

Gut Health, Nutrition, and Behavioral Development in Puppies: The Just Behaving Mentorship Model

Background

Early development in puppies is a critical window where health and behavior are deeply intertwined. Recent research in veterinary science has begun illuminating how a puppy's physical well-being—particularly gastrointestinal health—can shape its behavioral outcomes pubmed.ncbi.nlm.nih.gov news.oregonstate.edu. Just Behaving, a mentorship-based puppy-rearing philosophy, posits that raising a calm, emotionally resilient dog requires proactive care of both body and mind from the start. This model emphasizes preventive health practices (robust gut care, nutrition, parasite control) alongside gentle behavioral mentorship, rather than reactive training after problems emerge. By prioritizing a puppy's gut health and routine from birth, Just Behaving aims to “stack the deck” in favor of stable behavior and emotional resilience. Common early-life challenges—such as diarrhea from diet changes or infections with *Giardia* or *Coccidia*—are addressed not just as medical issues but as potential stressors that can impact a puppy's development. The following report integrates scientific insights on the canine gut-brain axis with Just Behaving's approach, outlining a framework for understanding and researching how optimal gut health and nutrition may prevent behavior problems. While focused on puppies raised under the Just Behaving model, these principles have broad relevance to any puppy rearing program that values preventive wellness and mentorship-based socialization.

Gut–Brain Axis Theory in Canines

The canine gut–brain axis is a bidirectional communication network linking the gastrointestinal tract and the nervous system, affecting mood, stress, and behavior.
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The gut-brain axis operates through neural pathways (primarily the vagus nerve), immune signaling, and metabolic and endocrine routes dvm360.com. In dogs as in other mammals, the trillions of microorganisms in the gut (the gut microbiome) play a pivotal role in this cross-talk. These microbes help digest food and synthesize essential nutrients, but they also produce neuroactive metabolites and neurotransmitters that can influence the brain dvm360.com lyka.com.au. For instance, gut bacteria produce γ -aminobutyric acid (GABA), serotonin, dopamine, and others—chemicals crucial for regulating sleep, mood, anxiety, and reward-seeking behavior dvm360.com dvm360.com. A healthy, balanced gut microbiome thus contributes to normal neurochemical levels, whereas disruptions in the microbiome can skew these signals. Scientists have observed that imbalances in gut flora (dysbiosis) are linked to anxiety, aggression, and other behavioral issues in dogs pubmed.ncbi.nlm.nih.gov

news.oregonstate.edu. In one study of shelter dogs, individuals categorized as aggressive had distinct gut microbiome profiles compared to non-aggressive dogs news.oregonstate.edu. While correlation is not causation, such data underscore a clear association between gastrointestinal microbial stability and behavior.

Importantly, the gut influences behavior not only via neurotransmitters but also through the immune system. The canine gut houses a significant portion of the body's immune cells, and gut microbes help “educate” this immune system on what to fight or tolerate justbehaving.com. Chronic gastrointestinal inflammation or infection can trigger the release of pro-inflammatory cytokines that affect the brain and may manifest as behavioral changes. For example, elevated inflammatory cytokines have been linked to increased aggression in dogs dvm360.com. Stress physiology is another pathway: activation of the hypothalamic-pituitary-adrenal (HPA) axis during chronic gut distress (or due to poor nutrition) can lead to heightened cortisol levels, sensitizing dogs to stress and potentially contributing to anxiety-related behaviors dvm360.com. Thus, a cycle can develop whereby stress worsens gut health, and poor gut health in turn impairs stress tolerance. This bidirectional loop means that gut stability is foundational for emotional stability. Indeed, Just Behaving's materials note that a healthy, diverse gut microbiome is “*foundational to a stable digestive system, robust immune function, and overall well-being*”, supporting better mood regulation and reduced anxiety. In puppies, whose developing brains are especially malleable, the gut-brain axis may be even more influential: stable early gut health can set the stage for a more resilient stress response later in life pubmed.ncbi.nlm.nih.gov.

Microbiome Stability and Behavior: A balanced microbiome communicates appropriate signals to the brain, promoting calm behavior and adaptability. Research in rodents has shown that altering the gut bacteria early in life can change levels of fear and stress behaviors dvm360.com dvm360.com. In dogs, emerging evidence suggests similar patterns. One review highlighted that the mammalian gut microbiome, nervous system, and immune system are in continuous communication, and disturbances in gut bacteria composition correlate with canine mental disorders like anxiety or aggression pubmed.ncbi.nlm.nih.gov. Beneficial bacteria may produce more calming or anti-inflammatory compounds (such as short-chain fatty acids like butyrate, which support brain health dvm360.com), whereas dysbiosis might lead to excess toxins or inflammation that heighten a dog's reactivity. A stable microbiome in puppies is thought to contribute to more balanced neurotransmitter levels and a well-regulated HPA axis, making them less prone to over-excitement or prolonged fear responses. Conversely, if a puppy experiences repeated GI upsets (e.g. frequent diarrhea or antibiotic courses that wipe out gut flora), the resulting microbial volatility could predispose it to irritability, poor focus, or difficulty managing stress. This theoretical link is supported by clinical findings: anxious dogs have shown altered gut bacterial populations and even

improvement in anxiety-like behaviors after probiotic supplementation or fecal microbiota transplants dvm360.com dvm360.com. In short, when the gut “second brain” is in balance, the puppy’s emotional brain can function optimally.

