Feline leukemia and immunodeficiency virus (FeLV & FIV) tests

Dr Diane D. Addie
Honorary Senior Research Fellow, University of Glasgow

More cats have died of FeLV and FIV tests than of the diseases

An incomplete understanding of FeLV and FIV tests can result in the unnecessary death of your patients

“……. the results of our study suggest that cats that are seropositive for FeLV antigen or FIV antibody are more likely to be euthanatized than seronegative cats.”

Goldkamp et al, 2008

FIV and FeLV testing refresher course

Definition reminders

**Antigen:** a substance which can elicit an immune response

**Antibody:** a protein produced by plasma cells as part of the acquired immune response to an **antigen**

<table>
<thead>
<tr>
<th>FeLV tests detect antigen</th>
<th>FIV tests detect antibodies</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCR tests detect proviral DNA or viral RNA (RT-PCR: i.e. reverse transcriptase PCR, since a DNA copy has to be made of an RNA genome before PCR can be done, not to be confused with Real Time PCR, also called quantitative or Taqman PCR)</td>
<td></td>
</tr>
</tbody>
</table>

**FeLV and FIV are both RNA viruses** carrying the enzyme reverse transcriptase, which, after infecting a cell, makes a DNA copy of the viral RNA. The DNA copy is inserted into the host's DNA and is called a “provirus” or “proviral DNA.”

**Cats can be positive on FeLV proviral DNA PCR but not actually be infectious to other cats.**

This statement is especially true of FeLV vaccinated cats who have subsequently been exposed to FeLV infection (Hoffmann-Lehmann et al, 2008)

**Sensitivity** is the ability to detect small amounts of something (e.g. think of peanut allergies – those who are allergic are sensitive to tiny amounts of peanut). Tests which have poor sensitivity will give rise to false...
negative results. For screening tests, in the veterinary practice, select the best sensitivity available.

Specificity is the measure of the ability of the test to detect something accurately. Tests which have poor specificity will give rise to more false positive results than tests with good specificity. Look at the examples below to understand this concept: A test which has a good, high, specificity of 99% will give one false positive result in 100 tests performed (a red circle). You want your reference laboratory to have a test with excellent specificity.

Positive predictive value is influenced by prevalence: where the prevalence of FeLV is 1% or less (e.g. in the UK, the Netherlands, Germany) then there will be one true positive in 100 cats tested, in addition to the one false positive result – this means that half of all positive results in the UK will be false positive results. In countries with higher FeLV prevalence, for example Portugal, where the prevalence is about 8% (Vilhena et al. 2013), there will be 8 true positive results and 1 false positive, meaning that only 1 in 9 positive results is a false positive. This is why ALL positive FeLV tests should be confirmed by some other technology, such as virus isolation, immunofluorescence, or PCR (but the latter must be interpreted VERY carefully – see PCR section below).

![A test with 99% specificity in a population with 1% prevalence](image1)

![A test with 99% specificity in a population with 8% prevalence (as in Portugal)](image2)

False positive results – where a test gives a negative cat an erroneous positive result. Some years ago, to evaluate their FeLV immunofluorescent (IF) test, the University of Glasgow Veterinary Diagnostic Laboratory offered free confirmatory tests for positive in-house tests and commercial FeLV tests used by other commercial laboratories 17 of 37 results (54%) were false positives. This was to be expected because of the low prevalence of FeLV in the UK – less than 1% - therefore even a test with a great specificity of 99% will give one false positive result in 100 tests. If there is one false positive test in 100 and one truly infected, then 50% of positive results will be false positivesv (see above on the left: one true positive (red circle) and one false positive. For this reason, all FeLV positive results on in-house tests and PCR tests should be confirmed using virus isolation, immunofluorescence or a PCR which gives you an indication of viral quantity (either Ct or RNA amount: the lab should also give you an indication of their scale, ie. whether it’s a low, medium or high positive).

Key message: using serum or plasma, rather than whole blood, on in-house tests will decrease the number of false positive results you obtain

In the case of kittens from FIV infected mothers, antibody tests can be misleading, without actually being a false positive: maternally derived antibody (MDA) persists an extraordinarily long time in FIV infection, thus can be detected on tests, therefore the test is a real positive because antibody really is there, even though the kitten is actually NOT infected by the virus: the antibody is from the kitten’s mother. Thus the test is correct, it is not a false positive, but the effect is the same: to falsely imply that an uninfected kitten has FIV.

