

THE INTERSECTION OF DIET AND BEHAVIOR

Creating Collaborative Care Through Nutrition Conversations



A PANEL DISCUSSION

Nutrition plays an important role in behavior, particularly in cases of chronic or repeated stress, via the gut–brain axis or, perhaps more accurately, the microbiota–gut–brain axis. In this discussion¹ moderated by Dr. Andrew Sparkes and featuring veterinary behaviorist Dr. Julia Albright and Board-Certified Veterinary Nutritionist® Dr. Martha Cline, learn about the pathways involved in this axis; how probiotics, prebiotics, medium-chain triglycerides, and other ingredients can support behavioral and cognitive health; and the importance of feeding management in addressing behavioral feeding issues.



THE GUT–BRAIN AXIS

**Andrew Sparkes, BVetMed, PhD,
Dipl. ECVIM, MANZCVS, MRCVS
(Chair/Moderator)**

Dr. Andrew Sparkes: What is the connection between the gut and behavior?

Dr. Julia Albright: We are learning more every day about what we call the gut–brain axis. It’s a complex, bidirectional communication network between the central nervous system and the enteric nervous system, with input from neural, immune, and endocrine pathways.

What is particularly fascinating is the growing recognition that the microbiome is actively participating in this communication. In fact, in much of the literature, you will see it referred to as the microbiota–gut–brain axis because of how central the microbial population is to these interactions.

The brain and gut communicate constantly to regulate processes like digestion and motility, but this system also influences emotional and cognitive processes. Even basic states such as hunger can affect mood, focus, and behavior.

When there is disruption in this axis, it is not a stretch to connect alterations to behavioral and neurodegenerative conditions including anxiety and cognitive dysfunction. The vagus nerve is an especially important anatomical component of the axis, acting as a major signaling pathway between the gut and brain. It allows signals to travel from the brain to the gut and vice versa.

Stress or emotional states can shift the composition of the microbiota, which in turn affects inflammation and immune function. Beneficial bacteria tend to produce metabolites with anti-inflammatory effects, while deleterious species are associated with pro-inflammatory states. These changes in the microbiota can affect the local intestinal immune system as well as gut barrier integrity.

However, those local effects in the gut can also extend systemically, including through vagal signaling. Some microbial metabolites can even serve as precursors for important neurotransmitters such as serotonin.

Dr. Sparkes: What is intestinal dysbiosis, and how does it fit into this picture?

Dr. Albright: Dysbiosis refers to a disruption in the normal balance or diversity of the microbiota, often with a shift toward less beneficial or more pathogenic organisms.

What is interesting is that dysbiosis is not just a gastrointestinal issue. It has been associated with broader disease processes throughout the body.

Dr. Sparkes: Conversely, how does stress affect the gut–brain axis?

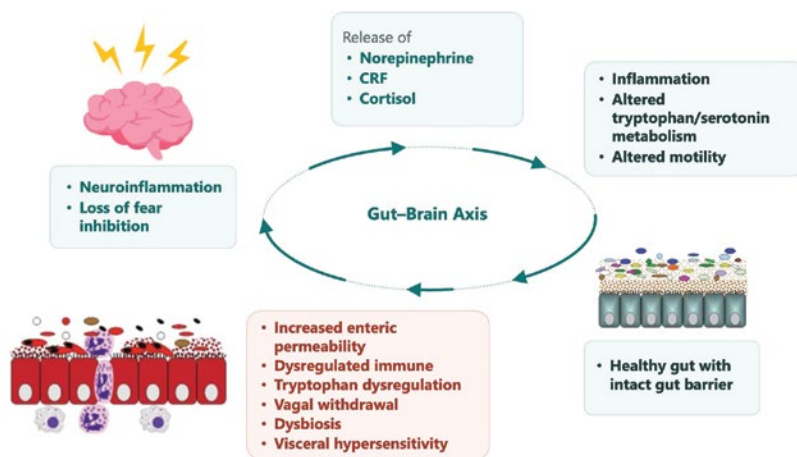
Dr. Albright: Acute stress is a normal physiologic response. Animals and people experience stressors all the time, and the body is designed to respond through activation of the sympathetic nervous system and the hypothalamic–pituitary–adrenal (HPA) axis, resulting in the release of mediators such as norepinephrine and cortisol.

