Newsletter 2020

VETERINARY MEDICINE & BIOMEDICAL SCIENCES
TEXAS A&M UNIVERSITY

The Gastrointestinal Laboratory

Promoting Gastrointestinal Health in Companion Animals

Editors: JM Steiner, JA Lidbury, JS Suchodolski, S Read, N Cangelose
Graphic Designer: RM Gold

News from the Gastrointestinal Laboratory at Texas A&M University

Once a year I get the privilege to share with you what has happened at the GI Lab over the last year. I need to start out with some sad news – Nancy Cangelose, our Assistant Laboratory Director retired at the end of December 2019. Those of you who have interacted with her over the years will remember her as the friendly voice of the GI Lab. Nancy made sure that our day-to-day operations ran smoothly, both in research and in service. While we are all a bit sad that Nancy has retired we are all very thankful of her leadership over the years. She very much deserves to have more time for herself and her grandkids.

Along the same lines, our Dean, Eleanor Green, has recently announced that she will be retiring from her position. She has served in this role for almost 10 years and while she is not a direct team member of the GI Lab, she has supported us wholeheartedly during her tenure and the GI Lab would not be what it is today without her determined leadership. We wholeheartedly thank her for all her support and wish her well.

Nancy Cangelose (far left), Sara Read (second from left), George (center), Alison Manchester (second from right), Emily Gould (far right)

Inside this issue:

On to happier news, Sarah Read has rejoined us as our new Assistant Laboratory Director. Sarah served as our Laboratory Manager for several years, before moving to Utah when her husband had to relocate there. We are extremely happy that we were able to lure Sarah back to College Station. She knows the GI Lab well and will be able to continue where Nancy has left off.

Two of our board-certified internists finished their PhD program over the last year and have left our team. Both Sina Marsilio and Yuri Lawrence had been with the lab for several years. Sina's project was aimed at identifying a new minimally-invasive marker that could help differentiate small cell lymphoma and inflammatory bowel disease in cats. While her work did not lead to any markers that will translate into a new diagnostic test her work was groundbreaking in other ways. As part of her studies she evaluated 20 healthy cats from volunteers and found that many of them were positive in clonality testing (PARR), suggesting that, as in humans, the specificity of PARR is low. Sina started a faculty position in internal medicine at UC Davis and we are excited to continue to collaborate with her. Yuri was working on new minimally-invasive markers for the diagnosis of liver disease in dogs. He was able to identify several markers of interest that are now being evaluated in more detail by another graduate student. Yuri has moved into a private practice position in Austin, Texas and we are looking forward to continuing to work with him on some clinical projects. We are proud of both of them for their accomplishments.

We also have some new graduate students, two of whom are board-certified in small animal internal medicine. On occasion you will be able to speak to them on the phone as they provide insight on difficult to diagnose or manage cases through our consultation service. Alison Manchester came to us from Colorado State University, where she completed a residency in small animal internal medicine. Jan Suchodolski will serve as her primary mentor as she works on furthering our understanding of the impact of the intestinal microbiome in patients with gastrointestinal disease. Emily Gould came to us

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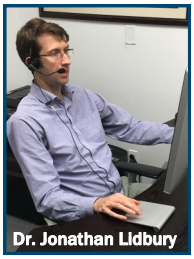
from the University of Tennessee, where she completed a residency in small animal internal medicine and started her PhD. She moved to the GI Lab with her primary mentor, Katie Tolbert, who joined us in 2018. Emily is working on a project to better understand the impact of various acid suppressant medications beyond their effects on gastrointestinal pH in dogs and cats. We feel honored that Alison and Emily have chosen to join us for this next stage of their career as they embark on an exciting career as clinician scientists. Both of them are highly knowledgeable clinicians whom you will love talking to when you have a case that is difficult to manage.

