



# SHOW THE GUT SOME LOVE: TREATING THE MICROBIOME

Alyssa M. Sullivant, DVM, MS, DACVIM

# GI DISEASE: WHAT'S THE SILVER BULLET

- Diet
  - Helpful for acute enteropathies
  - Curative for FRE
  - Helpful/necessary for IBD
  - Necessary for PLE





# GI DISEASE: WHAT'S THE SILVER BULLET

- Antibiotics
  - Limited indications
  - Disrupts microbiome





## **GI DISEASE: WHAT'S THE SILVER BULLET?**

- **Immunosuppression**
  - **Indicated for IBD/IRE**
  - **GI Lymphoma**



# GI DISEASE: WHAT'S THE SILVER BULLET

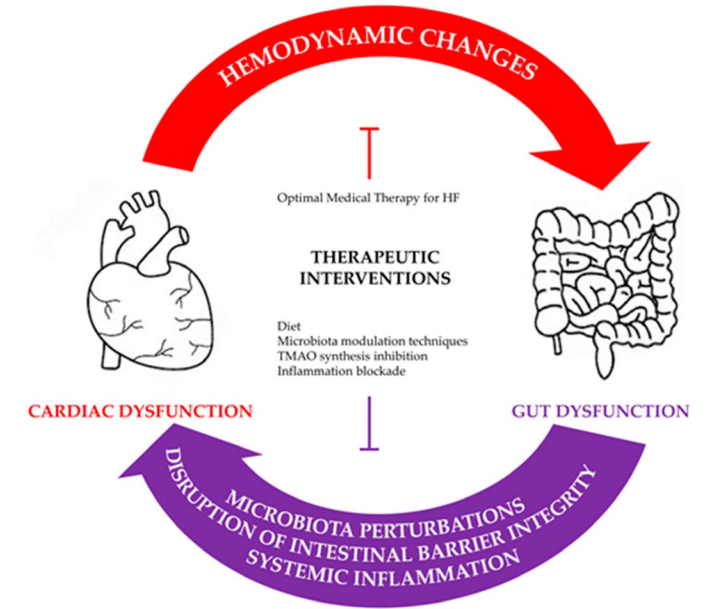
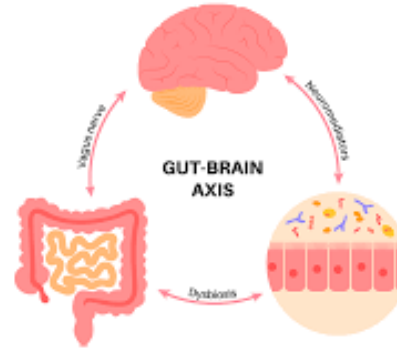
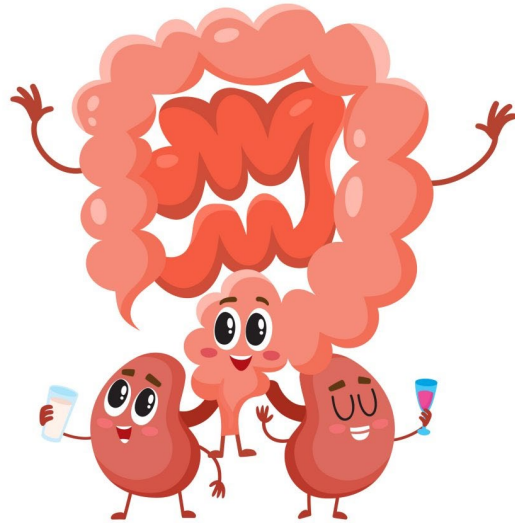
- Microbiome restoration
  - Acute enteropathy
  - ALL chronic enteropathies
  - Chronic pancreatitis



# GI DISEASE: WHAT'S THE SILVER BULLET

- Microbiome restoration
  - Antibiotic-associated diarrhea
  - Stress-associated diarrhea
  - Dysmotility
  - Bile acid diarrhea
  - Glucose regulation
  - Cardiovascular health
  - Dermatological health
  - Urinary health
  - Neurological health