Parasites and GI Health: Parasitic infections are an often-overlooked factor that can destabilize the gut and, by extension, behavior. Puppies are especially susceptible to intestinal parasites like *Giardia* and *Coccidia*; these organisms can cause diarrhea, pain, and malabsorption that undermine a puppy’s health during formative weeks. Even subclinical infections (those that don’t cause obvious illness) tax the immune system and may alter the gut microbial mix. The stress and discomfort caused by parasite infestations can translate into behavioral signs: affected puppies might be lethargic, irritable, or less able to concentrate on learning and play due to physical unease. For example, *Giardia* infection commonly leads to greasy, foul-smelling diarrhea, abdominal discomfort, and weight loss in pups petmd.com. Infected puppies often feel “*lethargic and unhappy*”, likely because of the nausea and weakness *Giardia* induces pvecvets.com. Such pups may “shut down” behaviorally or conversely act out due to discomfort. Moreover, inflammation from parasites can increase gut permeability and immune activation, potentially releasing inflammatory mediators that affect the brain’s emotional centers. If not managed, heavy worm burdens can even stunt a puppy’s growth and development vcahospitals.com, which may have cascading effects on brain maturation and behavior. Therefore, parasite management is a critical component of behavioral development: keeping a puppy’s GI tract free of high parasite loads removes a significant source of chronic stress and allows the microbiome to remain balanced. This is why the Just Behaving philosophy treats parasite prevention as paramount to raising a well-adjusted dog, a point expanded in their health and wellness guides justbehaving.com.

Nutrition Quality and the Gut-Brain Axis: Nutrition is the cornerstone that supports the gut, immune system, and brain during puppyhood. High-quality, nutrient-dense diets provide the building blocks for healthy neural development and help maintain an optimal gut environment. In contrast, poor-quality food or erratic feeding can disrupt digestion and microbial balance (for instance, diets with excessive fillers or allergens might provoke GI inflammation or an imbalanced microbiome). A varied diet rich in quality proteins, healthy fats, and fiber sustains a diverse microbiome, which, as noted, is linked to better behavioral outcomes. On the other hand, nutritional deficiencies or monotony can impair a puppy’s physical and cognitive growth. Just Behaving’s dietary philosophy stresses that dogs “*benefit from a varied diet*” and warns that sticking to one food forever is a myth that can reduce microbiome diversity. Nutritional neuroscience supports this: antioxidants, omega-3 fatty acids, and amino acids from a balanced diet all play roles in brain health and neurotransmitter synthesis. For example, dietary tryptophan (from proteins) is needed for serotonin production, and a lack of it could

potentially affect mood. There is evidence in dogs that adding certain nutrients to the diet can reduce behavioral issues – one study found dogs with behavior disorders showed fewer problem behaviors when supplemented with omega-3 fatty acids, magnesium, and zinc dvm360.com, highlighting how closely linked diet and behavior can be. Emotional resilience, the ability to cope with stress and novelty, is bolstered when a puppy's body is well-nourished and comfortable. We can expect a puppy on a consistent, high-quality feeding regimen to have steadier energy levels (avoiding hyperactive spikes or crashes), fewer GI upsets, and thus more capacity to learn and adapt calmly. In summary, the theoretical framework suggests that a puppy with a stable microbiome, protected from GI parasites, and nourished by an excellent diet is biologically primed for optimal behavioral development. This gut-brain axis perspective sets the stage for the preventive strategies used in the Just Behaving model.

Preventive Health and Nutrition in the Just Behaving Model

Just Behaving's approach is grounded in the principle that preventing problems is easier than fixing them – whether those problems are health-related or behavioral. This section overviews how Just Behaving integrates gut health management and nutrition into its puppy mentorship model to support calm, balanced behavior from the outset. The core idea is to cultivate a resilient digestive system and robust immunity in puppies so that they *feel good* physically, which in turn helps them *behave well* emotionally. Key aspects of this approach include the use of probiotics, a high-quality diverse diet, consistent routines, and proactive parasite prevention:

- **Proactive Microbiome Support (Probiotics & Prebiotics):** From the beginning, Just Behaving mentors emphasize seeding and feeding the puppy's gut with beneficial microorganisms. Puppies are given daily probiotics or probiotic-rich foods as part of their diet to introduce helpful bacteria (like *Lactobacillus* and *Bifidobacterium* strains) that can fortify the gut lining and modulate the immune system. For example, introducing a spoonful of plain yogurt or kefir with meals provides natural probiotics, and adding a bit of cooked pumpkin supplies prebiotic fiber that feeds good bacteria. This routine "immune training" of the gut helps puppies develop what the program calls a more "adult-like" gut flora early on. The expected benefit is a digestive tract that is better at fending off disturbances. In fact, the Just Behaving Guide to Puppy Wellness notes evidence that certain probiotic strains can boost a dog's immune responses and even help puppies resist infections like Giardia and Coccidia. By maintaining a healthy microbiome through supplementation, the puppy's gut can recover quickly from stress (such as transitioning to a new home) and is less likely to experience severe dysbiosis. This aligns with published findings that short-term probiotic supplementation can positively affect dog behavior; for instance, 14 days of a *Lactobacillus plantarum* probiotic was shown to improve aggression and anxiety

scores in dogs with behavior issues dvm360.com. Thus, Just Behaving's routine use of probiotics is not just about digestion—it is explicitly aimed at bolstering emotional resilience via the gut-brain axis.