For the last few years I have been updating you on our expansion and remodeling efforts in the GI Lab. Our facilities were built in the 1970s and therefore they needed a little bit more than just a facelift. Last year, we concentrated on building a state-of-the-art histology laboratory. As you can imagine, many of our studies involve histopathology, immunohistochemistry, and fluorescence in-situ hybridization. In the past we were always dependent on outside support for this as we simply did not have the equipment to process our own tissue sections. We have also hired a laboratory manager for our histopathology lab. Kelley Mallet is an extremely skilled histology technician with many years of experience in both human and veterinary medicine who will run our histology lab. With our new state-of-the-art histology laboratory and dedicated staff, we will be able to handle most of our tissue preparation in house. We also work with some of the premiere pathologists in the world to evaluate these tissues sections remotely by use of a high-end slide scanner.

As always, these exciting new developments along with everything else we do would not be possible without your support and patronage. I am looking forward to seeing what 2020 brings! (Jörg Steiner)

Consultants' Corner

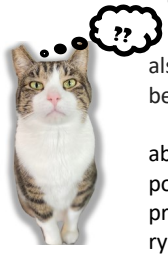

Dr. Jonathan Lidbury

As many of you know the GI lab offers a complimentary consultation service to the veterinarians who use our laboratory. Our team of board-certified internists is comprised of me (Jonathan Lidbury), Jörg Steiner, David Williams, Katie Tolbert, Emily Gould, and Alison Manchester. To set up a consultation, just call the lab at (979) 862-2861 and talk to our customer service representatives. As we all take the consultations in addition to our other clinical, research, and teaching responsibilities, if we are not available to talk to you immediately, our staff will take a message and the consultant on duty that week will call you back. Please give us a 4-hour window during which to call and it can also help to leave an evening number.

We have recently expanded the repertoire of fecal tests that we offer and I would like to take this opportunity to answer some questions that are frequently asked about them.

What organisms are included in your canine and feline enteropathogen PCR panel and when should I order these panels?

Our canine panel includes PCR testing for the *Clostridium perfringens* enterotoxin and net F toxin genes, *C. difficile*, *Campylobacter jejuni*, canine parvovirus, *Salmonella* on enrichment broth, and IFA testing for *Giardia* and *Cryptosporidium*. Our feline panel includes PCR testing for the *C. perfringens* enterotoxin and net F toxin genes, *C. difficile*, *C. jejuni*, feline panleukopenia virus (FPV), *Salmonella* on enrichment broth, *Tritrichomonas foetus*, and IFA testing for *Giardia* and *Cryptosporidium*. Indications for performing these panels include large or small bowel diarrhea that is not self-limiting, especially in young dogs/cats or where more than one dog/cat is affected, as well as for screening of donors before fecal microbiota transplantation (FMT). It is important to remember that several of the organisms and the toxins tested for can be found in the feces of healthy dogs/cats as well as those with diarrhea so the results must be interpreted in conjunction with other clinical information. Please see page 3 for more information.



What is the canine fecal dysbiosis index and when should I order it?

The canine microbiota dysbiosis index (DI) is a PCR-based assay that quantifies the abundance of 8 key bacterial groups from a fecal sample (i.e., *Faecalibacterium, E. coli, Blautia, Streptococcus, Turicibacter, C. hiranonis, Fusobacterium*, and total bacteria). The DI gives us the ability to consolidate the quantitative PCR results for each bacterial group into one single number. Thus, it allows us to assess whether or not the fecal microbiota of an individual dog is broadly similar to that of the majority of healthy dogs. A DI below 0 indicates normobiosis, while a DI of 2 or above indicates fecal dysbiosis. A DI between 0 and 2 is equivocal. It is important to note that dysbiosis often occurs secondary to other conditions, such as, diet-responsive enteropathy, IBD, or EPI in dogs and that an increased (abnormal) DI is not an indication to start any specific therapy such as antimicrobials (tylosin and metronidazole have actually been shown to increase DI in healthy dogs).

As part of the DI we also measure the abundance of *Clostridium hiranonis*, an important beneficial bacterial species that is primarily responsible for conversion of primary to secondary bile acids in the canine gastrointestinal tract. The abundance of *C. hiranonis* will be reported as a secondary interpretation in the comments section of the results form. A low abundance of *C. hiranonis* is associated with lack of conversion of primary to secondary bile acids and dysbiosis. The restoration of normal gut microbiota after FMT is highly correlated with the proper normalization of primary to secondary bile acid conversion due to recolonization with *C. hiranonis*. Therefore, we recommend screening donor dogs for the presence of *C. hiranonis.*

Indications for running a DI include: 1) screening donor dogs before FMT, 2) monitoring changes in the microbiota of canine FMT recipients, and 3) monitoring the recovery of

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GI dysbiosis after antibiotic therapy. As we learn more about the gastrointestinal microbiota of dogs new indications for this novel assay become apparent.