In the short term, that response can alter gut function—causing transient inflammation, changes in motility, and shifts in tryptophan–serotonin metabolism. That is adaptive and normal. It is the “fight or flight” response, where energy is redirected away from digestion.



“The brain and gut communicate constantly to regulate processes like digestion and motility, but this system also influences emotional and cognitive processes.”

Julia Albright, MA, DVM, DACVB



The pathophysiology of chronic stress and the gut–brain axis
(Image courtesy of Dr. Julia Albright)

The problem arises with chronic or repeated stress. This is when we start to see more persistent dysbiosis, increased gut permeability, immune dysregulation, and disruption of normal signaling pathways. Vagal activity is reduced, which means the parasympathetic “rest and digest” influence is diminished. Furthermore, without this counterbalance to the sympathetic system, the stress response can remain persistently overactive, leading to a cycle of ongoing inflammation, visceral hypersensitivity, and changes in neural circuitry related to fear and emotional regulation.

From a research perspective, there is growing interest in whether specific behavioral phenotypes, such as aggression or noise phobia, are linked to particular microbial profiles or microbial metabolites. That said, the evidence is only in dogs, not cats, and is still in the early stages and largely correlational. Methodological differences across studies also make it difficult to draw firm conclusions or apply findings clinically at this stage.

Dr. Sparkes: How do we begin to disentangle cause and effect in these situations?

Dr. Albright: We do not—at least not yet. We are very much in a correlation stage rather than a causation stage.

These associations are interesting and informative, but they are not enough to guide clinical decision-making on their own. For now, the practical takeaway is that these systems interact, and we often need to address them together rather than trying to isolate a single cause.

SUPPORTING BRAIN HEALTH OR BEHAVIOR THROUGH THE GUT

Dr. Sparkes: Can we modulate the microbiome to improve gut health and potentially behavior?

Dr. Albright: There is some evidence to support that. Probiotics—live microorganisms that confer a health benefit—are one approach. We often focus on bacteria, but there are microorganisms beyond bacteria in the intestinal microbiome that may have an effect. When we are specifically targeting effects on mood or behavior, we sometimes refer to these probiotics as psychobiotics.

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Dr. Albright

Prebiotics, which are fermentable fibers that support beneficial bacteria, are another key component. And when you combine prebiotics and probiotics, you get a synbiotic.

Looking ahead, there is also interest in postbiotics—metabolic byproducts of microbes, such as butyrate—as well as fecal microbiota transplantation. These approaches are being explored in gastrointestinal disease and may have broader applications in the future.

Dr. Sparkes: Let us shift to specific ingredients. What supplements or ingredients may support brain health or behavior?

Dr. Martha Cline: I’ll start with probiotics, particularly *Bifidobacterium longum*. This is a genus commonly found in mammals and often considered beneficial due to its low pathogenicity and other health-promoting characteristics, such as short-chain fatty acid production.

Importantly, probiotic effects are strain-specific. For example, the strain BL999 has been associated with anxiolytic effects. In studies, supplementation with this strain has been associated with reduced stress indicators.

In a study of cats, supplementation with *Bifidobacterium longum* strain BL999 was associated with more normal cortisol levels, reduced pacing, and increased social behavior.² In dogs with a history of anxious behaviors, similar supplementation was associated with reductions in stress-related behaviors like barking, jumping, and pacing, along with lower cortisol responses during stress challenges.³ These findings are promising, but again, they are specific to certain strains and study conditions.

Beyond probiotics, we’re also looking closely at prebiotic fibers and polyphenols.

Prebiotics are fibers that are selectively fermented in the large intestine and utilized by beneficial bacteria, conferring a health benefit to the host. Fermentation leads to production of short-chain fatty acids, which can be beneficial from an immunomodulatory standpoint. Prebiotics may cause selective enhancement of beneficial bacteria. There are some models that suggest certain prebiotics may reduce chronic stress and anxiety.

Polyphenols are really interesting in this area. Polyphenols are typically found in fruits and vegetables and can also be found in cereal grains, soy, various beans or other legumes. Their effects can depend on bioavailability, and again, coming from very fiber-rich foods, bioavailability may be affected. Effects would thus be dependent on total amounts in the diet and also bioavailability.

Looking at polyphenols and their effect on the microbiome, research has shown inhibition of pathogenic bacteria—either through bacteriocidal or bacteriostatic events or potentially by stimulating the growth of beneficial bacteria.

