

AN OWNERS GUIDE TO DIAGNOSIS AND TREATMENT OF CATS INFECTED WITH *TRITRICHOMONAS FOETUS*

Jody L. Gookin, DVM, Ph.D., DACVIM (Internal Medicine)
North Carolina State University
College of Veterinary Medicine
http://www.cvm.ncsu.edu/mbs/gookin_jody.htm

Dave Dybas
HighgaitPaws Abyssinians
Clintondale, New York
<http://www.highgait.com>

Tritrichomonas foetus is an emerging parasite of felines. This guide is a merger of experimental findings, clinical observations, anecdote, and breeder experience from which the authors have attempted to answer the most common questions and to provide practical recommendations to cat owners. Currently, no assurances can be given that following the recommendations in this guide will result in flawless determination of which cats are infected with *T. foetus* nor will it guarantee that *T. foetus* can be eradicated from any given cat or cattery.

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BACKGROUND ON *T. FOETUS* INFECTION

What is *T. foetus*?

Tritrichomonas foetus is a recently recognized parasite in the feline world. It is a single-celled protozoan that likes the warm, moist, and oxygen-deprived conditions inside the feline colon. Testing for this parasite is still not routine at most veterinary clinics. *T. foetus* looks similar to *Giardia* when viewed under a microscope. Therefore, its misdiagnosis as *Giardia* is common. Fecal floats and *Giardia* SNAP tests do not detect *T. foetus*; a *T. foetus*-specific test must be performed to detect it.

Where did *T. foetus* come from?

Tritrichomonas foetus is well known as a venereal infection of bovines (cattle). It was first reported in cats in 1996, where it was found in the intestine and was associated with diarrhea. There is no evidence that feline *T. foetus* came from cattle, in fact, veterinarians don't know how *T. foetus* made its way into the feline population.

How common is *T. foetus* infection?

T. foetus is common in purebred and shelter cats, with no particular breed being over represented. No breed of cat is known to be immune to *T. foetus*. Based on a survey of cats at an international cat show, approximately a third of the purebred feline population may be infected with *T. foetus*. Geographically, *T. foetus* has been found in many countries.

What are the symptoms of *T. foetus* infection?

Infected cats may or may not have observable symptoms. In cats showing symptoms, *T. foetus* causes diarrhea, characterized by cow pie-like stools that are often gassy and malodorous. Sometimes there can be mucus or fresh blood in the stool or feces can dribble from the anus. Several breeders have commented that in symptomatic cats the stool has a very strong and unpleasant odor, i.e. it can drive you from the room or force you to open windows.

How do cats get *T. foetus*? The primary infection pathway is probably the litter box where a well-timed use by two cats can transfer the parasite from the feces of one cat to the paws of another where they later become ingested during grooming. *T. foetus* can live for several days in a wet stool (wet is the key word). Mutual grooming may also transfer the parasite.

How will *T. foetus* affect the health of my cat? Infected cats usually do not have their overall health adversely affected. Therefore, owners of infected cats often ignore the infection since their cats maintain body and coat condition. Unfortunately, such cats remain a source of infection for others. If left untreated, approximately ninety percent of infected cats will stop having diarrhea within two years. However, most of these cats will continue to carry the *T. foetus* organism, possibly for a lifetime. Single cat owners may find this outcome satisfactory if the cat remains healthy in other respects. However, if left untreated the *T. foetus* infection will perpetuate within their cattery and spread to other cats and catteries when kittens are adopted or animals are transported for breeding. Although many cats will eventually resolve their diarrhea, the prolonged presence of the organisms could predispose to development of inflammatory bowel disease later in life, but this has not yet been explored.

Can *T. foetus* infect people? In light of the intimate association between infected cats and their human companions, the potential for zoonotic transmission should be considered. Only a single case of human infection with *T. foetus* appears in the literature. The infection was present in the central nervous system of a man who was immunosuppressed and had undergone a peripheral blood stem cell transplantation.

DIAGNOSIS OF *T. FOETUS* INFECTION

Who should test for *T. foetus*?

Catteries who currently or periodically have cats with bouts of diarrhea and that have passed tests for other parasites such as *Giardia*, Helminths (worms), and Coccidia. Catteries should also consider baseline testing their catteries even if there has been no instances of diarrhea lately. All new cats coming into the cattery should also be tested for *T. foetus*.

How can I tell if my cat has *T. foetus* infection?

There are 3 ways to test for *T. foetus* infection.