- **High-Quality, Diverse Diet:** Nutrition in the Just Behaving model is approached holistically, with an emphasis on whole, high-quality ingredients and *variety* to ensure complete nutrition. Rather than feeding the same kibble every day, mentors incorporate a rotation of protein sources and added fresh foods (as appropriate for the puppy's age) to broaden the pup's palate and nutrient exposure. For example, a Golden Retriever puppy might primarily eat a premium large-breed puppy kibble, but throughout the week might get boiled chicken or fish, organ meat, or different kibble formulas rotated in, plus extras like yogurt, pumpkin, or blueberries. This diverse diet is one of the “pillars” of Just Behaving's wellness approach. The rationale is that a varied diet leads to a more diverse gut microbiome, which in turn makes the digestive system more adaptable and robust. A rich microbiome can “educate” the immune system by exposing it to many benign microbes and food antigens, potentially reducing sensitivities and improving immune balance. In practical terms, puppies raised this way learn to tolerate different foods, which may prevent stomach upset when diet changes occur later (common when pups go to new homes). It also means they are less likely to become “picky” or fixated on a single food. The Just Behaving *Diet* whitepaper notes that a varied diet helps ensure broad nutrient intake and can prevent the development of food sensitivities or allergies that sometimes arise from monotonous diets. The feeding schedule is also kept consistent – puppies are fed at the same times each day in a calm setting, reinforcing routine and security. Regular meal times not only aid in house-training and digestive regularity but also become a predictable part of the puppy's day, which is behaviorally reassuring. Overall, by fueling puppies with top-quality nutrition and gut-friendly foods, Just Behaving mentors are supporting both the body (steady growth, strong immunity) and the mind (stable energy and neural development) of the pup.
- **Preventive Parasite Management:** A cornerstone of the program is vigilant parasite prevention and control. Just Behaving-raised puppies are routinely screened for intestinal parasites (via fecal exams) and kept in meticulously clean environments to minimize exposure to contaminant feces or dirty water. Hygiene protocols include prompt waste cleanup, sanitizing play areas, and careful monitoring of any loose stool. When parasites are detected, the approach balances effective treatment with gut health considerations. Mentors will treat the puppy to relieve discomfort and prevent environmental spread of the parasite, but they strive to avoid over-treating or unnecessary medications that could disrupt

the developing microbiome. For instance, if a puppy has mild giardiasis with no severe symptoms, the team might weigh the timing of medication, sometimes pausing to retest to ensure the parasite truly needs intervention, rather than administering repeated harsh drugs back-to-back. Any necessary antiparasitic medications (like fenbendazole or ponazuril) are given according to veterinary guidance, and afterwards probiotics or gut-soothing supplements are used to help restore microbial balance. This careful strategy is summed up in their guide: *“we want to relieve the puppy’s discomfort and prevent contagion, but we also want to avoid disrupting the puppy’s developing gut microbiome unnecessarily”*. Additionally, the program educates new puppy owners in preventive measures: avoiding high-risk areas (like dog park puddles) until the pup is older and fully vaccinated, and continuing monthly parasite preventatives as recommended by veterinarians. Interestingly, Just Behaving also recognizes the value of natural immune building against parasites. Under safe conditions, they allow puppies controlled exposure to the outdoors (and the accompanying microbes) once maternal antibodies and initial vaccines offer some protection. This might include supervised play in clean grass or interaction with the mentors’ healthy adult dogs. Such exposure, while adhering to good hygiene (e.g. not letting pups eat unknown feces), can introduce small antigen challenges that stimulate the puppy’s immune system in a beneficial way. The philosophy holds that a pup raised in an overly sterile bubble might actually be more susceptible to illness once it inevitably encounters real-world germs. Therefore, Just Behaving strikes a middle ground: excellent sanitation and quick treatment when needed, but not so sanitized that the puppy’s immune system never learns. They note that if a puppy does contract a mild case of coccidia and recovers, it can emerge with stronger immunity against future infections. By the time these puppies reach adulthood, many will have built up natural defenses, with their immune system having “seen” and learned to manage common pathogens in a controlled way. The end goal is a young dog whose gut is free of parasites and resilient to them, sparing the dog from the physical stress and behavioral regression that often accompany diarrheal illness.