Key message: if a kitten tests positive for FIV antibody, retest at 5 – 6 months of
age, when the kitten’s MDA has waned. Most kittens are NOT INFECTED WITH FIV.

In fact, it’s extremely rare for any cat less than a year old to be FIV infected.

False negative result – where the test fails to detect an infected cat. This is a problem in countries with a high prevalence of FeLV and tests with low sensitivity. Hartmann et al (2007) found the Speed Duo (BVT, Virbac) and FASTest FeLV (Megacor) tests the most sensitive amongst those they examined.

Positive and negative predictive values are influenced by prevalence and also by how good a vet you are: a FeLV positive test result from a vet who skilfully clinically identifies cats likely to be FeLV positive, (e.g. cats with thymic lymphosarcoma) will get a higher proportion of true positive results than somebody who blanket tests any sick cat they encounter or where all cats are screened on admittance to a shelter.

Positive control: ensures your test is working. For example in a rapid immunomigration test there is a second band after the result band to demonstrate that there was enough sample to travel all the way to, and past, the test band.

Negative control: ensures that the test antibody isn’t sticking to something it shouldn’t! In other words, this controls for false positive results.

FIV testing

Key messages:
- maternally derived antibody can persist up to 4 months of age, so test kittens of FIV positive queens when over 5 months of age
- FIV infected cats usually live as long and rich a life as uninfected cats! (although this does depend on the living conditions, cats in normal pet households of 1 or 2 cats fared better than those in a multicat environment Bęczkowski et al)
- cats should NEVER be euthanased on the basis of a positive FIV test

Consider carefully before FIV testing: will it really make any difference to how you will proceed with your patient? Or are you wasting your client’s money and precious cat blood sample which might be better used on another test? At least 4 studies have shown that FIV infected cats can live as long and healthy a life as uninfected cats. (Addie et al, 2000; Bęczkowski et al 2015; Liem et al, 2013; Ravi et al, 2010; Pointier et al, unpublished).

FIV infection is virtually impossible to prevent in cats who have access to the outdoors. However, as with FeLV, there will be geographic hotspots, where FIV is more endemic – usually because of a stray or feral colony nearby. Trap neuter return programs can reduce the occurrence of fighting in such colonies by neutering. The transmissibility of FIV varies from strain to strain, with some households of cats reporting 100% infection, (Addie et al, 2000) while in other households no transmission occurred. (Litster et al, 2014)

There is no FIV vaccine currently available in the UK and much of Europe. FIV vaccination can lead to positive FIV tests of FIV negative cats. (Westman et al 2015)

Testing for FIV before introduction to existing cats

In-house FIV tests detect FIV antibody. In the Hartmann study (2007), the Snap test was the best in-house test for FIV, but in a study by Westman et al (2015) it was unable to differentiate FIV infected cats from FIV vaccinated cats and the Anigen FIV test performed better (see table below).
### Type of test | Examples | Sensitivity | Specificity
--- | --- | --- | ---
ELISA | Snap Combo (Idexx, USA) | 100% | 99.6%<sup>a</sup> 0%<sup>b</sup>
 | Commercial laboratory tests | NA | NA
Rapid Immuno Migration (RIM) | FASTest (Megacor) Speed (BVT, France) Witness (Pfizer) Anigen Rapid (BioNote) | 96.4%<sup>a</sup> 96.3%<sup>a</sup> 94.5%<sup>a</sup> 100%<sup>b</sup> 100%<sup>b</sup> | 99.2%<sup>a</sup> 98.9%<sup>a</sup> 99.4%<sup>a</sup> 95%<sup>b</sup> 100%<sup>b</sup>
Immunofluorescence (IFA) | from Glasgow Vet School | Gold standard | Gold standard
Immunoblot | from Glasgow Vet School | Gold standard | Gold standard

<sup>a</sup> Hartmann et al, 2007  
<sup>b</sup> Westman et al, 2015  Note that the Westman study was looking at FIV vaccinated cats  
NA = not available/applicable

Maternally derived antibody (MDA) to FIV can persist until 16 weeks of age – since FIV rarely crosses the placenta – most FIV positive kittens are not truly infected, the test is detecting MDA. Re-test the kitten at 5 to 6 months of age.