However, translating findings from models into clinical practice remains challenging, and this is still an emerging area.

Dr. Sparkes: What about nutrients that support brain function more directly?

Dr. Cline: There are several other functional ingredients to consider.

The brain has a high energy demand, accounting for a substantial portion (~20–25%) of resting energy metabolism. Aging reduces the brain's ability to utilize glucose for energy, even when it is readily available. Reduced glucose metabolism leads to energy depletion and reduced brain cell function.

Medium-chain triglycerides, or MCTs, are metabolized into medium-chain fatty acids, such as octanoic acid and decanoic acid, which are then transported via the portal vein directly to the liver. In the liver, they are metabolized into ketone bodies, which serve as an efficient alternative energy source for the brain. Ketone bodies do not require glycolysis to enter the TCA cycle.

MCTs may support mitochondrial function, reduce oxidative stress, and influence neurotransmission. Clinically, they've been studied in cognitive support, including aging and cognitive dysfunction, as well as in idiopathic epilepsy in dogs.

Dr. Albright: There are ADHD-like behaviors or hyperactivity in dogs that might manifest as excitability, jumping, and chasing items. These behaviors tend to be more common in epileptic canine patients, just as they are in humans. Studies utilizing MCTs have shown improvement in these behaviors along with reduced seizure frequency and intensity.

Dr. Cline: Other relevant nutrients include antioxidants, which help mitigate the increased oxidative stress in the brain, often associated with aging and neurodegeneration. There is evidence that antioxidants may support cognitive function and may even help slow cognitive decline and brain atrophy.

Omega-3 fatty acids—especially DHA—are another key nutrient. DHA plays a structural role in the brain and is essential for development in young animals.

With aging, DHA levels in the brain decline, which may contribute to neurodegeneration and cognitive decline, so supplementation can be particularly relevant in senior patients. Omega-3s also have anti-inflammatory effects, which may be helpful when inflammation or pain is contributing to behavioral changes.

We do need to be mindful of dosage, though, as high levels can sometimes cause gastrointestinal upset.

Another ingredient worth mentioning is alpha-casozepine, a milk-derived compound that interacts with GABA receptors and has been associated with calming effects. One study in cats has demonstrated the potential for this ingredient to reduce anxiety.



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Martha Cline, DVM, DACVIM
(Nutrition)

Dr. Sparkes: What about dietary protein—does that influence behavior?

Dr. Cline: It is a common question. There are some studies suggesting relationships between protein levels and behavior, but the results are mixed.

For example, one study suggested that high-protein diets may be associated with increased aggression in dogs in certain situations. The study also showed that supplementation with tryptophan—a precursor to serotonin—in dogs fed a low-protein diet may have calming effects. So overall not necessarily causal effects, but perhaps some association with diet.

Another large cohort study suggested different behavioral patterns associated with protein intake, but also highlighted significant limitations, including reliance on survey data and lack of standardized behavioral diagnoses.

There are also many confounding factors, such as environment, training, and activity level. For example, high-protein diets may be more commonly fed to working dogs, which could influence behavior independently.

So, clinically, protein is not something I would use in isolation to manage behavior.

Dr. Albright: I would agree. From a behavioral standpoint, as long as the animal is receiving a complete and balanced diet, protein content is not typically a primary focus of mine.

Dr. Sparkes: Is the composition of the diet always the answer?

Dr. Cline: No—and that's why a comprehensive nutritional assessment is so important.⁴ This includes evaluating the animal, obtaining a complete diet history, and discussing feeding management.

Tools like the Purina fecal scoring chart⁵ can help with patient assessment by standardizing communication about gastrointestinal health, which is often subjective for owners. What an owner perceives as “normal” stool for their pet may not actually be ideal. Using the fecal scoring chart helps us communicate consistently about stool quality.

Also part of that complete nutritional assessment is taking a thorough diet history. Diet history forms are available online⁶ and can be completed by the owner prior to the appointment to help make efficient use of appointment time.

Feeding management is another critical piece to explore. For example, when an owner reports that an otherwise healthy pet with good body and muscle condition is a “picky eater,” the underlying issue may be behavioral rather than nutritional. Owners may also unintentionally reinforce food refusal by immediately offering more desirable or high value foods when the pet does not eat.