- **Structured Routine and Mentorship:** Though not strictly a “gut health” practice, the broader mentorship model creates a low-stress routine that itself benefits gastrointestinal stability. Puppies in Just Behaving are kept on consistent daily schedules for feeding, play, rest, and training. This predictability and gentle structure reduce random stressors that could trigger stomach upsets (for example, sudden excitement or anxiety can cause stress colitis in dogs). Moreover, the mentors serve as calm parental figures, which helps puppies feel secure. Lower overall stress means lower levels of stress hormones that can disrupt gut motility or microbiota dvm360.com. The puppies also observe and

mirror the calm behavior of adult mentor dogs and humans (instead of being overstimulated). This calm social environment likely contributes to steady appetites and digestion. It's a virtuous cycle: good health supports good behavior, and a calm environment supports good health. The Just Behaving philosophy explicitly ties these pieces together, encouraging owners to notice subtle signs of stress or GI upset early and intervene preventively—*“noticing health stress signs allows you to step in with support (like extra hydration, a calming night routine) before it escalates”*. Such attentiveness ensures that a puppy's minor diarrhea one day doesn't spiral into a week of illness and associated behavior regression; instead, it is quickly managed with both medical care and comfort. By raising puppies in a nurturing, health-focused bubble, Just Behaving expects fewer interruptions in training (since the pups rarely have long bouts of sickness) and fewer negative experiences (like extreme hunger, tummy pain, or punitive corrections) that could imprint lasting fear. In sum, the preventive health and nutrition practices under the Just Behaving model collectively aim to produce physically healthy, emotionally balanced dogs. Puppies emerge from this program with a strong gut (courtesy of probiotics, great diet, and minimal parasite burden) and a strong bond with their human mentors, ready to face new challenges without the baggage of poor early health. The next sections propose how to formally study this integrative approach through a longitudinal research design, detailing how one might measure and validate the effects of gut health on behavior over time.

Methodology: Longitudinal Study Design

To investigate the intersection of gut health, nutrition, and behavioral development in puppies, a longitudinal mixed-methods study is proposed. This study would primarily follow a cohort of puppies raised under the Just Behaving mentorship model, tracking them from early puppyhood into adulthood. By collecting both biomedical data and behavioral observations at regular intervals, the study can reveal patterns and potential causal links between gut health metrics and behavioral outcomes. Below is an outline of the research design:

Cohort and Sampling: The study will recruit a cohort of developing puppies (for example, $N = 10\text{--}20$ puppies in a given litter or successive litters) being raised with Just Behaving's protocols. Ideally, these would be puppies from the same breed and similar genetics (e.g., Golden Retrievers from the Just Behaving breeding program) to control for breed-related temperament traits. All puppies would be enrolled from birth (Day 0) or neonate stage, with owner consent for extensive monitoring. An optional addition is a **comparison group** of puppies raised in a more conventional manner (not under the Just Behaving model) to serve as a control, though ethical and logistical factors might make a true control group difficult. At minimum, the study could compare outcomes

within the cohort based on variation in gut health (e.g. puppies that happen to have a parasitic infection vs. those that do not, or those with higher microbiome diversity vs. lower). Each puppy in the main cohort will act as its own case in a rich **case series**, with data collected repeatedly over time.

Duration: The tracking will span from early development (0–8 weeks) through adolescence (6–12 months) and into young adulthood (up to ~24 months). Key developmental milestones will be captured. The longitudinal approach is critical because it allows observation of how early-life interventions and gut parameters influence later behavior as the dog matures. Behavior and health can change rapidly in the first year, so multiple follow-up points are needed. For instance, we might schedule formal assessments at 8 weeks (weaning/just before going to new homes), 16 weeks (~4 months, adolescent period onset), 6 months, 12 months, and 18–24 months. More frequent informal data collection (like weekly logs) will occur between these major checkpoints.

Data Collection Overview: The study employs a mixed-methods strategy, combining quantitative lab diagnostics with qualitative and quantitative field observations:

- **Lab-Based Diagnostics:** Each puppy will undergo periodic health screenings focusing on gut and immune indicators. Fecal samples will be collected at regular intervals (e.g., monthly for the first 6 months, then bi-monthly) for stool microbiome analysis and parasite exams. Microbiome profiling can be done via 16S rRNA gene sequencing to determine the diversity and relative abundance of bacterial taxa in the gut. From this, metrics like the Shannon diversity index can be calculated for each sample. We will also test for pathogens (Giardia, Coccidia, intestinal worm eggs) to document any infections. In addition, blood samples may be collected at key ages (perhaps 4–6 months and 12 months) to measure immune markers and nutrient levels. Immune markers could include baseline immunoglobulin levels (such as IgA, which reflects mucosal immunity) or cytokines indicative of inflammation (e.g., IL-6, TNF- α). We might also measure cortisol as a physiological marker of stress: for instance, a salivary cortisol test taken in a calm state vs. after a mild stressor can indicate stress reactivity. To assess nutrient absorption and overall nutrition status, blood chemistry (vitamins, minerals) and body condition scores will be recorded. If feasible, digestibility assays can be done (for example, comparing calorie intake to weight gain). These lab measures provide objective data on the puppies' gut health (microbiome composition, parasite status) and internal well-being (immune function, stress physiology).