- 1. Direct Fecal Smear:** Fresh feces are examined in saline under a microscope for the presence of trichomonads.

Cost – cheapest

Sensitivity – poor; specimen may contain only few *T. foetus* organisms that escape detection. Often falsely-negative if cat is taking any antibiotics.

Skill level – Examiner must be capable of differentiating between similar looking organisms such as *Giardia*. Should be performed by a veterinarian or diagnostic laboratory. A video of *T. foetus* and *Giardia* as observed under the microscope can be viewed at http://www.cvm.ncsu.edu/mbs/gookin_jody.htm.
- 2. Culture:** Voided feces and/or a specimen obtained by a rectal swab or loop is incubated in a growth medium. Included in this medium are antibiotics, which suppress unwanted bacteria growth. The culture is then examined microscopically for the presence of *T. foetus*. The only commercially available culture test kit is BioMed's Feline InPouchTF™ test kit.

Cost – low; \$5-\$8 per culture pouch depending on quantity purchased. Veterinary charges for sample collection, incubation, and examination will vary.

Sensitivity – very good; if *T. foetus* organisms are present their numbers will multiply in the culture over time, increasing the likelihood of their detection. Often falsely-negative if cat is taking any antibiotics.

Skill level – Ability to use a microscope. Since the InPouchTF test is selective, i.e. it will not support similar appearing organisms such as *Giardia* or *P. hominis*, the examiner need not have expertise in organism identification.

Comment – Currently the most user friendly testing method to detect *T. foetus*. Do-It-Yourself testing will lower testing cost considerably. For information on purchase of pouches go to www.biomed1.com.

3. **Polymerase chain reaction (PCR):** This is a molecular biology test that is used to identify trace amounts of *T. foetus* DNA in the feces.

Cost – expensive; \$100 per test depending on the laboratory. This does not include shipping or potential mark-up in price by your veterinarian.

Sensitivity – excellent; can detect both live and dead organisms.

Skill level – expert.

Comments – currently the most sensitive test in detecting infected cats. The sample must be submitted by your veterinarian. Detailed information on sample submission requirements for PCR testing can be found at http://www.cvm.ncsu.edu/mbs/gookin_jody.htm

Important Disclaimer – No diagnostic tests are available that will detect infection 100% of the time. If the test results are positive, the cat has *T. foetus* infection. If the test results are negative, the cat likely does not, but still could have *T. foetus* infection. Importantly, negative test results cannot be used to eliminate the possibility of this infection.

How should I obtain the fecal specimen?

Fecal samples should always be fresh, free of contaminating litter, and kept unrefrigerated prior to testing. If a stool sample is being transported to a veterinary clinic, keep it warm and moist. *T. foetus* organisms perish quickly at temperatures below 60°F or above 105°F. There are three options for obtaining the fecal sample.

Litter box specimen: Use clean litter (preferably non-clumping litter) and isolate cat (e.g. cage) to ensure that the specimen will not be misidentified and/or contaminated by another cat. Avoid using stools that are hours old. The wetter the stool the longer the *T. foetus* will survive outside of the cat's body. Always use the wettest part of the stool from which to extract a specimen. If necessary, sample the interior of the stool if the outside is dry or contaminated. Specimens obtained from dry or semi-dry stools should be avoided, in which case a loop or rectal swab method to gather a specimen should be substituted.

Fecal loop: Use a feline fecal loop to obtain a fecal sample. Unless skilled at using a fecal loop it is recommended that a kitten size loop be used to perform a shallow loop of the cat's rectum. Feces may not be readily available when a smaller loop is used but the loop may gather mucus from the lining of the colon. This is usually sufficient to inoculate a culture pouch. Do not use lubricants containing antiseptics, e.g. K-Y jelly. Use either sterile saline, the liquid media from the pouch or Aplicare Jelly (http://www.aplicare.com/catalog/index.php?cPath=1_103_10304).

Rectal swab: Wet a sterile Q-tip with sterile saline and insert it into the rectum. Fecal material need not be obtained; the lining of the colon is a rich source of *T. foetus* so the mucus gathered by the swab will be sufficient to inoculate a pouch, although insufficient if being submitted for PCR.

*****Note – Serious injury or perforation of the colon can result from improper use of a fecal loop and/or swab. It is highly recommended that you seek training from your veterinarian if planning on performing these procedures on your own.**

Can I test my own cats for *T. foetus*?