What is the best way to submit specimens for the fecal PCR test described above?

We recommend that, when possible, antimicrobial (and anthelmintic therapies for protozoal agents) are discontinued at least 14 days (ideally 28 days for the canine fecal dysbiosis index) before the fecal sample is collected. Approximately 1 gram of feces (a piece the size of a grape) is needed for these tests and the sample must be free from cat litter as some components of certain types of cat litter may inhibit PCR reactions. Samples must remain cold until receipt in the lab and therefore should be shipped by overnight courier service with frozen gel ice packs. Samples can be stored in the refrigerator over the weekend if you cannot ship by Thursday (our lab personnel are not here on weekends to receive samples).

Are there any special considerations when submitting a sample *Tritrichomonas fetus* PCR testing?

To increase the probability of detecting this organism, the cat should be sampled when it is having diarrhea. The fecal sample can be collected from a spontaneously voided stool, using a fecal loop, or using the colonic saline flush technique. The colonic saline flush technique (http://www.youtube.com/watch?v=JMfZ9M80V8E) and the fecal loop technique may help increase the probability of detecting *T. foetus*. The sediment of the sample of fluid obtained from a colonic saline flush should be separated by centrifugation or allowed to settle and this should be submitted for testing.

If you have any questions or concerns about our consultation service please feel free to contact us.
(Jonathan Lidbury)

Dr. Jörg Steiner Named University Distinguished Professor at Texas A&M University


Dr. Jörg Steiner

We are excited to announce that Texas A&M University has bestowed Dr. Jörg Steiner the title of University Distinguished Professor.

University Distinguished Professors represent the highest level of achievement. They are recognized as pre-eminent authorities in their respective fields, who have made at least one landmark contribution to their discipline, and whose work is widely recognized to have changed the direction of scholarship in the field. Past recipients of the lifetime title participate in the selection process, growing the ranks of Distinguished Professors by just a handful of scholars each year. As a result, there are currently more than 3500 faculty at Texas A&M University and less than 100 have been named University Distinguished Professor since the inception of the program in 1984.

Of particular note is that Dr. Steiner is the first veterinary clinician ever to have been recognized with this title, emphasizing that clinician-scientists can play a role in the field of veterinary research. He has authored or co-authored more than 300 peer-reviewed articles, 100 book chapters, and 450 research abstracts. His seminal contributions to small animal medicine include the development of routinely used diagnostic tests in small animal gastroenterology (e.g., tests for canine and feline pancreatitis and feline exocrine pancreatic insufficiency). As well as directing the Gastrointestinal Laboratory, his other accomplishments include his work with students. He has served as a mentor or co-mentor to more than 75 graduate and veterinary students and residents, many of them who went on to contribute to the field themselves.

His love and passion for the profession and mentoring of his students have directly changed the field, furthering the advancement of veterinary small animal gastroenterology, and thereby improving the quality of life of hundreds of thousands of companion animals. (Jan Suchodolski)

Diagnosis of Enteropathogens in Canine and Feline Fecal Samples

Infectious causes always need to be considered as differential diagnoses for diarrhea. When underlying enteropathogenic bacteria are suspected to be a potential cause of clinical signs, antimicrobial treatment needs to be considered carefully, as most cases are self-limiting and antibiotic treatment may have a negative impact on the intestinal microbiome.

Specific enteropathogens have been associated with GI disease in dogs and cats. However, some of these enteropathogens are commensal organisms in the GI tract and have been isolated at similar frequencies from diarrheic and non-diarrheic animals. This complicates the clinical interpretation when presumptive enteropathogens are identified. Therefore, adjunct laboratory testing for the presence of virulence genes and/or toxins can be helpful in determining the clinical importance of isolated enteropathogens.