### TNR (trap neuter return) programmes
Probably the biggest question in TNR programmes is what to do about FIV positivity. In a French study, feral cats in TNR programmes which were FIV positive lived just as long as FIV negative cats. Given the high prevalence of FIV in all countries there is NO justification in euthanasing FIV positive cats in a TNR program: one cat more or less will make absolutely no difference to the rate of FIV infection in an area and the cat will have been robbed of his life senselessly.

### FeLV – a doomed virus?
Evolutionarily speaking, FeLV is the new kid on the block: it has not yet evolved enough not to harm its host, to live in harmony with its host, as many feline retroviruses have, and as FIV is in the process of doing. Thus FeLV infected cats generally live only a few years, (Hardy 1981) and their virus dies with them. FeLV is a curiosity amongst the RNA viruses, which are notorious for mutating, in that once a cat is immune to FeLV, that immunity will protect the cat from other strains of FeLV (contrast this with, for example, other feline RNA viruses such as calicivirus or coronavirus, where immunity to one virus strain doesn’t necessarily protect against another strain). This feature, along with the virus’s fragility in the environment (in which it can survive only minutes outside of the host) and widespread testing and vaccination, give very real hope that FeLV could be eradicated completely in a number of countries. In the UK, Germany and Holland the prevalence is already at 1% or below, compared with around 5% or more in other countries.

### Choose in house FeLV tests (RIM or ELISA) with the best sensitivity
In house FeLV tests have the advantages of convenience, speed and possibly economy (though buying cheap can be a false economy if you miss infected cats and end up getting sued by your clients). However, in-house should only be used with an awareness of their limitations: while developing tests, manufacturers have to trade off sensitivity and specificity: for a screening in-house test it is more important to choose a test which is very sensitive than one with a high specificity because you don’t want to miss any infected cats and you can always confirm positive results at a reference laboratory.

In house tests detect a part of the FeLV core protein called p27 (p for protein, 27 is its weight – 27 kilodaltons). **Because of the very low prevalence of FeLV in the UK, one in 2 positive FeLV ELISA or RIM test results will be a false positive.**

**Discordant result** – a cat which is p27 or low PCR positive, but virus isolation or immunofluorescence negative (for more information see below).
### Type of test

<table>
<thead>
<tr>
<th>Type of test</th>
<th>Examples</th>
<th>What is detected:</th>
<th>Sens</th>
<th>Spec</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELISA</td>
<td>Snap Combo (Idexx, USA) Commercial laboratory tests</td>
<td>FeLV p27 antigen</td>
<td>92%*</td>
<td>97%*</td>
</tr>
<tr>
<td>Rapid Immuno Migration (RIM)</td>
<td>FASTest (Megacor) Speed (BVT, Virbac France) Witness (Pfizer) Anigen Rapid (BioNote)</td>
<td>FeLV p27 antigen</td>
<td>95%*</td>
<td>99%*</td>
</tr>
<tr>
<td>Virus isolation (VI)</td>
<td>Glasgow Veterinary Diagnostic Services (VDS)</td>
<td>Infectious virus</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Immunofluorescence (IFA)</td>
<td>from Glasgow Vet School (VDS) and Vetlab (US)</td>
<td>FeLV antigen is detected in neutrophils and platelets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polymerase chain reaction (PCR)</td>
<td>Glasgow Vet School (VDS) University of Bristol, UK Idexx not recommended because don't give Ct</td>
<td>FeLV proviral DNA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polymerase chain reaction (RT-PCR)</td>
<td>University of Zurich, Switzerland</td>
<td>FeLV RNA in saliva</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Virus neutralising antibody test (VNA)</td>
<td>Glasgow Vet School</td>
<td>VNAs are an indicator of natural immunity to FeLV</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Hartmann et al. 2007