- Field-Accessible Health Tracking:** Mentors and owners will use practical tools to log the puppies' day-to-day health. One simple but informative metric is a stool score chart – caregivers will score each pup's feces on a standardized scale (e.g., 1 = hard, pellet-like; 7 = watery diarrhea) whenever they observe a bowel movement vhc.missouri.edu vhc.missouri.edu. These scores, recorded daily or weekly, offer a non-invasive gauge of GI function over time. A consistently optimal stool score (mid-range, well-formed) indicates good digestive health, whereas frequent deviations (very loose or very hard stools) might flag an issue to correlate with other data. The study will also maintain growth charts for each puppy: weight will be measured at least weekly from birth to 6 months (and monthly thereafter) to ensure each pup is on track with expected growth percentiles for the breed. Sudden plateaus or drops in growth could correlate with GI problems (e.g., a Giardia outbreak causing weight loss). Health event logs will note dates of dewormings, vaccinations, or any illnesses/treatments – for example, if Puppy A had two bouts of diarrhea requiring vet visits, this will be documented as part of their health history. All of these field health records can be captured using a **Puppy Development Journal**, a tool that Just Behaving already uses. This Journal may include sections for noting daily feeding times/amounts, supplements given (like probiotic doses), any vomiting or diarrhea incidents, and general comments on the puppy's physical condition. By structuring these logs, the data becomes usable for analysis (e.g., number of loose stool days per month, or total weight gain by week 12).
- Behavioral Tracking (Just Behaving Tools):** To assess behavioral development, the study will leverage the Longitudinal Behavior Tracker and other observation instruments developed by Just Behaving. The Behavior Tracker likely involves regular checklists or rating scales of the puppy's behaviors in various contexts. For instance, mentors might score each puppy on parameters such as calmness during handling, response to new objects, degree of bite inhibition, or ability to settle after play. These assessments could be done weekly in the early phase. Additionally, the Puppy Development Journal has a qualitative aspect where mentors/owners jot down notable behavioral moments (e.g., "Day 50: Puppy showed hesitation with loud noise but recovered in 10 seconds"). Over time, these journals build a narrative of each puppy's temperament. For research purposes, qualitative entries can be coded into categories (like instances of fear, instances of high excitement, etc.) to quantify behavior trends. At the designated milestone ages (8 wk, 4 mo, 6 mo, 1 yr, etc.), more formal behavioral evaluations will be conducted. This could include standardized temperament tests. For example, at 7–8 weeks, a Puppy Aptitude Test (PAT) could be administered (testing things like reaction to a moving toy, retrieval interest, social attraction). At later ages, a certified applied animal behaviorist or DACVB resident might

administer assessments for anxiety (e.g. a mild thunderstorm simulation to gauge noise phobia) or attention (perhaps a short obedience command test to see how focused the pup is amid mild distractions). Owners will also be asked to fill out behavioral questionnaires at certain intervals. A tool like the Canine Behavioral Assessment & Research Questionnaire (C-BARQ) or a custom survey tailored to Just Behaving's focus (covering attention span, ease of training, sociability, reactivity, etc.) could be used at 6, 12, and 18 months. These multi-source behavior data (mentor ratings, objective tests, owner surveys) provide a comprehensive picture of each dog's behavioral repertoire over time.

The methodology intentionally pairs hard data (microbiome sequences, cortisol levels) with real-world measures (stool logs, behavior ratings). This mixed approach ensures that findings are both scientifically robust and practically meaningful. For example, if a puppy's microbiome diversity drops after antibiotic treatment, we might see in the journal that its stool scores worsened and maybe its behavior tracker showed more restlessness that week – reinforcing a connection between the biological change and outward behavior. Each data stream can be validated against the others.

Data Analysis Plan: Using the longitudinal data, several analyses will be performed. First, descriptive trends will be plotted for each puppy: e.g., microbiome diversity over time vs. fearfulness scores over time. Group-level analyses will examine averages – for instance, do puppies generally show an increase in attention span scores as their microbiome matures? Are there time periods (like the 8–16 week socialization window) where gut or behavior metrics fluctuate markedly (perhaps due to stress of weaning or vaccines)? Next, correlational analysis will directly test the association between gut health markers and behaviors. We will calculate correlations between variables such as: microbiome diversity index vs. anxiety scores; frequency of GI illness (days of diarrhea) vs. later fear responses; average stool quality vs. training focus scores. We expect to see certain correlations (based on our hypothesis that better gut health yields better behavior) – for example, higher microbiome diversity might correlate with lower incidence of fear-based behaviors, or puppies with no parasite infections might score better on attention/focus tasks than those that had recurrent parasites. More advanced statistical modeling (e.g., linear mixed-effects models) can be used to handle the repeated measures nature of the data, allowing us to account for the fact that multiple observations come from the same puppy over time. These models can test predictors like “did a change in X precede a change in Y?” For instance, if a puppy's microbiome diversity sharply declines (perhaps after medication), does its stress recovery score also worsen at the next check, compared to its usual trend? We can include confounders in models as well (for example, sex of puppy, or whether they went to a new home at 8 weeks which might temporarily affect behavior). Qualitative data from journals will be

analyzed for recurring themes, such as how mentors describe the puppy's energy or stress signals, to enrich our understanding of the numbers.