Yes. For detailed guidelines for do-it-yourself testing, please see **Appendix A** at the end of this manuscript.

TREATMENT OF *T. FOETUS* INFECTION

Disclaimer – Treatment of *T.foetus* infection should never be undertaken except in cases of confirmed infection and under the informed advisement of your personal veterinarian.

Is there any treatment for feline *T. foetus* infection?

Yes. Ronidazole has been shown to be an effective treatment when administered to cats that were experimentally infected with *T. foetus*.

What is the dose for Ronidazole?

There is no pharmacokinetic information about Ronidazole in cats. The experimental study suggests that 30-mg/kg orally twice a day for 14 days is a reasonable regimen.

Is Ronidazole safe?

Toxicity data have not been published for this drug. However, neurotoxicity has resulting in some cats treated with this drug. The signs include lethargy, inappetence, ataxia (drunken-like behavior), or seizures. These generally resolve if the drug is withdrawn immediately, but can last 1-2 weeks and may require intensive care. Cats need to be monitored closely while receiving ronidazole.

Ronidazole is not FDA approved for use in companion animals. It is currently banned for use in food-producing animals in countries outside of the United States due to human hazards. Due diligence is required for protection of humans from exposure to ronidazole and veterinarians are advised to obtain informed consent prior to use of this drug in cats.

Where can I get Ronidazole?

Veterinarians can write a prescription for ronidazole to be compounded by various pharmacies around the country. A prescription is required. Ronidazole can also be obtained as a 10% active-drug powder used to treat trichomonosis in pigeons. This tastes terrible and is hard to administer to cats in sufficient quantities to be effective. We do not recommend it.

Ronidazole Suppliers:

United States:

Diamondback Pharmacy (866-646-2223)

Roadrunner Pharmacy (877) 518-4589

Westlab Pharmacy (352) 373-8111

Canada:

Haber's Compounding Pharmacy, Toronto, Ontario (416-656-9800)

Formulations available:

Capsules: Preferred, since it is the most accurate method of administering RDZ. Most pharmacies custom fill the capsules to the dose prescribed by your vet. Some pharmacies are now offering an alternative, at a bit lower cost, by offering a range of pre-filled capsules. Your veterinarian selects the amount closest to what he/she wants prescribed.

Liquid: Ronidazole is very bitter so it is difficult to mask its taste. However for those unillable cats out there, a liquid formulation may be the only alternative. The problem with liquid is that the cat has to be able to accept 28 doses of RDZ. If a portion of the dose is spit out, it is very difficult to determine how much was lost. This leaves open the possibility of underdosing.

Can I give Ronidazole to nursing queens or very young kittens (<12-weeks)?

Not recommended. Ronidazole is believed to be passed in the milk and young kittens may be at higher risk for neurotoxicity.

Can I give Ronidazole to pregnant queens?

Not recommended. There is the possibility that ronidazole may lead to birth defects or neurotoxicity in the unborn kittens.

Do I need to do any special disinfection of the cattery?

T. foetus is a fragile organism whose life span outside the body is normally less than an hour although it can live for several days in moist stools. This lack of hardiness is due to the fact that *T. foetus* cannot form a cyst (as can *Giardia*) and does not like the presence of oxygen. If *T. foetus* dries out, if it is refrigerated or if it experiences temperatures above 105°F it will die. Keeping surfaces clean and dry is most important. During treatment, litter should be replaced and boxes disinfected on several occasions to prevent cats from re-infecting themselves with *T. foetus* shed during the treatment period.

APPROACH TO MANAGEMENT OF *T. FOETUS* INFECTION IN THE CATTERY

How can I identify *T. foetus* infected cats from uninfected cats in my cattery?

Repeated testing, performing tests appropriately, and appropriate efforts to isolate infected cats to avoid transmission of the infection or re-infection are essential to efforts to identify all of the infected cats in the cattery.

Here is one possible approach:

- Make sure that all cats to be tested have not received any antibiotics such as Flagyl (metronidazole) for the past 14 days. These types of drugs may temporarily reduce the number of *T. foetus* and cause a false negative test result.

- Isolate cats in which *T. foetus* infection may be suspected, such as those with clinical signs of diarrhea.
- If your facility allows, you may want to divide the initial test group in smaller sub-groups. This will minimize sampling errors and limit the number of possible re-infections if a treatment fails. Cat in any group should be compatible and of the same gender.
- Obtain a test specimen from each cat, in every group and test.