### Interpreting in-house FeLV p27 detecting kit results:

<table>
<thead>
<tr>
<th>Use</th>
<th>Positive result</th>
<th>Negative result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis of cat with thymic lymphoma, leukaemia or severe non-regenerative anaemia</td>
<td>Probably true - continue as if truly FeLV positive</td>
<td>May not be true if test is not sensitive: confirm with PCR; IF or VI. FeLV test in-contact cats</td>
</tr>
<tr>
<td>Diagnosis of cat with vague clinical signs: e.g. pyrexia, anorexia</td>
<td>Confirm by VI, IF or quantitative PCR before proceeding. Test in- contact cats</td>
<td>Possibly true - look for other diagnosis</td>
</tr>
<tr>
<td>Healthy cat pre-vaccine screen</td>
<td>Confirm by VI, IF or PCR. Retest in 12 weeks</td>
<td>Vaccinate. If suspected contact with FeLV positive cat in previous month, retest in 12 weeks</td>
</tr>
<tr>
<td>Routine annual screen of cat breeder’s cats</td>
<td>Probably false positive. Send for VI, IF or PCR</td>
<td>Probably true</td>
</tr>
<tr>
<td>Screen cat of unknown FeLV status for introduction into FeLV negative household</td>
<td>Confirm by VI, IF or PCR. Isolate cat. Retest in 12 weeks</td>
<td>Probably true, provided your test is sensitive enough. If could be in early infection, quarantine from negative cats, and retest in 4 weeks</td>
</tr>
</tbody>
</table>

### FeLV PCR tests

**Key message: cats can have a positive FeLV PCR test and not only not be infectious to other cats, but be actually immune!**

Polymerase chain reaction (PCR) tests can detect either the proviral DNA, or, more recently, viral RNA. For the former, obviously cells are required, (so don’t use a gel blood tube and do use an anticoagulant) the latter allows detection in saliva (only available from the University of Zurich). **Be aware that cats who are not infectious can be positive for proviral DNA by PCR tests and interpret PCR tests with extreme caution.**
### Glasgow and Langford quantitative PCR which detects FeLV proviral DNA

<table>
<thead>
<tr>
<th>qPCR ct values</th>
<th>VI positive</th>
<th>VI negative</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20</td>
<td>18 Elisa + 0 Elisa -</td>
<td>0 Elisa + 0 Elisa -</td>
<td>ct &lt; 20 clearly FeLV positive</td>
</tr>
<tr>
<td>20-25</td>
<td>21 Elisa + 0 Elisa -</td>
<td>8 Elisa + 1 Elisa -</td>
<td>ct 20 – 25 likely FeLV positive</td>
</tr>
<tr>
<td>&gt;25</td>
<td>3 Elisa + 2 Elisa -</td>
<td>4 Elisa + 44 Elisa -</td>
<td>ct 25 – 45 interpret with caution and repeat the tests 4-12 wks later</td>
</tr>
<tr>
<td>&gt;45</td>
<td>1 Elisa + 0 Elisa -</td>
<td>2 Elisa + 356 Elisa -</td>
<td>ct &gt;45 clearly FeLV negative (unless infected within previous 4 weeks before virus gets to bone marrow)</td>
</tr>
</tbody>
</table>

Based on Pinches et al, 2007

---

**Key message**

**Use a laboratory that gives you a QUANTITATIVE FeLV PCR result: not just “positive” or “negative”**

If your laboratory is not giving you a Ct, or some other measure of viral quantity, with your PCR test results, you are mis-diagnosing immune cats as FeLV positive in about 10% of cases.

See appendix 1. for a list of laboratories who provide this service.

---

**Abortive infection (i.e. exposed and recovered / immune cats).** Immediately post infection, the virus replicates in the local lymphoid tissue in the oropharyngeal area. In most adult immunocompetent cats viral replication will be terminated by an effective cell-mediated immune response as early as one week post-infection, with virus neutralising antibodies (VNA) appearing 6-9 weeks post infection (Flynn et al, 2002). Abortive FeLV infection is likely caused when a cat is exposed to low doses of FeLV (Major et al, 2010).

Since viral antigen is necessary to stimulate an immune response, these cats must either be getting exposed to FeLV positive cats in their environment, or by a nidus of FeLV infected cells within their own bodies. Monitoring a household of 26 naturally infected cat, Addie et al, (2000) found persistence of VNA at high levels (titre >32) over a period of 8 years in 2 cats, but in 3 other cats VNAs reduced after the death of the last FeLV positive cat.

No FeLV antigen, viral RNA or proviral DNA can be detected in the blood at any time.