A fecal enteropathogen panel is recommended for dogs and cats developing diarrhea after show attendance or kenneling, animals with acute onset of diarrhea in association with evidence of sepsis (which should receive prompt empiric antimicrobial therapy pending results), and in diarrhea outbreaks occurring in more than one pet in the household. The fecal enteropathogen panel is also an important part of screening of potential donors for fecal microbiota transplantation to exclude subclinical infections.

The role of ***C. perfringens*** enterotoxin in

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Diagnosis of Enteropathogens in Canine and Feline Fecal Samples

canine and feline intestinal disease remains controversial. While *C. perfringens* enterotoxin might contribute to GI upset in dogs and cats in rare cases, the recently described *netF* toxin may be of diagnostic importance, as it has recently been strongly associated with acute hemorrhagic diarrhea syndrome (AHDS) in dogs. A positive result of a combination of testing for the *C. perfringens* enterotoxin via ELISA and the enterotoxin gene by PCR is *presumptive* for a diagnosis of *C. perfringens* infection in an animal with no other identifiable cause. A positive result of the netF-toxin gene PCR suggests netF toxin forming *C. perfringens* as the cause of AHDS in dogs with no other identifiable cause. Nevertheless, the management of uncomplicated cases is nonspecific and supportive, as clinical signs are often self-limiting. Only animals that are systemically ill (e.g., evidence of sepsis) should receive appropriate antimicrobial therapy.

Similarly, the role of ***C. difficile*** in canine and feline enteric disease is currently unclear. There is an increasing amount of information suggesting that the organism may be part of the overall microbiota dysbiosis observed in patients with diarrhea rather than being a causative agent. Positive toxin detection by ELISA and concurrent detection of the organism (PCR) are needed for a diagnosis of *C. difficile* enteropathy in an animal with diarrhea and no other identifiable cause. The management of uncomplicated cases is nonspecific and supportive and is chosen on the basis of clinical findings. If *C. difficile* infection is suspected to be antimicrobial-associated, antimicrobial therapy should be stopped if possible. Animals that are systemically ill (e.g., evidence of sepsis) should receive appropriate antimicrobial therapy.

***Campylobacter* spp.** have been found in healthy and diarrheic animals at similar rates. *Campylobacter jejuni* is most commonly suggested as the species causing diarrhea. PCR-based methods allow identification and accurate differentiation of *Campylobacter* spp. that can be especially useful for those species, which are difficult to cultivate. The results must always be considered in light of the patient signalment, history, clinical signs, and exclusion of other causes of diarrhea. Uncomplicated campylobacteriosis is generally self-limiting and resolves with nonspecific and supportive therapy. Only animals that are systemically ill should receive appropriate antimicrobial therapy.

The prevalence of ***Salmonella* spp.** in healthy dogs and cats is similar to that observed in diarrheic animals, which complicates the diagnosis of Salmonella-induced disease. Infection with Salmonella spp. can result in colonization or infection, with disease manifestations ranging from mild self-limiting diarrhea to severe hemorrhagic gastroenteritis and septicemia. Our lab offers a PCR assay after overnight enrichment in a nonselective broth. All specimens that test positive by PCR assay can be cultured (on the clinician's request) using selective enrichment to isolate and identify the infecting organism and to allow antibiotic susceptibility testing. Positive PCR results indicate the presence of Salmonella in feces, not necessarily the presence of salmonellosis. Isolation of Salmonella in an animal with clinical signs consistent with salmonellosis provides a relatively reasonable *presumptive* diagnosis. The management of uncomplicated cases is nonspecific (signs are often self-limiting) and supportive. Animals that are systemically ill (e.g., evidence of sepsis) should receive appropriate antimicrobial therapy.