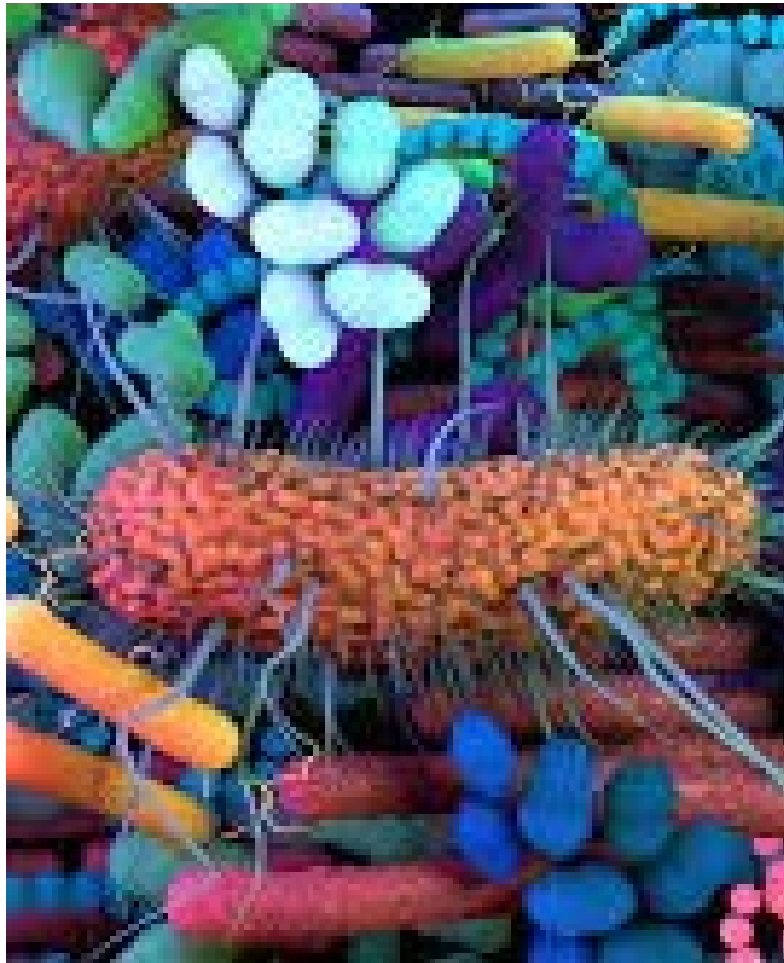




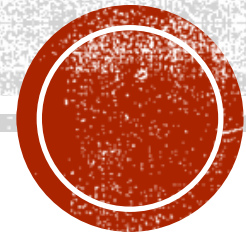
## GUT (INSERT ORGAN SYSTEM) AXIS

- An unhealthy microbiome leads to local and systemic inflammation



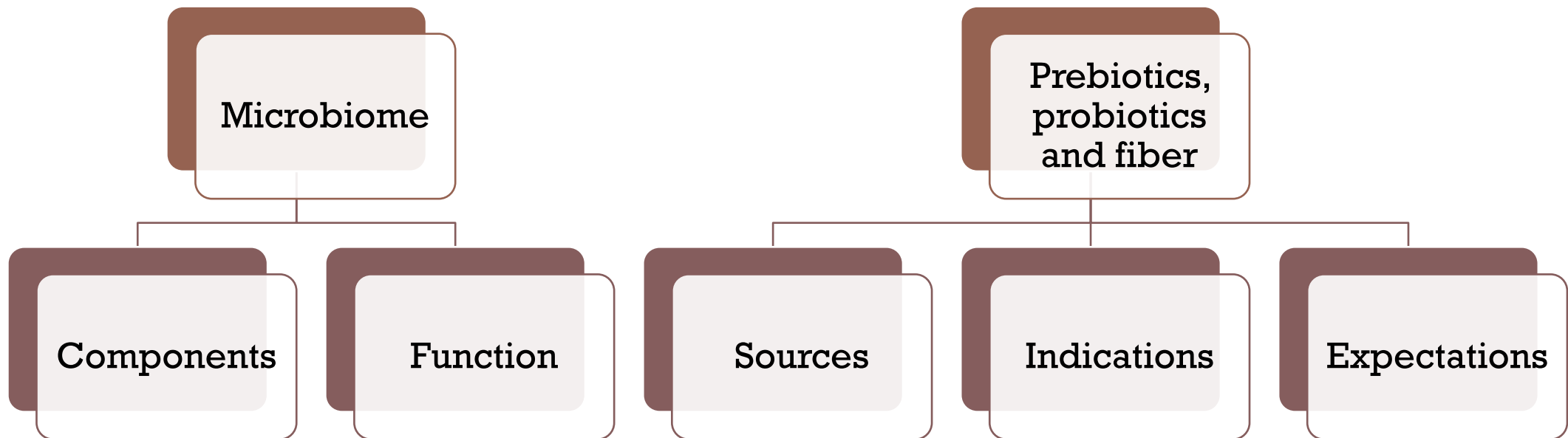


# GI MICROBIOME SUPPORT



# OVERVIEW

---



# THE GI MICROBIOME

- Normal enteric flora of bacteria, yeast, fungi, viruses, protozoa that maintains GI health and function
- Trillions of bacteria
- Mostly anaerobic bacteria



# GI MICROBIOME

---

## Bacteria differ in segments

- Increasing in number from stomach to colon
- Trillions in numbers

## Small intestine: aerobic and anaerobic mix

## Large intestine: anaerobic

- Main site of fermentation of certain dietary substrates by the microbiota



# THE GI MICROBIOME



- Consists mostly of strict or facultative anaerobic bacteria
- Major phyla
  - Firmicutes
  - Bacteroidetes
  - Fusobacteria
  - Proteobacteria
  - Actinobacteria
- Dogs vs cats





# FELINE MICROBIOME

- Less in the literature compared to dogs
- Dominated by Firmicutes, then Proteobacteria, Actinobacteria, Bacteroidetes, and Fusobacteria



# THE GI MICROBIOME

- The microbiome is a metabolic organ
  - Fermentation of dietary molecules
    - CHO's (esp soluble fibers)
    - Proteins
    - Fats
- Production of substances beneficial to health of the the hosts
- Host and immune-system interaction



**POSTBIOTICS**



# FUNCTIONS OF THE MICROBIOME

Modulation of immune

- Production of local
- Differentiation of T<sub>H</sub> precursors
- Epithelial barrier
- Development and maturation of GI immune system

Provision of vitamins and nutrients

- B12, folate, Vitamin K



GI Motility

Fermentation of substrates to produce beneficial  
**POSTBIOTICS**



# POSTBIOTICS (THAT THE GUT LOVES)

- Part of the metabolome
- Produced by the fermentation of carbohydrates (esp. soluble fiber) protein, and fats
- Numerous benefits to the host
  - Immunomodulatory
  - Anti-inflammatory
  - Regulation of gut motility
  - Anti-diarrheic effects
  - Mucin secretion



# POSTBIOTICS THAT THE GUT LOVES



- Short-chain fatty acids (SCFA)
- Indole
- Secondary bile acids
- Neurotransmitters
  - GABA
  - Serotonin





# SHORT-CHAIN FATTY ACIDS

- Acetate
- Propionate
- Butyrate
  - Major energy source of colonocytes



Miller et al. *BMC Veterinary Research* (2023) 19:281  
<https://doi.org/10.1186/s12917-023-03824-9>

BMC Veterinary Research

RESEARCH

Open Access

# Faecal microbiota and fatty acids in feline chronic enteropathy



Julia Miller<sup>1\*</sup>, Paulina Żebrowska-Róžańska<sup>2</sup>, Aleksandra Czajkowska<sup>2</sup>, Bogumiła Szponar<sup>2</sup>, Aleksandra Kumala-Ćwikła<sup>3</sup>, Magdalena Chmielarz<sup>4</sup> and Łukasz Łaczmański<sup>2</sup>

**Results** Both the alpha and beta diversities were significantly lower in samples obtained from cats with chronic enteropathy. The relative abundance of the phylum Proteobacteria, orders Lactobacillales and Enterobacterales, family *Enterobacteriaceae* and genus *Escherichia Shigella* were higher in diseased cats, whereas the abundance of the phylum Bacteroidota and order Peptococcales were higher in control cats. The faecal concentrations of short-chain fatty acids were higher in cats with chronic enteropathy, with lower propionate proportions and higher butyrate proportions.

**Conclusion** The study revealed alterations in microbiota compositions and short-chain fatty acid concentration in cats suffering from chronic enteropathy, which is an important finding both for research on the pathogenesis of the disease and for potential therapeutic interventions in the form of faecal microbiota transplantation and/or probiotic supplementation.