**FeLV tests in abortive infections**

<table>
<thead>
<tr>
<th>FeLV test</th>
<th>Result</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>p27</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Virus isolation</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>PCR (blood wbc)</td>
<td>Negative</td>
<td>(i.e. Ct over 45)</td>
</tr>
<tr>
<td>VNA</td>
<td>Positive</td>
<td>Virus neutralising antibodies are a measure of IMMUNITY! A good VNA titre shows that the cat is FeLV negative, is not infectious to other cats and is immune to FeLV.</td>
</tr>
<tr>
<td>RT-PCR saliva</td>
<td>Negative</td>
<td></td>
</tr>
</tbody>
</table>
Regressive / latent / discordant infection

After initial infection, FeLV spreads systemically through infected mononuclear cells (lymphocytes and monocytes). (Hartmann, 2012) During this stage of infection, cats have positive results on tests that detect free p27 antigen in plasma (e.g. RIM or ELISA). After 3-4 weeks of viremia, bone marrow cells become infected, and infected hematopoietic precursor cells develop into infected granulocytes and platelets that circulate in the body.

Around 10% of cats positive by FeLV PCR are negative for p27 (Miyazawa & Jarrett, 1997; Hofmann-Lehmann et al, 2001; Pinches et al, 2007): this form of discordant result was named regressive infection by Torres et al (2005).

**Definition FeLV discordancy**

Discordant results means conflicting FeLV test results, examples include:
- FeLV p27 positive but virus isolation negative (the commonest discordant result)*
- FeLV PCR positive but p27 negative
- FeLV PCR positive and virus isolation negative
- FeLV PCR positive and virus isolation positive, but p27 negative (i.e. FeLV infected cells which do not release p27 antigen): these cats are progressive infections, not regressive

* FeLV p27 positive but PCR negative is a false positive, not a discordant

In regressive infection, virus replication and viremia are contained prior to, or shortly after, bone marrow infection. (Hartmann, 2012) Regressive infection covers two scenarios: the development of an effective immune response (an immune cat with a good cytotoxic T lymphocyte (CTL) response and a humoral immune response: virus neutralising antibodies (VNA).

The second type of regressor is a cat whose immune system is still battling with the infection, who has virus infected cells, but is not shedding virus in the saliva (so is not infectious to other cats), but has not yet made VNA. This is an intermediate stage between full recovery from infection and solid immunity, and full-blown FeLV infection. These cats have cells containing FeLV provirus - most commonly in the bone marrow - but occasionally elsewhere (e.g. the mammary glands, Pacitti et al 1986), see ‘focal infection’ below. These cats are often referred to as being “latently infected” and if they become immunocompromised - e.g. by use of steroids or cyclosporin – the immune system can no longer contain the infection and infected cells begin to produce virus the course of the FeLV infection becomes progressive. Cats with discordant results should be monitored (i.e. FeLV tested) every 3-6 months to find out if the infection is regressive or has become progressive: regressive infection is associated with low virus load, progressive infection with high virus load. (Hoffmann-Lehmann et al, 2001) Latent infection can sometimes persist for years, although 75% of the cats become p27 and virus isolation negative within 6 months of the first positive FeLV test. (Jarrett, personal communication).

Latently infected / regressor cats should NOT be used as blood donors, since in the absence of the host’s immune response containing the latent virus infection, virus can flare up in the recipient cat. (Nesina et al, 2015)
Key message: 
**Cats who are FeLV PCR positive should NOT be used as blood donors**

In cats who have recovered from FeLV the immune (regressor cats) it is the immune system which is preventing FeLV provirus-positive cells from successfully producing virus: if you remove that immune response by putting the infected cells into a non-immune cat, fulminating FeLV will likely occur. FeLV PCR testing would also be advisable for cats about to receive immunosuppressive treatment (corticosteroids, cyclosporin A, megestrol acetate) in areas with a high prevalence of FeLV.

In cats with **progressive infection**, (formerly called **persistently infected cats or persistent viraemia**) FeLV infection is not contained early in the infection. Thus, extensive virus replication occurs, first in the oropharyngeal lymphoid tissues and salivary glands, followed by the bone marrow and mucosal and glandular epithelial tissues. Progressively infected cats remain persistently viremic. Cats with progressive infection develop FeLV-associated diseases, and 83% will die within 3 years. (Hardy, 1981)

**Focal infections** or atypical infections have been reported in up to 10% of experimentally infected cats. Focal infections or atypical infections may also be observed in natural infections, but are probably rare in the field. (Hartmann, 2012) Focal infections are characterized by a persistent atypical local viral replication e.g., in mammary glands, (Pacitti et al, 1986) bladder, eyes. This replication can lead to intermittent or low-grade production of antigen, and therefore, these cats can have weakly positive or discordant results in antigen tests, or positive and negative results may alternate (Levy et al, 2008).