Tritrichomonas foetus should be on the list of differential diagnoses when evaluating feline patients with diarrhea. In general, kittens and young cats from multi-cat environments with diarrhea should be tested. However, cats in single cat households and older cats can also get the disease, so cats with clinical signs that do not have another obvious cause for their diarrhea should also be tested. PCR has been shown to be the most sensitive diagnostic modality for detecting *T. foetus* in fecal samples. Using rectal flushing or fecal loops may improve sensitivity. During administration of antimicrobial drugs fecal consistency improves and trichomonads may be difficult to detect, but diarrhea containing trichomonads reappears shortly after treatment is discontinued. Hence, any oral antimicrobial agents should be withdrawn for a minimum of several days prior to fecal collection. Ronidazole is the only antimicrobial for which convincing efficacy for treatment of feline *Tritrichomonas* species infection has been demonstrated.

Infections with ***Giardia* spp**. are a common cause of diarrhea in dogs and cats. Younger or immunosuppressed animals and those living in crowded environments are at the highest risk of showing clinical signs of disease. In some animals, especially young animals and those that are immunosuppressed, the organism may cause intermittent chronic diarrhea and a malabsorptive syndrome because of villous atrophy, villous fusion, and inflammation. The use of an immunofluorescence assay (IFA) has been recognized as an excellent tool for the concurrent detection of ***Cryptosporidium* spp**. oocysts and *Giardia* spp. cysts in both canine and feline fecal samples. The assay gives both immunologic confirmation (fluorescence; Figure 1) and morphologic evaluation (size and shape; Figure 2) to confirm the presence of the organism in feces, and so this assay is considered by most to be the gold standard.
(Jan Suchodolski)

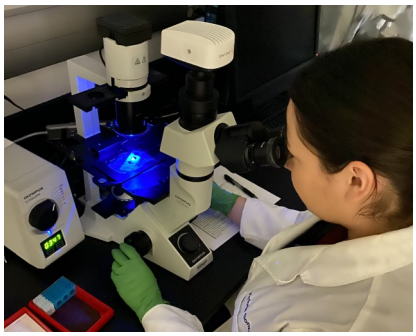

Figure 1. Victoria Gonzalez evaluating *Giardia* and *Cryptosporidium* samples on the inverted microscope.

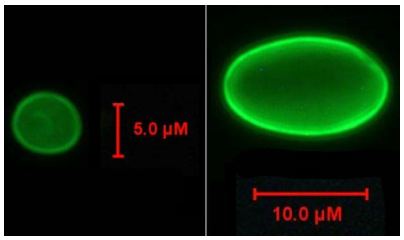

Figure 2. Immunofluorescence assay (IFA) for the detection of *Cryptosporidium* spp. (left) and *Giardia* spp. (right) in feces.

2020 Vet KU - Texas A&M Internal Medicine Conference: Nephrology/Urology

For the past two years we have held the annual Vet KU – Texas A&M University Internal Medicine Conference in Thailand. In 2019 we were joined by over 100 veterinarians from the US and across Asia, and our focus was small animal endocrinology. I am pleased to say that the event was a great success! The lectures were both interesting and informative, the panel discussions were lively and thought-provoking, and I can certainly say that I learned a lot. Staying at the Centara Grand Beach Resort Phuket was a real treat; the facilities were amazing, and the staff was truly hospitable. It was also a great experience to spend time getting to know colleagues from all over the world. The conference was made possible by generous support from IDEXX Laboratories, Nestlé Purina, Nutramax Laboratories, Royal Canin, Dechra, and Haemaru Animal Referral Hospital.

We are very excited to announce the 2020 Internal Medicine Conference in partnership with the Faculty of Veterinary Medicine at Kasetsart University in Bangkok, Thailand. The conference will be held at the family friendly five-star Centara Grand Mirage Beach Resort Pattaya, Thailand between **Monday, September 28th and Friday, October 2nd 2020.** The focus this year will be small animal nephrology and urology. A panel of internationally renowned experts will deliver twenty-five hours of top-quality continuing education.