Overall, this methodology is designed to capture the dynamic interplay between gut health and behavior as puppies grow. By extending into adulthood, the study can determine if early gut-focused interventions (probiotics, diet, etc.) have lasting behavioral benefits – do the Just Behaving puppies show fewer fear or aggression issues at maturity compared to typical incidence rates in the general dog population? Furthermore, the data gathered will be invaluable in pinpointing which specific aspects of gut health (e.g., certain bacteria populations, or absence of any GI disease in first 6 months) are most predictive of positive behavior outcomes. The following section details the metrics and outcomes that will be measured, bridging the gap between this study design and the theoretical framework discussed earlier.

Metrics and Behavioral Outcomes

A variety of **behavioral outcomes** and **health metrics** will be measured to evaluate the puppies' development. These metrics were chosen to operationalize concepts like “stress resilience” and “gut health” in ways that can be observed or quantified. Below we list the key outcomes of interest and how each will be assessed:

- **Stress Response and Recovery:** This refers to how a puppy reacts to a mild stressor and how quickly it returns to a calm baseline. To measure this, we will conduct simple stress tests at several ages (e.g., a sudden loud sound, or a brief separation from the familiar caretaker, appropriate to the pup's age). During these tests, observers will score the puppy's immediate stress response (signs like startle, freezing, running away, vocalizing) on a scale of intensity. Equally important, we will measure recovery time – how many seconds or minutes it takes for the puppy to exhibit relaxed behavior again (such as wagging tail, resuming play, or normal breathing). We will also collect physiological data to complement the behavioral observation: a saliva sample for cortisol could be taken before and after the stress test to quantify the hormonal stress response. A puppy with a well-regulated HPA axis is expected to have a smaller cortisol spike and/or faster return to baseline. Behaviorally, we define good stress recovery as the puppy being able to settle down shortly after the stressor is removed. Repeated measures across development will show if the puppy is becoming more resilient (shorter recovery times as it matures and gains coping skills) or if problems are emerging (lingering stress signals, difficulty calming). We hypothesize that puppies with robust gut health (and thus lower baseline inflammation and balanced neurochemistry) will handle stress better – e.g., a

possible finding could be that higher gut microbial diversity correlates with quicker stress recovery times.

- **Excitability Levels:** Excitability describes a puppy's propensity for over-arousal or hyperactive behavior in stimulating situations. While puppies are naturally playful, excessively high excitability can be a risk factor for impulsivity or anxiety later on. We will assess excitability using both observations and owner reports. In a standardized setting, we might evaluate how the puppy behaves after a exciting stimulus (for example, a visitor arrives or during a play session with lots of toys). We'll use a rating scale where low scores = remains mostly calm or can self-soothe quickly, and high scores = becomes very frenetic, jumping, inability to settle. The Longitudinal Behavior Tracker presumably includes an index for "ability to remain calm vs. easily excited," which we will extract. Owners will also answer questions like "How often does your puppy get over-excited (unable to calm down) when playing or when guests visit?" on a frequency scale. The focus is on baseline temperament rather than training compliance (we're not measuring if the puppy obeys a command to settle, but rather its natural excitability). We expect that puppies raised with the calm mentorship and optimal diet will have moderate, controlled excitability. For instance, they might get playful but not to a chaotic extent, and they calm down faster after play. One outcome metric could be time to calm after peak excitement (in a play session). If data allows, we will also monitor if excitability is linked with any GI signs (anecdotally, extremely excited or anxious dogs can get "the runs" due to stress). It will be interesting to see if puppies with more stable guts have fewer episodes of excitement-induced diarrhea or if calmer pups maintain better stool consistency during stimulating events.
- **Attention and Focus:** This outcome pertains to the puppy's ability to concentrate on a task or stimuli without being easily distracted. We will measure attention through simple cognitive or training exercises appropriate to age. For young pups, it could be looking at a social referencing task (e.g., how long will the puppy make eye contact or remain oriented to a person who is talking to it softly). For older pups, it might be a short obedience command sequence (sit, stay for a few seconds) or an interactive game like finding a hidden treat, and noting how well the puppy stays on task. We can quantify attention span in seconds (how long the pup engages before losing interest) or as a success rate (completing a basic task without disengaging). Additionally, owners will report on everyday attention, e.g. "When teaching new cues, does your puppy stay focused or get easily distracted?" on a Likert scale. Good focus is a proxy for cognitive development and impulse control; it's also very relevant to training ease. We anticipate that a nutritionally sound, gut-healthy puppy will have more

consistent energy and possibly better focus. On the flip side, a puppy with underlying GI discomfort might be restless or inattentive. An outcome like average attention duration (in a given test) will be tracked over time. We'll also note any correlation with diet changes – e.g., if a puppy has an episode of loose stool or poor appetite (gut upset) during a period, does its attention span decrease on that day's training?