## POSTBIOTICS

- Indole is converted from tryptophan by intestinal bacteria
  - Immunoregulation
  - Anti-inflammatory
  - Mucin gene expression
  - Strengthens tight junction resistance

# POSTBIOTICS



## Secondary bile acids

Bacterial conversion of primary  
bile acids to secondary bile acids



## Neurotransmitters

Serotonin  
GABA





**TABLE 1, VET CLIN PATH  
ANALYSIS OF THE GUT MICROBIOME IN DOGS AND CATS  
VET CLIN PATHOL 2022 FEB: 50**

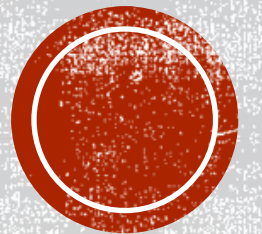


TABLE 1 Contribution of intestinal bacteria to metabolic pathways that influence health and disease

Source	Bacteria involved	Microbial metabolite(s)	Effects on host	
			Beneficial when in normal concentrations	Potentially deleterious when in abnormal concentrations
Dietary carbohydrates	Various (eg, <i>Faecalibacterium</i> , <i>Bifidobacterium</i> )	Fermentation to short-chain fatty acids	Anti-inflammatory properties Improve barrier function Regulate intestinal motility Provide systemic and local energy	Abnormal SCFA ratio can activate virulence factors of enteropathogens (eg, <i>Salmonella</i> invasion genes, <i>Escherichia coli</i> motility)
Primary bile acids from liver	Mostly <i>Clostridium hiranonis</i> in dogs and cats	Transformation to secondary bile acids (BA)	Anti-inflammatory Secondary BA are a major regulator of normal microbiome, also inhibit growth of <i>C difficile</i> , <i>C perfringens</i> , <i>E coli</i>	Increased primary BA can lead to secretory diarrhea
Tryptophan from diet	Various	Indole metabolites	Anti-inflammatory, maintain intestinal barrier function	In increased concentrations cytotoxic, putrefactive indoxyl sulfate acts as uremic toxin
Dietary carnitine and choline	Various (eg, <i>E coli</i> )	Trimethylamine N-oxide (TMAO)	n/a	Altered cholesterol metabolism associated with heart disease



# **DYSBIOSIS**

**A shift or a change in the microbiota that changes its function.**



# DYSBIOSIS

---

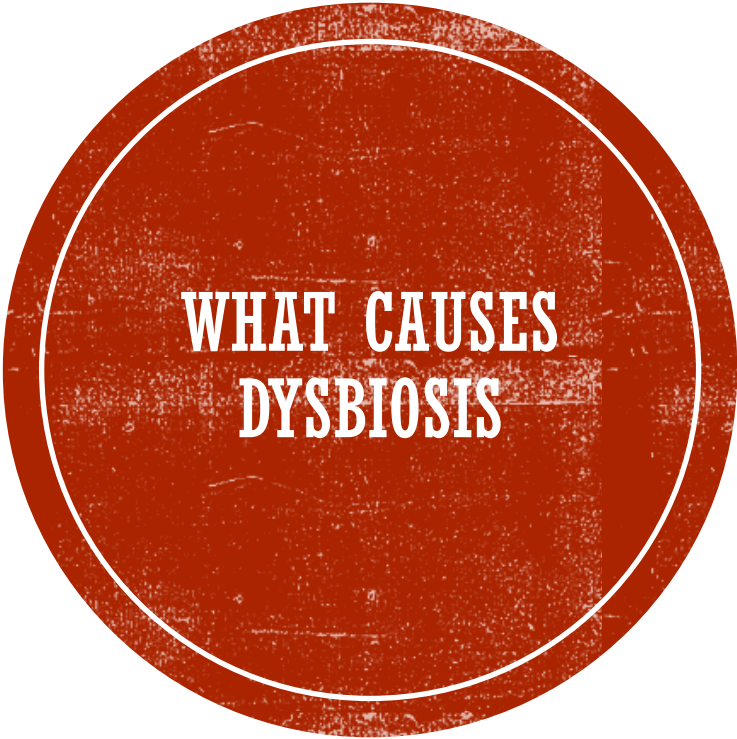
Faecalibacterium,  
Fusobacterium,  
C. hiranonis, Blautia and  
Turicibacter decreased

- i.e. decrease in SCFA producers

Increase in abundance of  
facultative anaerobic  
bacteria of family  
Enterobacteriaceae is  
the hallmark of dysbiosis

- Streptococcus and E coli increased





**WHAT CAUSES  
DYSBIOSIS**



**Antibiotics**

**Proton-pump inhibitors**

**Chemotherapeutics**

**Inflammation**

**Structural changes**

**Maldigestion**

**Decreased perfusion**

**Anorexia**

**Hypomotility**

# WHY DO WE CARE??

Dysbiosis signals an unhealthy GI tract

- Other organ systems are impacted

We want to minimize GI inflammation and dysfunction

Dysbiosis therapy may improve acute and chronic clinical disease

- GI and beyond



# Microbial dysbiosis and fecal metabolomic perturbations in Yorkshire Terriers with chronic enteropathy

Alexandra I. Galler<sup>1</sup>✉, Jan S. Suchodolski<sup>2</sup>, Joerg M. Steiner<sup>2</sup>, Chi-Hsuan Sung<sup>2</sup>, Katharina M. Hittmair<sup>3</sup>, Barbara Richter<sup>4</sup> & Iwan A. Burgener<sup>1</sup>

# Characterization of the fecal microbiome in cats with inflammatory bowel disease or alimentary small cell lymphoma

Sina Marsilio<sup>1,2\*</sup>, Rachel Pilla<sup>1</sup>, Benjamin Sarawichitr<sup>1</sup>, Betty Chow<sup>1,3,6</sup>, Steve L. Hill<sup>3,7</sup>, Mark R. Ackermann<sup>4</sup>, J. Scot Estep<sup>5</sup>, Jonathan A. Lidbury<sup>1</sup>, Joerg M. Steiner<sup>1</sup> & Jan S. Suchodolski<sup>1</sup>

