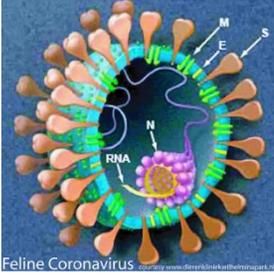


## Feline Infectious Peritonitis Virus



Model of a feline coronavirus. Coronaviridae are enveloped RNA viruses that are common in the intestinal tract of cats. As yet uncharacterized mutations of the viral genome allow the virus to escape the intestinal tract and multiply in blood mononuclear cells. This causes the Feline Infectious Peritonitis disease syndrome.

### Samples:

|  |   |
|--|---|
| Fluid Specimens (ascetic, pleural effusions)   | EDTA-blood as is, purple-top tubes                          |
| Tissue biopsies/aspirates  | Of affected organ or lymph node                             |
| Fecal specimens/swabs  | For exclusion of acute enteric feline coronavirus infection |
| Notes: Send all samples at room temperature, preferably preserved in <a href="#">sample buffer MD Submission Form</a> <ul style="list-style-type: none"> <li>• Do NOT freeze samples</li> <li>• Ship (preferably by courier) to Molecular Diagnostic Lab</li> <li>• Results within one working day</li> <li>• Cost \$80 (single sample), \$150 (two samples), \$220 (three samples)</li> </ul> |   |

This PCR test detects mRNA of the M gene of all known feline coronavirus strains in any sample; however, for diagnosis of FIP, only the detection of mRNA outside of the intestinal tract is indicative since active replication of the virus in circulating mononuclear cells is typical for FIP. In contrast, non-FIP feline coronavirus strains replicate in the intestinal tract, but not in blood mononuclear cells.

### Interpretation of PCR Results:

|   |  |
|---|--|
| High Positive<br>(> 50 copies/specimen) | FIP (interpretation must be correlated to clinical symptoms) |
| Low positive<br>(<50 copies/specimen)   | FIP (interpretation must be correlated to clinical symptoms) |
| Negative                                | FIP viral mRNA not detectable                                |

### Feline Infectious Peritonitis Virus

Feline Infectious Peritonitis Virus (FIPV) is a coronavirus, an enveloped, positive-stranded RNA virus. There are many strains of feline coronaviruses. Strains of Feline Coronavirus that cause a mild intestinal disease (diarrhea) are called Feline Enteric Coronavirus (FECV). Strains that cause Feline Infectious Peritonitis (FIP) are thought to be a form of the enteric virus (FECV) that has mutated into the lethal FIPV in the affected cat. The specific mutations that cause low-virulence FECV strains to become high-virulence, FIP-causing strains are not unique and are still poorly understood. All cats that have FIPV also have FECV, whereas not all cats that carry FECV develop FIP ([Simons et al., 2005](#)).

Antibodies against Feline Coronavirus are found in 80-90% of the animals living in catteries or multiple-cat households, and in up to 50% of solitary cats; however only some 1-5% of the seropositive cats eventually come down with FIP. Avirulent FECV strains causing inconspicuous infections are responsible for the high seroprevalence ([Simons et al., 2005](#)).

## Clinical Signs

FIP is the major infectious cause of mortality in cats ([Paltrinieri et al., 2001](#)). Infected cats may develop respiratory infection or intestinal problems. Many cats have nonspecific symptoms such as intermittent loss of appetite, depression, rough hair coat, weight loss, and fever. The hallmark of lethal effusive FIP is accumulation of fluid in abdomen or chest cavity. Non-effusive FIP usually develops slowly, with little fluid accumulation. Symptoms depend on the organs affected. The affected organs often develop a characteristic pyogranulomatous inflammation.

## Standard Diagnostic Methods

At present, there are no routine serological and virological assays available for an etiological diagnosis of FIP, or to distinguish a virulent FECVs from virulent FIPVs. Although serology is still used in the diagnosis of FIP, it is of very limited value. A definite diagnosis can only be made on the basis of histological examination of biopsy material or postmortem. An important event in FIP pathogenesis is the infection of monocytes and macrophages. Thus, a virulent FECVs remain largely confined to the digestive tract and typically do not spread beyond the intestinal epithelium and regional lymph nodes. FECVs that have entered the bloodstream do not replicate. Virulent FIPVs, on the other hand, leave the gut, enter the bloodstream, replicate in peripheral blood mononuclear cells (PBMC), generalize and reach different organ parenchymas via infected monocytes. FECVs can also be detected in peripheral blood, but do not replicate in PBMC.

## Our Method

Our lab has developed a quantitative PCR targeting subgenomic mRNA of the M gene of Feline Coronavirus with high sensitivity. Thus, our PCR specifically detects and quantifies the replicating virus as opposed to only detecting the presence of viral genomic RNA that may or may not be associated with active viral replication. This approach diagnoses FIP with very high specificity ([Simons et al., 2005](#)).

## FIP mRNA Multiple-test

We offer multiple PCRs at a reduced cost:

- 2 samples (\$150)
- 3 samples (\$220)
- [MD Submission Form](#)

In this FIP mRNA Multi-test, several independent samples from the same cat are examined. The aim of the FIP mRNA Multi Test is to maximize the predictive value for confirmation as well as exclusion of FIP (near 100% positive and negative predictive value).

In FIP mRNA-positive cats, FIP mRNA is consistently present at very low copy numbers (less than 5 copies / PCR = less than 100 copies / ml fluid) in the diseased tissue and effusions, and at even lower numbers in blood or buffy coat cells. This explains the historically difficult detection of the virus in FIP, and argues for extensive sampling to maximize diagnostic accuracy.

The FIP mRNA Multi-test offers PCR testing of multiple samples from a cat with symptoms of FIP. Preferred samples that maximize sensitivity are:

1. effusion fluid (ascites, pleural)
2. biopsy or aspirate of the tissue of an affected organ (e.g., kidney, enlarged lymph node)
3. blood

The addition of a fecal sample will not increase the positive predictive value of the extra-intestinal samples, but negativity in this test will rule out concurrent intestinal feline coronavirus infection. This will increase the negative predictive value of the FIP mRNA Multi-test if all extra-intestinal samples are also negative.

The rationale for the FIP mRNA Multi-test is that:

1. Multiple sampling increases detection sensitivity over single sampling, therefore reducing false negative results
2. Detection of FIP mRNA in any of the extra-intestinal samples confirms FIP with essentially 100% specificity
3. Absence of FIP mRNA in the samples rules out replicating FIPV with high specificity
4. Detection of FIP mRNA in an additional fecal sample, but not in the extra-intestinal samples, identifies an animal that carries the feline coronavirus or presently undergoes acute infection with the virus. Such animals may be developing FIP, and should be re-tested later or if they develop symptoms of FIP.