How certain can I be of the *T. foetus* test results?

A positive test result indicates that a cat has *T.foetus* infection. A negative test result can never *prove* that your cat is not infected as no diagnostic test is capable of detecting the infection 100% of the time. Negative test results obtained on multiple occasions builds the strongest case for the absence of *T. foetus* infection in a given cat.

Here are some considerations that may help you evaluate the test results:

- If all cats are tested, no cats test positive, and signs of diarrhea are not present in the cattery, then *T. foetus* infection is unlikely.
- If all cats are tested, no cats test positive, and signs of diarrhea are present in the cattery, retest the cats with diarrhea. Evaluate and recheck the methods used to collect the specimen and perform the test. Consider using a more direct method (e.g. fecal loop or rectal swab) to obtain the specimen for a second test.

Note: If any cats test positive, they should be isolated from the rest of the group. Any cats they were previously in contact with the infected cat are at high risk for also being infected. These other cats should be tested repeatedly for *T. foetus* infection.

How do I get *T. foetus* out of my cattery?

Reinfection with *T. foetus* is a common problem in catteries. Many cats are infected and do not show clinical signs. Thus, treating only the cats with diarrhea or confirmed infection will generally be ineffective unless the treated cats are isolated or removed from the cattery. Once an infection is discovered all cats in the cattery must be tested. Treating all cats in a cattery with ronidazole without a confirming test is problematic as pregnant and nursing queens and very young kittens should not be treated with the drug, the likelihood of toxicity will increase with the larger number of cats that are treated, there is no guarantee that treatment will be effective in all of the cats, and doing so may be cost-prohibitive.

What are the costs of treating *T. foetus*?

Cost considerations are always a factor in multi-cat households. The financial impact of testing and possibly treating many cats are obvious. This may create a temptation to work independently of one's veterinarian. This would be ill-advised. For those interested, information on do-it-yourself testing can be found at the end of this document. Cost of the drug to treat a *T. foetus* infection has dropped markedly in recent months. It would be prudent to price shop the cost at several different compounding pharmacies as pharmacies with a new stock of the drug tend to charge the lowest prices.

Once I complete the drug treatment for *T. foetus*, what should I do next?

Do not assume all cats are cured. Keep the treated cats isolated. Wait at least 14 days before re-testing to allow any persistent effects of the drug to subside. If all test negative, wait another 14 days and perform a second group-wide post treatment test. Periodic testing for this group is recommended. Relapse of infection may happen as long as 20+ weeks after treatment. To avoid reinfection it is advisable to not re-introduce treated cats to the general cattery population.

What should I do if a cat that has been treated breaks with diarrhea?

First, realize that diarrhea in cats is not uncommon but a *T. foetus* infection must be considered as a possible cause. Isolating and testing any cats with diarrhea is highly recommended.

How can I tell if my cat has been cured of *T. foetus* infection?

It is very difficult to prove that a cat has been cured of infection. We recommend that cats be repeatedly tested for *T. foetus* by either culture of feces (most practical) or PCR for follow-up periods of 20 or more weeks after completion of treatment.

What if I have a *T. foetus* infected pregnant female?

Females cannot be treated while carrying or nursing kittens.

What can be done to prevent the kittens of a *T. foetus* infected female from becoming infected? Removing the kittens from the mother at birth is one obvious, but not recommended method. The risk of harm to kittens and mother would probably outweigh the benefits. Another approach, which has worked on several occasions is to place a platform (i.e. roof) over the kitten's litter pan such that the mother is excluded but the kittens have free access. Place the mother's litter pan out of reach of the kittens. Longhair mothers who are symptomatic will require closer monitoring than shorthairs as they may bring fresh feces on their coats back to the kittens. A 'fanny wash' should be performed to prevent this carry-back.

When the kittens are weaned and it is safe to remove the mother, begin treatment of the mother. Begin testing of the kittens if symptoms are observed otherwise wait 14 days after separating the mother to allow for incubation of a possible infection.

APPENDIX A: GUIDELINES FOR DO-IT-YOURSELF TESTING FOR *T. FOETUS* INFECTION

Dave Dybas
HighgaitPaws Abyssinians
Clintondale, New York
<http://www.highgait.com>

Disclaimer – Provision of the following information should not be interpreted as recommending or condoning do-it-yourself testing. Do-it-yourself testing is highly prone to false-negative results. It cannot be used to prove that cats are not infected. Also, it is not unreasonable that other cattery owners, customers purchasing kittens, or veterinarians will be wary of the accuracy of the results of such testing. More credence should be given to finding positive results than to finding negatives.