# Effects of metronidazole on the fecal microbiome and metabolome in healthy dogs

Rachel Pilla<sup>1</sup> | Frederic P. Gaschen<sup>2</sup> | James W. Barr<sup>1</sup> | Erin Olson<sup>2</sup> | Julia Honneffer<sup>1</sup> | Blake C. Guard<sup>1</sup> | Amanda B. Blake<sup>1</sup> | Dean Villanueva<sup>1</sup> | Mohammad R. Khattab<sup>1</sup> | Mustafa K. AlShawaqfeh<sup>3</sup> | Jonathan A. Lidbury<sup>1</sup> | Jörg M. Steiner<sup>1</sup> | Jan S. Suchodolski<sup>1</sup>

# Long-term impact of tylosin on fecal microbiota and fecal bile acids of healthy dogs

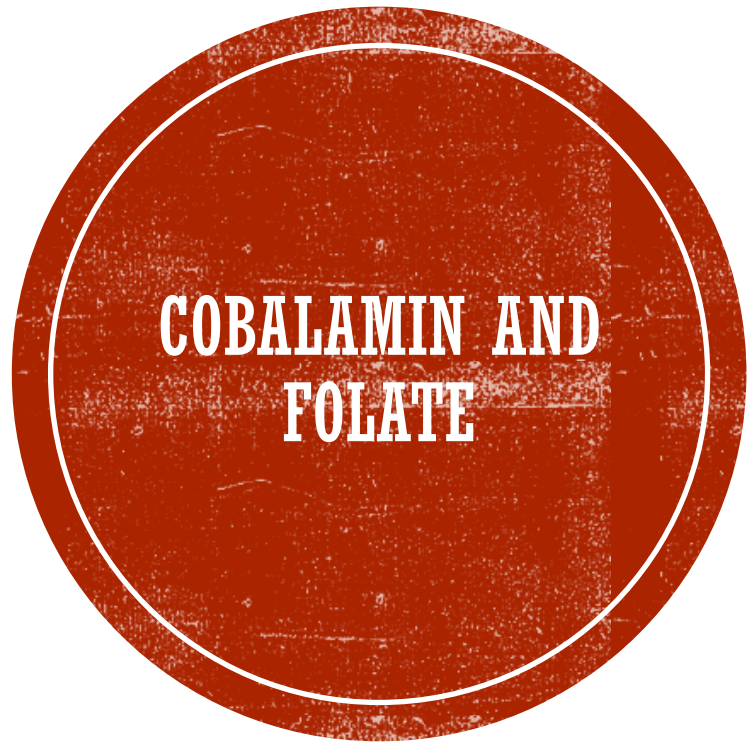
Alison C. Manchester<sup>1</sup> | Craig B. Webb<sup>2</sup> | Amanda B. Blake<sup>1</sup> | Fatima Sarwar<sup>1</sup> | Jonathan A. Lidbury<sup>1</sup> | Jörg M. Steiner<sup>1</sup> | Jan S. Suchodolski<sup>1</sup>



# HOW DO YOU PRACTICALLY ASSESS THE MICROBIOME?

- Fecal smear/cytology?
- Fecal culture?





### Low normal cobalamin

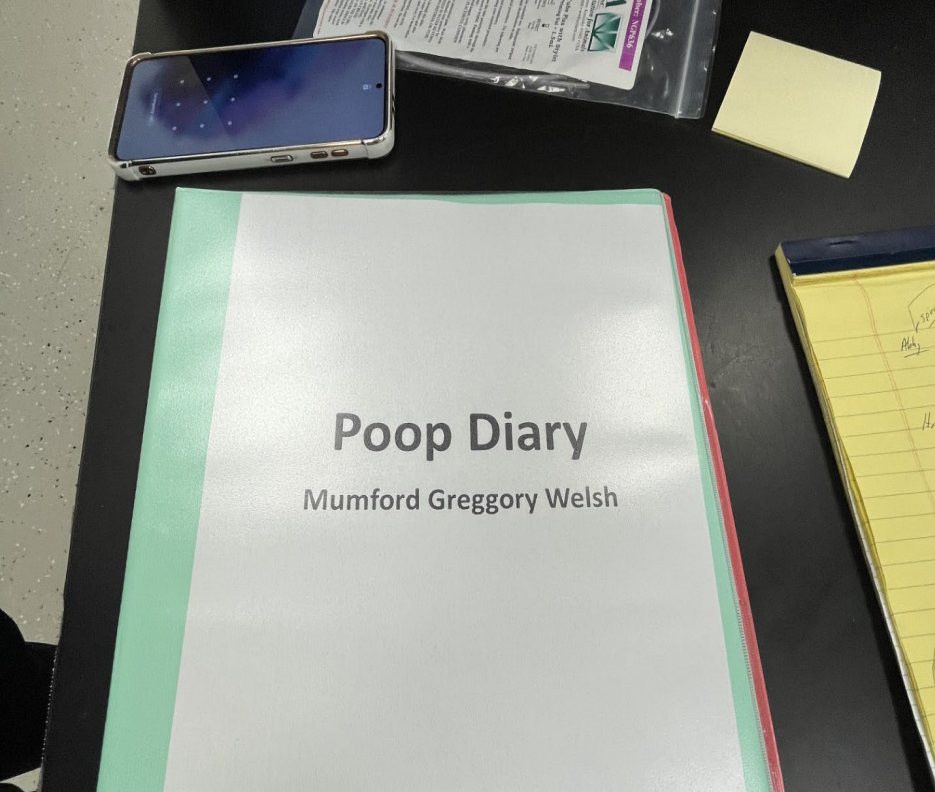
- Malabsorption in the ileum
- Dysbiosis