**Summary**

**FIV**

**Key messages:**
- maternally derived antibody (MDA) persists up to 5 months: therefore kittens can give a positive FIV test but **NOT BE INFECTED**. If you retest at 5 to 6 months of age, most kittens will be negative since mother to kitten transmission is very rare
- at least 4 studies have shown a life expectancy in FIV infected cats at least as good as that of FIV negative cats
- seriously consider whether FIV testing is worth it: will it make a difference to how you proceed with your case?
- the prevalence of FIV is so high in all countries that one more FIV positive cat in the community will make no difference: there is NEVER a justification for euthanasing a healthy cat simply because he or she is FIV positive

**FeLV**

**Key messages:**
- in the UK, Netherlands and Germany, because of the low prevalence of FeLV, around half of all in-house test FeLV positive results will be false positives
- FeLV vaccination will not cause a positive p27 antigen test
- be aware that FeLV PCR positive testing does NOT mean that the cat is
going to die of FeLV, nor does it mean he or she is infectious to other cats: at least
10% of these cats are actually immune
- testing and quarantine can prevent exposure to potentially lethal viruses such
as FeLV
- it is essential to understand which FeLV test is best in different circumstances
- choose your in-house FeLV test on basis of best sensitivity
- use a reference laboratory that gives you some sort of quantitative or a Ct result for FeLV PCR tests

References and further reading

Addie DD., Dennis JM, Toth S, Callanan JJ, Reid S, Jarrett O. 2000 Long-term impact on a
closed household of pet cats of natural infection with feline coronavirus, feline leukaemia virus
and feline immunodeficiency virus. Veterinary Record. 146 419-424

Bęczkowski PM, Litster A, Lin TL, Mellor DJ, Willett BJ, Hosie MJ. 2015 Contrasting clinical


Flynn JN, Dunham SP, Watson V, Jarrett O. 2002 Longitudinal analysis of feline leukemia

stochastic modelling to estimate population risk factors in infectious disease: the example of
FIV in 15 cat populations. PLoS One. 16;4(10) e7377

Goldkamp CE, Levy JK, Edinboro CH, Lachtara JL. 2008 Seroprevalences of feline leukemia
virus and feline immunodeficiency virus in cats with abscesses or bite wounds and rate of


Hardy WD 1981 The Feline Leukemia Virus. JAAHA 17 951-980

Hartmann K, Griessmayr P, Schulz B, Greene CE, Vidyashankar AN, Jarrett O, Egberink HF. 2007 Quality of different in-clinic test systems for feline immunodeficiency virus and feline

Hartmann K. 2012 Feline leukemia virus. Infectious Diseases of the Dog and Cat. 4th edition. Editor: Greene, Craig. Published by W.B. Saunders Elsevier Company, 11830 Westline
Industrial Drive, St. Louis, Missouri 63146, USA. ISBN 978-1-4160-6130-4 108 – 136

Hartmann K. 2012 Clinical Aspects of Feline Retroviruses: A Review Viruses 4, 2684-2710

leukaemia provirus load during the course of experimental infection and in naturally infected


Loong T-W, 2003 Understanding sensitivity and specificity with the right side of the brain BMJ 327:716-719


USEFUL WEBSITES AND CONTACT DETAILS

Dr Diane Addie’s website:  
www.catvirus.com

Diane’s email address: draddie@catvirus.com. Diane is available for coaching of veterinary surgeons: either as one-to-one coaching for FIP / FCoV expert certification, or for general life coaching. Consultations on cases also available.

http://www.youtube.com/user/DrDianeDAddie

Diane’s Twitter name: @FIPvet

Diane’s blog on Steemit: @catvirus

For general searches on any medical condition:  

University of Glasgow Veterinary School Diagnostic Laboratory:  
http://www.gla.ac.uk/schools/vet/cad/

Noah Compendium:  
www.noahcompendium.co.uk/Compendium/Overview/

Hoardings of Animals Research Consortium (HARC)  http://www.tufts.edu/vet/cfa/hoarding

European Advisory Board of Cat Disease (ABCD):  
www.abcd-vets.org (can download the ABCD guidelines and factsheets for free from this site). Full recommendations written so far were published in the July 2009 and 2015 editions of JFMS.