For do-it-yourself testing, **BioMed Feline InPouchTF™** culture is the most practical. This test makes it feasible to do your own testing and you may gain a large cost savings when compared to diagnostic laboratory-performed tests.

No special skills are needed to detect *T. foetus* in a positive pouch culture. However, positive test results depend on finding live *T. foetus* in the sample, so appropriate care must be taken in obtaining a fresh specimen and maintaining the culture properly. *T. foetus* may be a stubborn adversary inside the body of a feline but it is very fragile outside of these confines so one has to keep *T. foetus* living to prevent the test results from becoming falsely negative.

Precautions: All specimens should be handled in accordance with CDC-NIH recommendations for potentially infectious organisms, BIOHAZARD LEVEL 2. Refer to BioMed Diagnostics instruction brochure, which is shipped with the InPouchTF tests. Additional information on BIOHAZARD LEVEL 2 recommendations can be found at these websites:

<http://bml.od.nih.gov/sect3bsl2.htm> (NIH)

<http://www.cdc.gov/od/ohs/biosfty/bml4/bml4s3.htm> (CDC)

How do I perform an InPouch test for *T. foetus*?

Gather the required equipment

Microscope: Normally three magnification objectives are provided (4X, 10X and 40X), which when combined with the eyepiece lens provide a total magnification of 40, 100 or 400X. Looking for *T. foetus* with the 10X objective (100X magnification) or 40X objective (400X) magnification is best. It is also advisable to select a model that has adjustable illumination (e.g. iris or multi-holed disk). These microscopes, normally described as student microscopes, can be found on Ebay (either new or used) or from other web suppliers (<http://www.microscope-depot.com/seriesM.asp>). Cost: approx. \$100.

Digital thermometer: Indoor/Outdoor thermometers work the best as these come with a

detached temperature sensing element which can easily be placed alongside the pouches. The thermometer should also have a min/max feature. This feature will store the highest and lowest temperatures sensed. This feature will alert the user to temperature excursions that may bias the test results. Acu-Rite makes several styles of these widely available thermometers. Cost \$20-25.

Hint: Prior to performing a test, use this thermometer to locate a consistently warm place in your home where the pouches can be incubated.

Disposable Gloves

Feline InPouchTF cultures: Source: <http://www.biomed1.com/>. Cost \$5-\$8/ pouch depending on quantity purchased. An optional clip is also available to hold the pouch on the microscope for viewing the contents.

Set-up

- Prior to beginning, fully acquaint yourself and any assistants with the biohazards associated with performing this test. Check to make sure all appropriate safety apparel is being worn (see Precautions above).
- Select an area where you can safely obtain the specimen and inoculate the pouch. This area should be cat-free....the last thing you need to have together is an open pouch, a fecal sample, and a curious cat.
- You should have some clean up items such as paper towels, disinfectants, and waste disposal bags available
- Label the pouch with identifying information, e.g. cat's name, date, type of specimen.

Select a method for obtaining a specimen, i.e. litter box, fecal loop or rectal swab. The latter two methods require an assistant and training by your veterinarian. Do not attempt to perform these methods without training and without an assistant.

Obtain the specimen. How much of the specimen should be used to inoculate the pouch is always troublesome as each specimen may contain different levels of bacteria which could negatively effect the performance of the pouch. Specimens obtained by a shallow fecal loop (i.e. using a kitten loop) or by a rectal swab normally don't contain much fecal material. Specimens taken from litter boxes have an abundance of fecal material. Too much fecal material can cause a bacterial overgrowth ruining the test so in most cases where fecal material makes up much of the specimen, less is better. If either a loop or swab is used, only mucus may be retrieved. If there is no fecal material, i.e. only mucus, the entire specimen can then be used to inoculate the pouch. If a fecal specimen is used (e.g. litter box method) limit the size of the specimen to a quantity required to form a 1/8" diameter ball. Alternatively if the stool is watery, dip a Q-tip into the puddle so that only 1/4 -1/2 of the cotton bulb is immersed and use that amount.