- **Fear-Based Behaviors:** We define this category to include signs of fear or anxiety such as cowering, avoidance, excessive submission, or appeasement behaviors in response to various stimuli. To measure fearfulness, we will use controlled exposure tests: e.g., introduce a novel object (an umbrella, a vacuum cleaner) and see if the puppy investigates confidently or backs away with tucked tail. Another test is a gentle handling exam (mimicking a vet exam) to see if the puppy shows fear (trembling, trying to escape). Each puppy will receive a fear reactivity score based on these tests, combining intensity of fear behaviors and recovery (similar to the stress test, but specifically focusing on novel/fear-inducing stimuli). Owners will provide input too, via questions about common fear-triggering situations (“Does the puppy startle or hide at loud noises like thunderstorms or fireworks?” and “How does the puppy react in new environments outside the home?”). We'll track how these fear behavior scores change with age – ideally, as pups are socialized under a supportive model, their fear responses should diminish or remain low. A key outcome metric might be incidence of notable fear behaviors by age (for example, number of phobic reactions observed between 3–6 months). We will also correlate fearfulness with any gut health issues: high fear could correlate with high baseline gut inflammation or certain microbiome profiles. Notably, research suggests a link between gut dysbiosis and increased anxiety behaviors in animals [researchgate.net](https://www.researchgate.net). Our study can test, for instance, if puppies with lower levels of beneficial Lactobacillus bacteria show more fear responses than others. Success for the Just Behaving approach would be indicated if their puppies display **minimal fear-based behaviors** and handle new experiences with curiosity rather than anxiety.
- **Emotional Regulation:** This is a broader, composite outcome reflecting the puppy's general ability to regulate emotions (both positive excitement and negative stress) and return to equilibrium. It essentially sums up the above aspects into an overall “behavioral wellness” measure. We will derive an emotional regulation score that incorporates data from multiple sources: perhaps a combination of the puppy's average calmness rating, its ability to self-soothe, frequency of extreme behaviors (tantrums or panic), etc. The Just Behaving mentorship model aims to produce dogs that “just behave” – meaning they are

calm, confident, and emotionally stable in everyday life. To quantify this, we might use an expert evaluator (like a DACVB resident) to give each pup an overall behavior wellness rating at several points in time, after reviewing all the data and observing the pup. Alternatively, a scoring rubric can be created (assign points for good recovery, good focus, low fear, etc., to total an emotional regulation index). Emotional regulation can also be gauged by scenarios that test patience or impulse control – e.g., having the puppy wait a moment for food or remain in a sit while a toy is waved, and seeing if it can tolerate frustration without meltdown. Puppies with high emotional regulation will perhaps whine a bit but not completely lose composure, whereas poorly regulated pups might bark, jump, or give up. By correlating this overall metric with gut health markers, we directly address the central question: do puppies with healthier guts and better nutrition show *better emotional regulation*? We suspect yes, and hope to see statistically significant positive correlations (for example, puppies with consistently normal stool and no GI issues might score in the top tier of emotional regulation).

On the gut health side, our metrics include: microbiome diversity indices, presence/absence of specific microbial groups of interest (like *Firmicutes:Bacteroidetes* ratio, or detection of probiotic strains if given), incidence of GI illness (number of diarrhea days, number of positive parasite tests), and immune markers (baseline IgA, etc.). We will also consider body condition as a metric (a pup that is underweight due to malabsorption might have different behavior than one in ideal condition).

Using statistical methods, we will correlate the above behavioral outcomes with gut health metrics. For example, we'll test if higher microbiome diversity is associated with higher attention scores and lower fearfulness. We'll examine if puppies with any parasite infection history have different behavior trajectories than those with none. Prior studies give us reason to expect meaningful correlations – one landmark study found a clear link between dogs' aggressive behavior and the composition of their gut microbiome news.oregonstate.edu, and others have indicated that modulating the gut (via diet or supplements) can alter behaviors dvm360.com dvm360.com. Our methodology will rigorously explore these links in a controlled developmental context.

By defining and measuring these metrics, the study creates a data-driven way to capture what Just Behaving mentors have informally observed: that the puppies under their care seem exceptionally calm, focused, and resilient. The goal is to move from anecdote to evidence, identifying which gut health factors correlate most strongly with desirable behaviors. The next section will outline how this study can be implemented in practice and how collaboration with veterinary specialists and scientists can enhance its rigor and impact.

Implementation Plan

Conducting this longitudinal study will require careful planning, coordination with the Just Behaving program, and collaboration across disciplines. Here we present an implementation roadmap, detailing how the research will be executed step by step and how the various data collection activities will be integrated into the puppies' rearing process without causing undue burden or disruption.

Phase 1: Study Setup and Coordination – In this initial phase (pre-puppy birth and neonatal period), the research team will finalize protocols and obtain necessary approvals. This includes ethical approval from an Institutional Animal Care and Use Committee (IACUC) or equivalent, since we will be working with live animals and taking biological samples. We will collaborate with the Just Behaving breeders to time the study with an upcoming litter. All participating puppy families (the breeder and eventual new owners) will provide informed consent for the puppy to be part of the study, understanding what observations and tests will be done. The research team will also train the Just Behaving mentors and any staff on data recording procedures—ensuring that stool scoring, journal entries, and behavior trackers are done consistently and according to the defined scales. A calibration session might be held: for example, the team and mentors review stool photos to agree on scoring, or watch example videos of puppy behaviors to align scoring of excitability or fear. We will prepare kits for each puppy: a folder or digital app for their behavior and health journal, sample collection supplies (small containers for feces, etc.), and a schedule of when each action (like fecal sample, or a test) is due. By front-loading the preparation, once the puppies are born, the mentors can incorporate the research tasks into their regular care routine relatively seamlessly.