American Association of Feline Practitioners (AAFP):  
www.catvets.com/professionals/guidelines/publications/?Id=323 (can download the AAFP guideline references for free from this site)

FIV information for cat guardians:

Celia Hammond Animal Trust leaflet on FIV is available from catvirus.com:  
www.catvirus.com/downloads.html#Trust%20leaflet%20on%20FIV
Appendix 1

RECOMMENDED VETERINARY LABORATORIES & IN HOUSE TESTS FOR FeLV AND FCoV TESTS

Laboratories which will supply some sort of quantitative measure for FeLV PCR and FCoV RT-PCR are:

1. Veterinary Diagnostic Services, University of Glasgow, UK
2. Diagnostic Laboratories, Langford, Bristol UK
3. Scanelis Laboratoire, Toulouse, France
4. Zurich Veterinary School, Switzerland

Idexx do NOT currently supply a quantitative result (but I am informed that they plan to do so).

Glasgow Veterinary School

<table>
<thead>
<tr>
<th>FeLV immunofluorescence, FeLV virus isolation, PCR and virus neutralising antibody testing; FIV antibody IF and immunoblot:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veterinary Diagnostic Services</td>
</tr>
<tr>
<td>Glasgow University Veterinary School</td>
</tr>
<tr>
<td>Bearsden Rd</td>
</tr>
<tr>
<td>Glasgow</td>
</tr>
<tr>
<td>G61 1QH</td>
</tr>
<tr>
<td>UK</td>
</tr>
</tbody>
</table>

Samples to send:
FeLV, FIV, FCoV antibody: send 1ml heparin blood or serum
FeLV proviral PCR: send 1 ml EDTA blood and 1ml heparin blood
FCoV RT-PCR: send effusion (pleural, ascitic, etc), faeces, mesenteric lymph node fine needle aspirate

Glasgow Veterinary School receives samples from all over the world: you can download a special importation form from their website if sending from abroad

Langford Bristol Veterinary School

<table>
<thead>
<tr>
<th>FeLV PCR with Ct result given. Also FCoV RT-PCR with Ct.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostic Laboratories</td>
</tr>
<tr>
<td>Langford House</td>
</tr>
<tr>
<td>Langford</td>
</tr>
<tr>
<td>North Somerset</td>
</tr>
<tr>
<td>BS40 5DU</td>
</tr>
<tr>
<td>UK</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Samples to send:
FeLV, FIV, FCoV antibody: send 1ml heparin blood or serum
FeLV proviral PCR: send 1 ml EDTA blood and can also test bone marrow, smears, tissues etc
FCoV RT-PCR: send effusion (pleural, ascitic, etc), faeces
Langford offers FIV PCR but for UK clades only: 98% sensitive.
Scanelis Toulouse Veterinary School

FeLV proviral DNA PCR. Also FCoV RT-PCR. Results are expressed in quantities, not Ct

<table>
<thead>
<tr>
<th>Scanelis</th>
<th>Tel: + 33 534 50 50 90</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 allée Charles Cros</td>
<td>Email: <a href="mailto:contact@scanelis.com">contact@scanelis.com</a></td>
</tr>
<tr>
<td>CS 70006</td>
<td><a href="http://www.scanelis.com">www.scanelis.com</a></td>
</tr>
<tr>
<td>31771 Colomiers Cedex</td>
<td></td>
</tr>
<tr>
<td>FRANCE</td>
<td></td>
</tr>
</tbody>
</table>

Scanelis receives samples from France, Spain and Portugal as well as other countries

Zurich Toulouse Veterinary School

FeLV proviral DNA PCR. FeLV RNA RT-PCR. FCoV RT-PCR.

<table>
<thead>
<tr>
<th>Zurich Veterinary School</th>
<th>Tel: +41 44 635 81 11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Laboratory,</td>
<td>Fax +41 44 635 89 06</td>
</tr>
<tr>
<td>University of Zurich,</td>
<td></td>
</tr>
<tr>
<td>Winterthurerstr. 260,</td>
<td>Email: <a href="mailto:rhofmann@vetlabor.uzh.ch">rhofmann@vetlabor.uzh.ch</a></td>
</tr>
<tr>
<td>CH-8057,</td>
<td><a href="http://www.vetlabor.ch">www.vetlabor.ch</a></td>
</tr>
<tr>
<td>Zürich,</td>
<td></td>
</tr>
<tr>
<td>Switzerland</td>
<td></td>
</tr>
</tbody>
</table>

Japan

FeLV proviral DNA PCR. FCoV RT-PCR (but not quantitative).