### Low folate

- Malabsorption in the duodenum
- Dysbiosis

### Increased folate

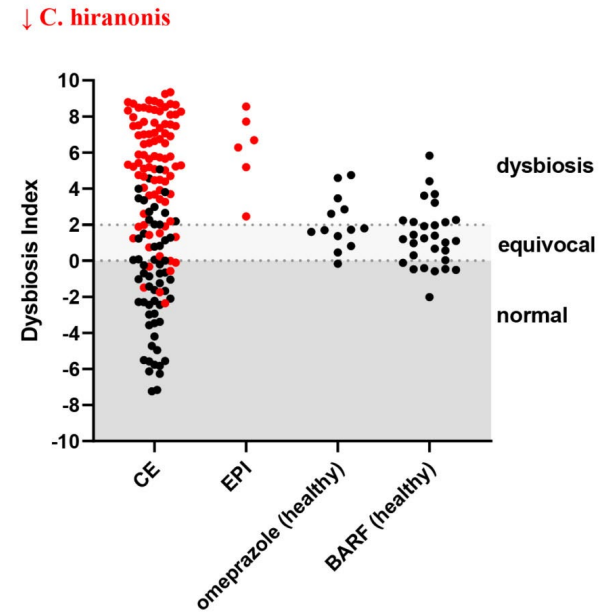
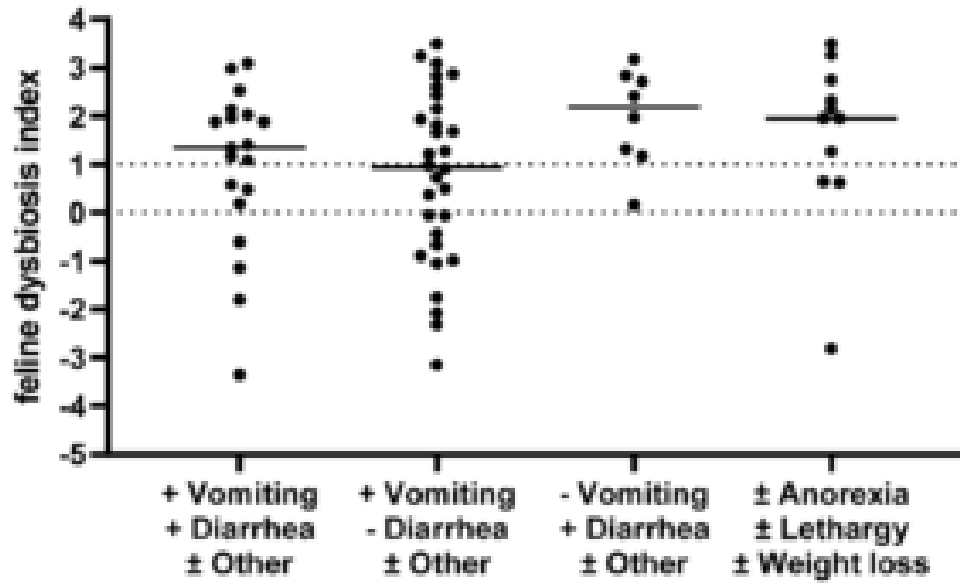
- Dysbiosis



# DYSBIOSIS INDEX

- qPCR approach offered by Texas AM GI Lab
- Mathematical algorithm that denotes the abundance of bacterial taxa and total bacteria
- A higher DI indicates lower microbial diversity
- $DI > 2$  = dysbiosis
- $DI 0-2$  = equivocal/ minor shifts
- $DI < 0$  = “normal” microbial diversity





# CANINE AND FELINE DYSBIOSIS INDEX

- <https://vetmed.tamu.edu/gilab/service/assays/canine-microbiota-dysbiosis-index/>



# REVISITING GI THERAPEUTICS

---



The microbiome influences/determines the health of the GI tract



The microbiome regulates the GI immune system



Treatment of dysbiosis is a strategy for GI disease



A fluffy brown and white cat with blue eyes is sitting on a patterned rug. The cat is looking towards the camera. The rug has a dark blue and black pattern with gold and brown accents. A person's leg in blue jeans is visible on the left side of the frame.

**PUBLIC SERVICE  
ANNOUNCEMENT**

Healthy Microbiome=Healthy Gut





# THERAPEUTIC STRATEGIES

- Diet
- Prebiotics
  - Soluble fiber
    - Fermentation →  
BENEFICIAL POSTBIOTICS
- Probiotics
- Fecal transplantation



# PREBIOTICS

## What are they?

- Non-digestible food substances, **usually SOLUBLE fibers**, that promote the growth and replication of existing beneficial microbiota
- Fermented by the host microbiota
- Yield short-chain fatty acids that nourish the GI tract

## Why should I use them?

- Promotes growth and metabolic activity of healthy microbiome
- Long-lasting effect on the microbiome



# PREBIOTICS

## Sources

**Pectin, FOS, MOS, GOS, fructans, inulin, chicory, lactosucrose, oligofructose, beet pulp, flaxseed, crushed pecan shells, pressed cranberries, citrus pulp**