Our in-depth program focuses on providing you with the latest practically relevant information on renal and lower urinary tract disease in dogs and cats. To this end, several sessions outline a logical diagnostic approach to challenging but common problems, while others will help you formulate better treatment plans. The final hour of each day will be an interactive session, covering complex and controversial topics. Audience participation is very much encouraged, and we anticipate some great discussions. We have been fortunate to recruit four fantastic speakers: Dennis Chew from The Ohio State University, Jonathan Elliott from the Royal Veterinary College, Greg Grauer from Kansas State University, and Jody Lulich from the University of Minnesota. The speakers are excited to talk about your challenging cases and answer your questions throughout the conference. Lectures will run between 8:00 am and 1:10 pm, allowing you free afternoons to enjoy the beautiful venue with your family. Thanks to our generous sponsors, a social program will be offered in addition to the educational program; this will provide an excellent opportunity for you to network and mingle with colleagues from the United States and across Asia.

The conference will be held at the Centara Grand Mirage Beach Resort in Pattaya, Thailand. This exciting family-friendly five-star resort is a "destination in its own right, a place where everyone will find something to amaze and delight. It offers eight dining venues, an award-winning spa, a kids' club, water sports, and an extensive water park." We have negotiated a fantastic rate for conference participants with rooms starting at 4,800 THB (about 160 USD) a night including a buffet breakfast. Please book early as this hotel is very popular! The drive to and from the main airport in Bangkok is easy and convenient and takes approximately one and a half hours. When you make your reservation at the Grand Mirage Centara a representative will be happy to book transportation to and from one of Bangkok's International Airports for you.

Multicultural, vibrant Pattaya lies on the east coast of the Gulf of Thailand and is about 90 miles from Bangkok. The Centara Grand Mirage Beach Resort is 10 minutes to the south of the city with a superb beachfront location offering soft white sands, warm water, and a peaceful setting. Pattaya Beach, the most popular in the area, is close by and offers a wide variety of water sports. The bustle of Central Pattaya with its electrifying nightlife is only a short taxi ride away. Other famous attractions in the area include the beautiful island of Koh Larn, the Pattaya floating market, and the unique ornate Sanctuary of Truth.

For more information and to register for the conference, please visit our conference website (texasimconference.tamu.edu). If you have any other question please feel free to contact our office manager, Lori Kessler (LKessler@cvm.tamu.edu, (979) 458-0732).

We hope that you can join us for what promises to be an unforgettable experience!
(Jonathan Lidbury)

VET KU - TEXAS A&M

Internal Medicine Conference

FOCUS: NEPHROLOGY AND UROLOGY

MONDAY, SEPTEMBER 28TH, 2020 - FRIDAY, OCTOBER 2ND, 2020

Centara Grand Mirage Beach Resort | Pattaya, Chon Buri Thailand

	Before May 15, 2020	May 16 - August 1, 2020	From August 2, 2020
TAMU Faculty and Alumni	$600	$720	$840
General Participants	$750	$900	$1,050

Dr. Dennis Chew
The Ohio State University

Jonathan Elliott
Royal Veterinary College

Dr. Greg Grauer
Kansas State University

Dr. Jody Lulich
University of Minnesota

- Faculty of Veterinary Medicine, Kasetsart University
- Texas A&M University

KU Kasetsart University Faculty of Veterinary Medicine

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Veterinary Medicine & Biomedical Sciences