<table>
<thead>
<tr>
<th>Veterinary Diagnostic Laboratory, Marupi Lifitech, Co, Ltd.</th>
<th>Email: <a href="mailto:takehisa-soma@ah.ds-pharma.co.jp">takehisa-soma@ah.ds-pharma.co.jp</a></th>
</tr>
</thead>
</table>

FCoV RT-PCR: send effusion (pleural, ascitic, etc)

BEST PERFORMING IN HOUSE TESTS

Speed FeLV, FIV and FCoV (Duo and Trio) tests available from your Virbac supplier:

<table>
<thead>
<tr>
<th>Virbac Ltd</th>
<th>Tel.: +44 (0) 1359 243243</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windmill Avenue</td>
<td>Fax: +44 (0) 1359 243200</td>
</tr>
<tr>
<td>Woolpit Business Park</td>
<td><a href="http://www.virbac.co.uk">www.virbac.co.uk</a></td>
</tr>
<tr>
<td>Woolpit</td>
<td></td>
</tr>
<tr>
<td>Bury St Edmunds</td>
<td><a href="mailto:enquiries@virbac.co.uk">enquiries@virbac.co.uk</a></td>
</tr>
<tr>
<td>Suffolk</td>
<td></td>
</tr>
<tr>
<td>IP30 9UP</td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td></td>
</tr>
</tbody>
</table>

Sorry about the UK bias. I contacted Virbac to ask about their representation in the countries of delegates to this webinar and received the following list, but was reminded that not all Virbac products are available in all countries. I guess we’ll have to rely on good old search engines!

Australia - Virbac subsidiary in Sydney
Austria - Virbac subsidiary in Vienna
Canada - Virbac subsidiary in Cambridge (Ontario)
India - Virbac subsidiary in Mumbai
Indonesia - Virbac has a licensed distributor
Jamaica - No direct sales activities
New Zealand - Virbac subsidiary in Hamilton
Pakistan - Virbac has a licensed distributor (small product portfolio)
Portugal - Virbac subsidiary in Lisbon
South Africa - Virbac subsidiary in Johannesburg
Turkey - Virbac has a licensed distributor (small product portfolio)
USA - Virbac subsidiary in Fort Worth
Zimbabwe - Import of Virbac products from South Africa

<table>
<thead>
<tr>
<th>Country</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jamaica</td>
<td>No direct sales activities</td>
</tr>
<tr>
<td>New Zealand</td>
<td>Virbac subsidiary in Hamilton</td>
</tr>
<tr>
<td>Pakistan</td>
<td>Virbac has a licensed distributor (small product portfolio)</td>
</tr>
<tr>
<td>Portugal</td>
<td>Virbac subsidiary in Lisbon</td>
</tr>
<tr>
<td>South Africa</td>
<td>Virbac subsidiary in Johannesburg</td>
</tr>
<tr>
<td>Turkey</td>
<td>Virbac has a licensed distributor (small product portfolio)</td>
</tr>
<tr>
<td>USA</td>
<td>Virbac subsidiary in Fort Worth</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>Import of Virbac products from South Africa</td>
</tr>
</tbody>
</table>

FASTest FeLV, FIV antibody tests are distributed in the UK by

<table>
<thead>
<tr>
<th>Location</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vetlab Supplies</td>
<td>Tel: 01798 874567</td>
</tr>
<tr>
<td>Unit 13 Broomers Hill Park</td>
<td>Fax: 01798 874787</td>
</tr>
<tr>
<td>Broomers Hill Lane, Pulborough, West Sussex, RH20 2RY, UK</td>
<td>e-mail <a href="mailto:info@vetlabsupplies.co.uk">info@vetlabsupplies.co.uk</a></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.vetlabsupplies.co.uk/">www.vetlabsupplies.co.uk/</a></td>
</tr>
</tbody>
</table>

For suppliers in other countries, please contact Megacor: www.megacor.at

FCoV (FIP) antibody Immunocomb tests

<table>
<thead>
<tr>
<th>Details</th>
<th>e-mail: <a href="mailto:Len.Small@Biogal.Co.il">Len.Small@Biogal.Co.il</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact Len Small to find out your local supplier: Len is one of the world's most helpful people!</td>
<td><a href="http://www.biogal.co.il">www.biogal.co.il</a></td>
</tr>
</tbody>
</table>