## Diets

## Synbiotics (Probiotic + Prebiotic)

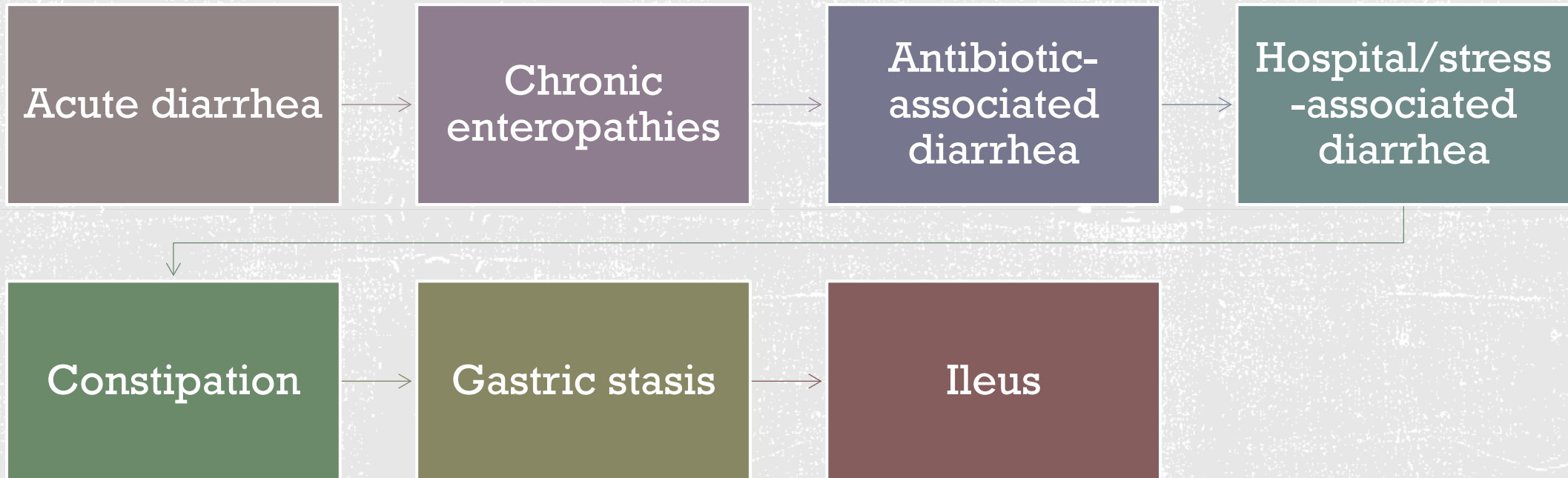
**Provable Forte<sup>®</sup>**

**FortiFlora SA<sup>®</sup>**

**ProPectalin<sup>®</sup>**

## OTC products

# INDICATIONS FOR PREBIOTICS



# PROBIOTICS

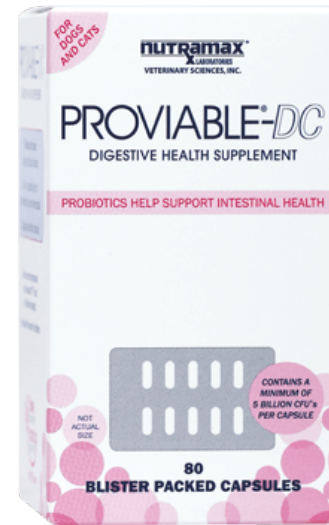
## What are they?

- Live “good” bacteria (or yeast) that are supplemented or added to diets
- Colonizes the gut in 1-2 days
- Give bacterial probiotics 4 hours apart from antibiotics

## Why should I use them?

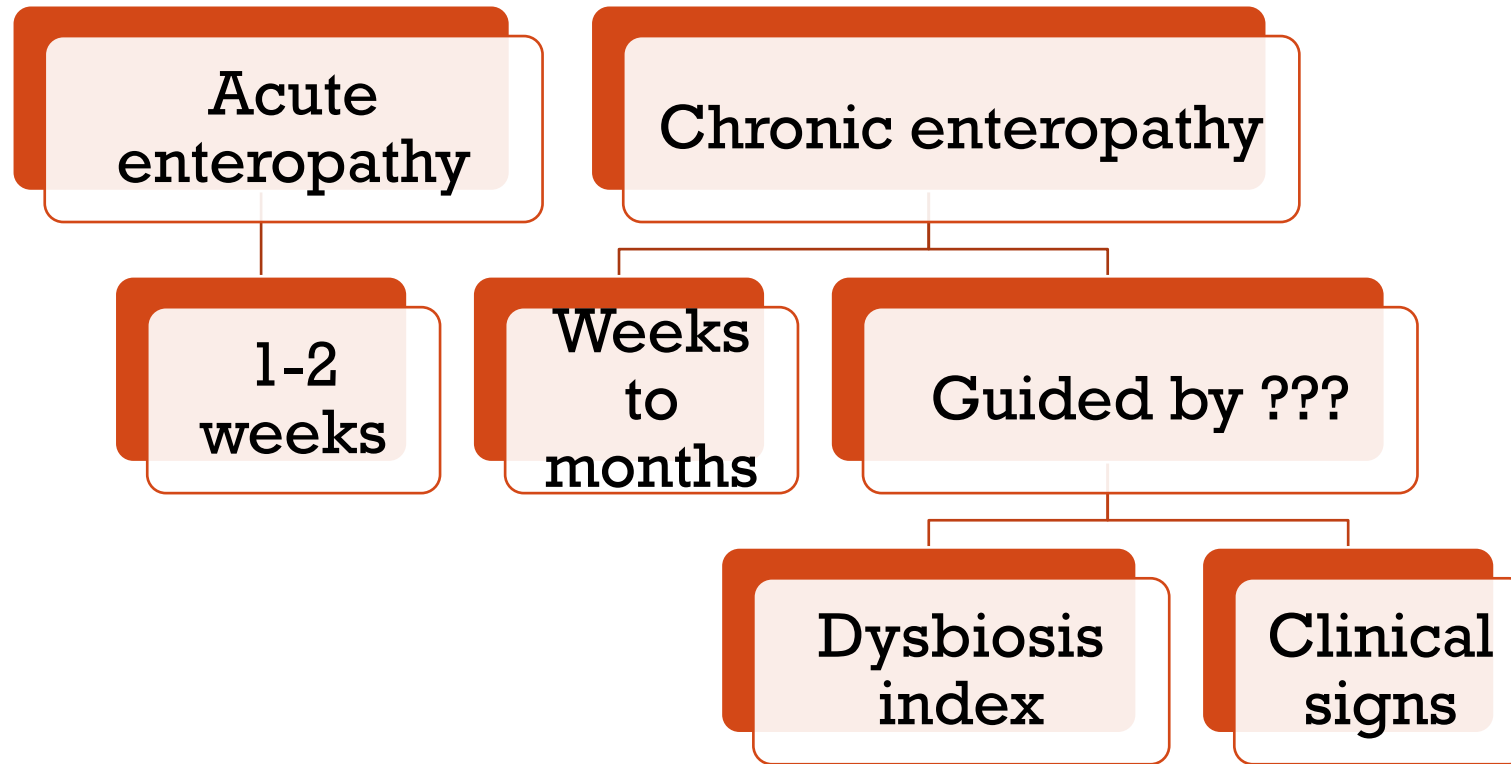
- Confers similar benefits as the healthy microbiota

## How long should I give them?



# DOSING

---



# PROBIOTIC SOURCES

---



Veterinary  
Products



OTC



Diets



# PROBIOTICS: STRAINS AND GAINS

- FortiFlora SA\*: *Enterococcus faecium* ---- 1 x 10<sup>8</sup> CFU/g
- Proviabile Forte\*: 7 strains----- 10 x 10<sup>9</sup> CFU/capsule
- Visbiome Vet: 8 strains----- 112.5 x 10<sup>9</sup> CFU/capsule
- Mycequin\*: *Saccharomyces boulardii*----5 billion CFU/capsule
- Pro-Pectalin\*: *Enterococcus faecium*-----6 x 10<sup>9</sup> CFU / tablet

■ Diets

\*Contains a prebiotic



## Provable®-Forte contains seven beneficial bacteria strains

*Enterococcus  
faecium*

*Streptococcus  
thermophilus*

*Lactobacillus  
acidophilus*

*Lactobacillus  
bulgaricus*

*Lactobacillus  
casei*

*Bifidobacterium  
bifidum*

*Lactobacillus  
plantarum*



## Ingredients per Capsule:

Fructooligosaccharide, gum arabic, gelatin, maltodextrin, dried *Enterococcus faecium* fermentation product, dried *Bifidobacterium bifidum* fermentation product, dried *Streptococcus thermophilus* fermentation product, dried *Lactobacillus acidophilus* fermentation product, dried *Lactobacillus bulgaricus* fermentation product, dried *Lactobacillus casei* fermentation product, dried *Lactobacillus plantarum* fermentation product, magnesium stearate, titanium dioxide, and ascorbic acid.