Over time, this becomes a learned behavior. In those cases, the solution is not changing the diet but changing feeding practices—such as structured feeding times and consistency.

Dr. Albright: Exactly. That is a classic example of operant conditioning, where the owner inadvertently rewards the pet for holding out. At the same time, we do need to rule out medical contributors, such as nausea, that could also lead to reduced food intake.

Dr. Sparkes: What does the future look like in this space?

Dr. Cline: There are definitely opportunities, but we need more robust evidence to move from associations to causation. It is unlikely that there will ever be a single diet or supplement “solution.” Rather, we may see combinations of ingredients with complementary or synergistic effects to address different underlying problems.

Ultimately, behavioral cases require a multimodal approach—integrating nutrition with behavioral interventions and potentially medical management.

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Dr. Cline

Dr. Albright: And I think that is key—there is no quick or easy fix. Supporting overall systemic health provides the foundation for behavioral change.

If an animal is uncomfortable or unwell, it is much harder for them to engage in behavioral modification or learning. Addressing comorbidities helps set them up for success.

FINAL THOUGHTS

Dr. Sparkes: What are your final take-home messages?

Dr. Cline: For me, it is the importance of a complete nutritional assessment—not just the dietary composition, but the whole animal, including environment and feeding practices.

Dr. Albright: And from a behavioral perspective, take a holistic approach. Avoid working in silos, but prioritize what to address first, and build a plan step by step rather than trying to tackle everything at once.

CHAIR/MODERATOR

Andrew Sparkes, BVetMed, PhD, Dipl. ECVIM, MANZCVS, MRCVS, is a leading feline medicine expert. After completing a residency and PhD, he lectured at the University of Bristol. Dr. Sparkes headed the Division of Small Animal Studies at the Animal Health Trust and later served as Veterinary Director of International Cat Care (iCatCare) and International Society of Feline Medicine (ISFM; now the iCatCare Veterinary Society). Founder and co-editor of the *Journal of Feline Medicine and Surgery*, he works as an independent consultant.

PANELISTS

Julia Albright, MA, DVM, DACVB, is an Associate Professor at the University of Tennessee College of Veterinary Medicine. She earned a master’s degree in Experimental Psychology and a DVM from the University of Tennessee, followed by a residency and fellowship in Animal Behavior at the Cornell University College of Veterinary Medicine. Dr. Albright’s current research interests focus on the use of pharmaceuticals and psychoactive dietary supplements to help reduce the effects of acute and chronic stress in companion animals.

Martha Cline, DVM, DACVIM (Nutrition), is Senior Manager for Veterinary Technical Communications at Nestlé Purina PetCare. She earned her DVM from the University of Tennessee (UT), then completed an internship at Oradell Animal Hospital in New Jersey and a residency in Small Animal Clinical Nutrition at UT. She then practiced clinical nutrition full time at Red Bank Veterinary Hospitals in New Jersey until 2021 and continues to provide clinical support there. Dr. Cline is past president of the American Academy of Veterinary Nutrition.

¹ Adapted from the live broadcast of The Intersection of Diet and Behavior, a Purina Institute Creating Collaborative Care Through Nutrition Conversations webinar, available on demand at [Purina Institute Webinar Series 2026](#).

² Davis, H., & McGowan, R. T. S. (2021). Effect of *Bifidobacterium longum* 999 supplementation on stress associated findings in cats with FHV-1 infection. *Journal of Veterinary Internal Medicine*, 35(4), 116, NM01.

³ McGowan, R. T. S., Barnett, H. R., Czarnecki-Maulden, G., et al. (2018, July 12). Tapping into those “gut feelings”: Impact of BL999 (*Bifidobacterium longum*) on anxiety in dogs. *Proceedings of 2018 ACVB Veterinary Behavior Symposium*. Denver, CO, United States, 8-9.

⁴ Learn more from the Purina Institute at [Nutritional Assessment Resources | Purina Institute](#).

⁵ Find it here: [fecal-chart.pdf](#).

⁶ See [screening-evaluation.pdf](#).

For more information and a wealth of pet nutrition resources, visit [PurinaInstitute.com](#) and sign up for scientific communications. By signing up, you'll receive updates on discoveries in nutritional science, free resources to support you in your nutrition conversations with clients, invitations to events, newsletters, and much more from the Purina Institute. [PurinaInstitute.com/Sign-Up](#)