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Current Studies

Project I Contact Information	Brief Description
Comparison of parenteral and oral cobalamin supplementation Dr. Chee-Hoon Chang chchang@cvm.tamu.edu	This project aims to compare the efficacy of parenterally and orally administered cobalamin supplementation in cats. Cats with cobalamin deficiency for any reason can be enrolled. However, patients cannot have any significant co-morbidities, such as chronic kidney disease. There is no cost to owner for participation other than for any veterinarian office visit fees.
Canine chronic enteropathy study Amanda Blake tamu.gilab@gmail.com	The purpose of this study is to discover non-invasive biomarkers for dogs with chronic enteropathy. Dogs with chronic signs of gastrointestinal disease in which intestinal biopsies have been collected or are planned are eligible for enrollment. The study provides complete bloodwork (including a GI panel), fecal testing, and histopathology interpretation at no cost. Samples can be submitted up to three times (initial presentation and two rechecks).
Treatment trial for canine chronic pancreatitis Dr. Sue Yee Lim slim@cvm.tamu.edu	The aim of this clinical trial is to assess the efficacy of cyclosporine and prednisolone for treating chronic pancreatitis in dogs. Patients will receive prednisolone or cyclosporine for the three weeks of the study at no charge as well as GI panels.
Dietary management for chronic pancreatitis Dr. Floris Droees fdroees@cvm.tamu.edu	The aim of this study is to evaluate the efficacy of an ultra-low fat diet for dogs with chronic pancreatitis. The study will provide the diet free of charge for the duration of the study as well as blood testing.
Feline chronic pancreatitis Dr. Yu-An (Andy) Wu yuanwu@cvm.tamu.edu	The aim of this clinical trial is to assess the efficacy of cyclosporine and prednisolone for treating chronic pancreatitis in cats. Patients will receive prednisolone or cyclosporine for the three weeks of the study at no charge as well as GI panels.
Evaluation of curcumin as a treatment for cats with chronic enteropathy. Dr. Adrian Tinoco Najera atinoconajera@cvm.tamu.edu	The aim of this study is to assess the efficacy of oral curcumin as a treatment for cats with chronic enteropathy. Enrolled patients will receive oral curcumin for three weeks at no charge. The study will also provide blood and fecal testing up to two occasions at no charge.
Trial of a novel hypoallergenic diet for dogs with chronic enteropathy Dr. Alison Manchester amanchester@cvm.tamu.edu	The aim of this trial is to assess the efficacy of a novel hypoallergenic diet as a sole treatment for dogs with chronic enteropathy. Enrolled dogs must have normal serum albumin concentrations. The costs of pertinent diagnostics, recheck visits, and the diet will be covered by the study. Participation involves up to 4 visits to the TAMU Veterinary Medical Teaching Hospital in College Station, TX, over the course of 10 weeks.

Assay Prices

Serum Submissions

Assay	Amount Required	Price
TLI, PLI, Cobalamin, Folate	2.0 ml fasted	$76.00
TLI, Cobalamin, Folate	1.0 ml fasted	$55.00
PLI, Cobalamin, Folate	1.0 ml fasted	$55.00
TLI, PLI	1.0 ml fasted	$55.00
Cobalamin, Folate	1.0 ml fasted	$38.00
TLI	1.0 ml fasted	$29.00
PLI ***Serum PLI (Spec cPL or Spec fPL will be run only within panels or alone as a follow-up test)	0.5 ml fasted	$29.00
Canine C-reactive Protein	0.5 ml fasted	$45.00
Bile Acids	Pre-feeding: 1.0 ml fasted 2 hr post-feeding: 1.0 ml	$18.00 $18.00
Methylmalonic Acid	0.5 ml fasted	$56.00
Gastrin	0.5 ml fasted	$29.00
Triglycerides	0.5 ml fasted	$16.00

Fecal Submissions

Assay	Price
Bacterial Toxin Assay (ELISA) *Clostridium difficile* Toxin A and B *Clostridium perfringens* enterotoxin	$34.00 $34.00
Canine Microbiome Dysbiosis Index	$48.00
Canine Enteropathogen Panel Canine panel includes PCR testing for *Clostridium perfringens* enterotoxin gene, net F toxin gene-*C. perfringens*, *C. difficile*, *Campylobacter jejuni* and coli, canine parvovirus, *Salmonella* spp., and IFA testing for *Giardia* and *Cryptosporidium*	$110.00
Feline Enteropathogen Panel Feline panel includes PCR testing for *Clostridium perfringens* enterotoxin gene, net F toxin gene-*C. perfringens*, *C. difficile*, *Campylobacter jejuni* and *coli*, feline panleukopenia virus (FPV), *Salmonella* spp., *Tritrichomonas foetus*, and IFA testing for *Giardia* and *Cryptosporidium*	$120.00
Real-time PCR Assays *Tritrichomonas foetus, Campylobacter jejuni* and *C. coli, Heterobilharzia Americana,* Canine Parvovirus (CPV-2), Feline Panleukopenia virus (FPV), *Salmonella* spp., Net F toxin gene - *C. perfringens*	First PCR assay $36.00 Each additional $12.00
Immunofluorescence Assay (IFA) *Giardia* and *Cryptosporidium*	$38.00

Gastrointestinal Laboratory

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