## Ingredients per Paste:

Soybean oil, kaolin, fructooligosaccharide, gum arabic, pectin, dextrose, sucrose, silicon dioxide, maltodextrin, dried *Enterococcus faecium* fermentation product, dried *Bifidobacterium bifidum* fermentation product, dried *Streptococcus thermophilus* fermentation product, dried *Lactobacillus acidophilus* fermentation product, dried *Lactobacillus bulgaricus* fermentation product, dried *Lactobacillus casei* fermentation product, dried *Lactobacillus plantarum* fermentation product, artificial beef flavor, and ascorbic acid.





# PROVIALE PASTE

- Kaolin
- Pectin
- FOS
- Probiotic strains (7)





## De Simone Formulation

Visbiome® Vet contains the De Simone Formulation, a high potency 8-strain probiotic blend, which has been one of the most widely studied probiotic formulations for humans on the market. New clinical evidence in canines and felines has established that this unique formula yields similar positive benefits in the microbiome of domestic pets.

Genus	Species	Strain Reference Number
Lactobacillus	paracasei	DSM 24733 / SD5218
Lactobacillus	plantarum	DSM 24730 / SD5209
Lactobacillus	acidophilus	DSM 24735 / SD5212
Lactobacillus	delbrueckii subspecies bulgaricus±	DSM 24734 / SD5210
Bifidobacterium	longum†	DSM 24736 / SD5219
Bifidobacterium	infantis†	DSM 24737 / SD5220
Bifidobacterium	breve	DSM 24732 / SD5206
Streptococcus	thermophilus	DSM 24731 / SD5207





## MYCEQUIN: A DIFFERENT TAKE ON PROBIOTICS

- A yeast, *Saccharomyces boulardii*
- 5 billion CFU/capsule
- Contains beta-glucan polysaccharide, a soluble fiber
  - Improves gut immunity
- May be given concurrently with an antibiotic



Acute diarrhea

Chronic enteropathies

Antibiotic-induced diarrhea

Chemotherapy-induced diarrhea

Hospital/stress-associated diarrhea

Constipation

AHDS

Parvovirus

Dysmotility

# INDICATIONS FOR PROBIOTICS

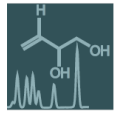




# DOES ANY OF THIS WORK??




- Research has increased
- Controlled prospective trials are ongoing
- Products are improved
- Results are promising





Article

# Effect of a Multistrain Probiotic on Feline Gut Health through the Fecal Microbiota and Its Metabolite SCFAs

Yifei Li <sup>1</sup>, Ilyas Ali <sup>2</sup> , Zhiqi Lei <sup>1</sup>, Yanan Li <sup>1</sup>, Min Yang <sup>1</sup> , Caixia Yang <sup>1</sup> and Lian Li <sup>1,\*</sup> 


**Abstract:** With the increasing awareness of raising pets following scientific methods, people are becoming increasingly more interested in the nutrition and health of pets, especially their intestinal health, which has become a research hotspot. Both *Saccharomyces boulardii* and *Pediococcus acidilactici* are probiotics with strong probiotic properties that can maintain the balance of intestinal flora. However, the role of *Saccharomyces boulardii* and *Pediococcus acidilactici* in felines has not been comprehensively studied to date. The aim of this study is to investigate the effect of multistrain probiotics consisting of *Saccharomyces boulardii* and *Pediococcus acidilactici* on the gut health of felines by modulating gut microbes and the production of metabolite SCFAs. The results show that the multistrain probiotic did not alter the intestinal microbial diversity and structure of short-haired domestic cats, promoted the colonization of beneficial bacteria, increased the levels of microbiota-derived SCFAs and fecal antioxidants, and reduced the levels of fecal inflammatory markers. In conclusion, the use of a multistrain probiotic in healthy, short-haired domestic cats can promote gut health by modulating gut microbes, improving microbiota-derived SCFA production, reducing inflammatory conditions, and improving antioxidant status. These results provide new insights for further exploration of the role of probiotics in the gut microbiome of cats.




*Standard Article*

*J Vet Intern Med* 2017;31:1406–1413

## **Randomized, Controlled, Crossover trial of Prevention of Clindamycin-Induced Gastrointestinal Signs Using a Synbiotic in Healthy Research Cats**

J.E. Stokes, J.M. Price, and J.C. Whittemore 

- 
- **Effects of Concurrent Ronidazole and Probiotic Therapy in Cats with *Tritrichomonas Foetus*-Associated Diarrhoea**
  - *Stephanie M Lalor and Danièle A Gunn-Moore*
  - **Royal (Dick) School of Veterinary Studies, Division of Veterinary Clinical Sciences, The University of Edinburgh, Scotland, UK**



# Comparison of Microbiological, Histological, and Immunomodulatory Parameters in Response to Treatment with Either Combination Therapy with Prednisone and Metronidazole or Probiotic VSL#3 Strains in Dogs with Idiopathic Inflammatory Bowel Disease

Giacomo Rossi<sup>1</sup>, Graziano Pengo<sup>2</sup>, Marco Caldin<sup>3</sup>, Angela Palumbo Piccionello<sup>1</sup>, Jörg M. Steiner<sup>4</sup>, Noah D. Cohen<sup>5</sup>, Albert E. Jergens<sup>6</sup>, Jan S. Suchodolski<sup>4\*</sup>

**Conclusions:** A protective effect of VSL#3 strains was observed in dogs with IBD, with a significant decrease in clinical and histological scores and a decrease in CD3+ T-cell infiltration. Protection was associated with an enhancement of regulatory T-cell markers (FoxP3+ and TGF- $\beta$ +), specifically observed in the probiotic-treated group and not in animals receiving combination therapy. A normalization of dysbiosis after long-term therapy was observed in the probiotic group. Larger scale studies are warranted to evaluate the clinical efficacy of VSL#3 in canine IBD.