Inoculate the pouch. The pouch has two chambers (Fig. 1). Before opening the pouch, squeeze a small amount of liquid from the lower chamber into the upper chamber. This liquid will be used to dilute the specimen. Open the pouch by tearing (see notches in plastic) off the top while using care not to position your hand such that you will push any liquid out of the pouch. Gripping the two short white tabs on the side of the pouch, spread open the top. Insert the specimen and 'rinse off' the specimen's applicator by gently squeezing the sides of the pouch against the applicator with your thumb and forefinger. Remove the applicator and then try to remove as much air as possible while you close the pouch without spilling out the liquid. Fold (roll) the top down (like a tube of toothpaste) to force all of the liquid in the upper chamber through the center passageway to the lower chamber. Secure the folded portion down by folding back the wire ties.

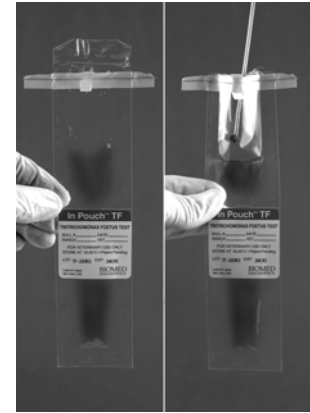


Figure 1

Incubation: Place the pouch on edge in a light tight container (e.g. small box) and keep the temperature between 22°C (72°F) and 37°C (98°F). Keeping the pouches at 37°C (98°F) will reduce the time needed to see a result. The growth rate of the culture is proportional to temperature. However, unwanted bacterial growth is also increased when higher temperatures are used, especially if a fecal specimen is used. If you're willing to accept a few pouch failures for faster results, use the higher temperatures. Otherwise, lower temperatures within the range will also work but the growth rate of the *T. foetus* population will be slower.

Hint: In most homes finding a way to maintain a temperature higher than room temperature without an incubator is difficult. An alternative is to use a naturally and consistently warm location in the home or to use a safe heating source such as a pet warmer. Always monitor the pouch temperature with your thermometer to make sure the pouches remain within the recommended temperature range.

1. Examining the pouch: Remove the pouch from the container carefully so as not to disturb/mix the contents. Before placing the pouch on the microscope's stage note the clarity of the liquid media in the pouch and whether any gas bubbles are present. Unwanted growth in the pouch can cause clouding of the liquid and produce gas. Both usually occur simultaneously, but the clouding of the media appears to be the most detrimental to the validity of the test. Pouches that have become cloudy such that a microscopic examination through the clouded media is impaired should be discarded. The pouch should be examined daily. If *T. foetus* is present in the pouch, it is normally observable within 3 days. Room temperature pouches may take upwards of 12 days. To avoid missing a positive result, it is recommended that the pouch, regardless of incubation temperature, be examined daily for 12 days.

T. foetus organisms are not strong swimmers so they will sink to the bottom of the pouch and collect along the pouch's crease and along and amongst the settled material, e.g. feces. This area is also shallow waters so it makes *T. foetus* easier to find with the microscope.

Place the pouch on the stage of the microscope. **Do not open the pouch, the pouch's contents can be examined through the plastic.** Examine the side of the pouch where the material in the pouch has settled. A good technique is to examine the perimeter of this settled material, especially along the crease side. The settled material gives you an object on which to correctly focus your microscope. This will help you avoid focusing on the plastic surface of the pouch which may have some irregularities that could be misleading. Examine the contents of the pouch using the 10X or 40X lens. The microscope's illumination can be adjusted to suit but often a darker field increases the contrast, making the *T. foetus* easier to see.

Identifying *T. foetus* is relatively easy. After the pouch has incubated for 24 hrs the only independently moving organism in the pouch will be *T. foetus*. You'll often see a flow of the settled material in the pouch caused by the placing of the pouch on the microscope's stage, this is not *T. foetus*. This "other" material will be moving uniformly, typically in a single direction. *T. foetus* organisms will appear like small circular or football shaped 'jitterbuggers' moving in jerky, random, non-uniform patterns.

Note: One or more *T. foetus* organisms is a positive test result.

A video of *T. foetus*, as observed under the microscope, can be viewed at either of the following two website locations:

http://www.cvm.ncsu.edu/mbs/gookin_jody.htm

http://faculty.vetmed.ucdavis.edu/faculty/rhbondurant/t_foetus.mov

A population of *T. foetus* organisms can grow until the pouch media is literally teeming with them. You may only see one or two organisms in the first few days but these will rapidly increase until every part of the pouch seems packed with them.

Verifying the infection: If a positive culture is obtained, do not discard. Your veterinarian will likely want to confirm the infection first-hand before they will be willing to prescribe treatment for your cat.

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