Original Article



# Open-label trial of a multi-strain synbiotic in cats with chronic diarrhea

Marcia L Hart<sup>1</sup>, Jan S Suchodolski<sup>2</sup>, Jörg M Steiner<sup>2</sup>  
and Craig B Webb<sup>1</sup>

*Journal of Feline Medicine and Surgery*  
14(4) 240–245  
© ISFM and AAFP 2012  
Reprints and permission:  
[sagepub.co.uk/journalsPermissions.nav](http://sagepub.co.uk/journalsPermissions.nav)  
DOI: 10.1177/1098612X11434386  
[jfms.com](http://jfms.com)  


*Article*

# Microbiome Responses to Fecal Microbiota Transplantation in Cats with Chronic Digestive Issues

Connie A. Rojas<sup>1,2</sup>, Zhandra Entrolezo<sup>3</sup>, Jessica K. Jarett<sup>3</sup>, Guillaume Jospin<sup>3</sup>, Dawn D. Kingsbury<sup>3</sup>, Alex Martin<sup>3</sup>, Jonathan A. Eisen<sup>1,2</sup>, Holly H. Ganz<sup>3\*</sup>

<sup>1</sup> Genome Center, University of California – Davis, Davis, California, USA

<sup>2</sup> Department of Evolution and Ecology, University of California – Davis, Davis, California, USA

<sup>3</sup> AnimalBiome, Oakland, CA, USA

\* Correspondence: Ganz, [holly@animalbiome.com](mailto:holly@animalbiome.com) (corresponding author)



# **RETHINKING FIBER**

**Another way to  
modulate the  
microbiome**

# TYPES OF FIBER

## Insoluble

- Non or poorly fermentable
- Little to no yield of postbiotics
- Promotes motility and bulkier stools

## Soluble

- Usually fermentable
- Yield SCFA and other beneficial postbiotics
- Soluble fibers are PREBIOTICS



# DIETS AND FIBER

Most diets have insoluble or soluble fiber or a mixture of both

Amount of added fiber is also variable

High fiber diets usually have mostly insoluble fiber

Normal: <5% dry matter

Mildly increased: 5-10% dry matter

Moderately increased: 10-15% dry matter

High fiber: 15-30% dry matter





# INTERPRETING FIBER CONTENT IN DIETS

- *Guaranteed Analysis* found on food labels is not helpful for determining how much soluble and insoluble fiber is in the diet
- Crude fiber only considers insoluble fiber
- Total Dietary Fiber provides both insoluble and soluble fiber content

## Dietary fiber aids in the management of canine and feline gastrointestinal disease

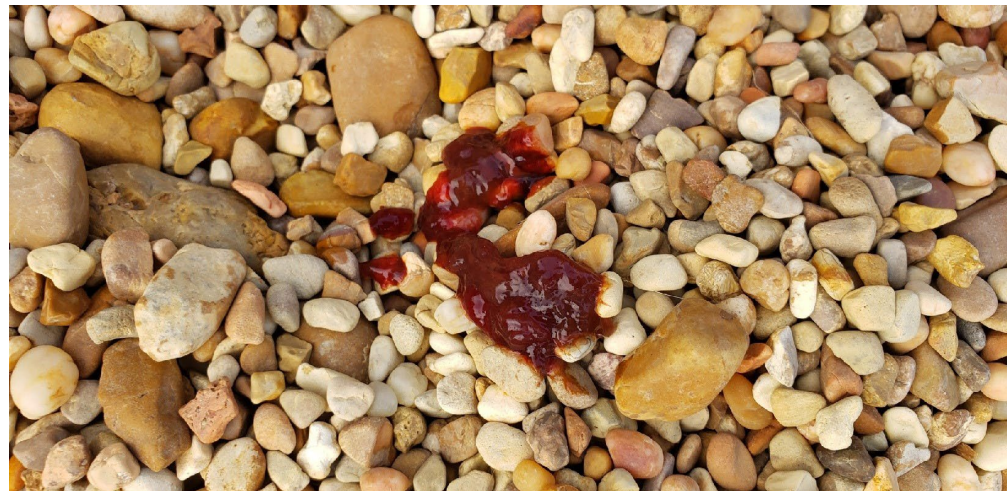
Adam A. Moreno, DVM<sup>1,2</sup>; Valerie J. Parker, DVM, DACVIM (SAIM and Nutrition)<sup>1,2</sup>;  
 Jenessa A. Winston, DVM, PhD, DACVIM (SAIM)<sup>1,2</sup>; Adam J. Rudinsky, DVM, MS, DACVIM (SAIM)<sup>1,2\*</sup>

Dietary Fiber Sources		Solubility		
		High	Moderate	Low
Fermentability	High	Fructose, Galactans, Mannans, Mucilages, Apple pectin, Citrus pulp, Guar gum, Gum arabic, Soy fiber, Apple pomace, Carrot pomace, Citrus pectin		
	Moderate	Pectin, Flaxseed	Grape pomace, Tomato pomace, Pea hulls	Hemicellulose, Beet pulp, Corn bran, Pea fiber, Rice bran, Soy hulls, Wheat brans, Wheat middlings
	Low		Pistachio Psyllium	Hemicellulose, Cellulose, Soy hulls, Peanut hulls, Sunflower hulls



# FIBER TRIALS: RECOMMENDATIONS

- Keep it as a treatment option for GI disease
  - Especially large bowel
  - Especially prebiotic (soluble) fibers
- Consider fiber before trying a GI antibiotic
- Start with a mixture of insoluble and soluble fiber for colitis
- Add fiber slowly to limit diarrhea



# DOSING FIBER

---

Start low and increase dose every 1-2 weeks to avoid adverse side effects/assess response

$\frac{1}{4}$  teaspoon BID to 3 TBS BID, depending on size



# FECAL TRANSPLANTS

Administration of a fecal suspension from a healthy individual into the GI tract of an individual with colonic disease

Goal: reintroduction of a complete, stable microbial community aimed at repairing the disrupted native microbiota to correct underlying microbial imbalances

May need to be repeated multiple times

## Indications:

- Life saving for humans with C.difficile
- IBD
- Antibiotic responsive diarrhea/enteropathy
- Dysbiosis of any cause
- Parvovirus!



# SUMMARY

Knowledge of the microbiome has changed GI medicine

Dysbiosis causes GI inflammation

Microbiome support is a treatment strategy for acute and chronic GI disease





**THANK YOU!!**

- Nutramax
- Audience
- [asullivant@cvm.msstate.edu](mailto:asullivant@cvm.msstate.edu)