Phase 2: Intensive Puppy Monitoring (0–6 months) – This phase covers the period from birth (or enrollment) through the critical socialization window and into early adolescence. It is the most data-rich period. The implementation strategy here is to integrate research activities with the puppies' normal care and socialization events. For instance, fecal sample collection can coincide with routine deworming schedules or vet visits (at 2, 4, 6, 8 weeks, etc.). We will ensure a veterinarian is on board as part of the team to perform blood draws at scheduled times (likely when puppies are getting vaccinations, to minimize additional pokes). Because frequent lab tests on very young pups can be invasive, we will emphasize non-invasive measures in the first 8 weeks (like stool and behavior observation), and schedule any blood draws to piggy-back on necessary clinical procedures (e.g., drawing a little extra blood during an already-planned vaccine appointment at ~8-10 weeks). Throughout this phase, Just Behaving mentors will maintain daily journals and weekly summaries. The research team will have bi-weekly check-ins (virtually or in person) with the mentors to collect data, address any issues, and ensure protocol adherence. For example, a check-in might involve reviewing the past two weeks of stool score logs and reminding to send the next stool

sample to the lab. We will also start early behavioral tests during this phase. Many of these can be done at the breeding home: the evaluator (or mentor following instructions) can perform the standard puppy temperament test at 7 weeks before the puppies go to their new families. The results will be recorded in the dataset. At 8 weeks, most puppies will transition to their new homes (if they are being placed). This is a potentially stressful event that we are keen to monitor; we will instruct new owners on how to continue the tracking (they will receive orientation, possibly a simplified version of the journal to continue, and materials like a stool chart and some probiotic supply to maintain consistency). It's crucial to keep owners engaged; to that end, we might set up a shared online platform or mobile app where owners can easily input data (and see their puppy's progress). The Just Behaving team will also remain in contact with owners as they normally do for mentorship, which helps with retention in the study. From 8 weeks to 6 months, owners (with guidance from Just Behaving and researchers) will implement the plan: feeding the recommended diet (so nutritional consistency remains), giving probiotics, and logging behaviors. The research team will collect follow-up samples – perhaps sending out a mail-in stool sample kit at 4 months and 6 months, or arranging a vet visit for those times. If the owners are local, the study vet or team could host a meetup at 4 months for a quick health and behavior check (which doubles as a socialization outing for the pups). By 6 months, we will have intermediate data and can do a preliminary analysis to ensure everything is on track.

Phase 3: Ongoing Adolescent Tracking (6–18+ months) – In this phase, the puppies are older, typically in their new homes, and we shift to somewhat less frequent data collection (to reduce owner fatigue) while still capturing crucial developmental stages (sexual maturity around 6-8 months, social maturity around 18 months). We will likely schedule a 12-month evaluation where all owners either return to the Just Behaving facility or have a home visit by a team member for a comprehensive check. At this one-year mark, we can collect another stool sample, do a full physical exam, and run a standardized behavioral assessment (for example, a modified Canine Good Citizen test to see how the dog behaves in various scenarios). Leading up to that, owners will continue monthly reporting via the Longitudinal Behavior Tracker app or forms. We will encourage them to especially note any behavioral problems that arise (e.g., if at 9 months the dog develops a fear of strangers, that should be logged and communicated). The research team can then advise to get a concurrent gut health check (maybe an extra fecal test) to see if anything changed, thereby catching incidents even in between the big milestones. At 18 months or 24 months, a final round of assessments will take place, mirroring the earlier ones (collection of stool and blood, a behavioral test, and an owner questionnaire).

Data Management: Throughout these phases, data will be flowing in from multiple sources (mentor logs, lab results from different time points, owner surveys, etc.). We will

employ a robust data management system, likely a cloud-based database, to store all information linked by puppy ID and date. This system can trigger reminders (e.g., if a scheduled data collection is overdue). For quality control, the research coordinator will periodically audit the data – e.g., cross-check an owner's reported vaccination log with veterinary records, or verify that stool samples were indeed processed for each puppy at each timepoint. If any data points are missing, the team will follow up promptly.

Maintaining Protocol Adherence: One challenge is ensuring that all puppies remain on similar protocols (especially diet and supplements) even after they leave the breeder's direct care. To address this, Just Behaving will likely have educated the new owners as part of their puppy handoff – owners will be given the puppy's current food and probiotics and instructions to continue them. The research team can incentivize adherence by explaining the importance for the study and possibly providing some free supplies (for example, if the study budget covers providing owners with a certain probiotic to use for the first 6 months, that ensures consistency). Owners are more likely to comply knowing this is part of giving their puppy the best start and contributing to knowledge that could help all dogs. Regular communication, as mentioned, will also keep them engaged (e.g., monthly newsletters summarizing interesting preliminary findings or giving puppy care tips, making them feel part of a community project).

Collaboration and Roles: We anticipate a collaborative effort where DACVB residents may take the lead on behavioral evaluations and data interpretation (see next section for more on collaboration). Veterinary nutritionists might consult on diet plans and help analyze nutrient-related data. Laboratory partners (microbiologists) will handle the sequencing of stool samples and share the results with the team for analysis. If any puppy shows concerning health issues during the study, the priority is its well-being: veterinary care will not be withheld or altered for study reasons (the study is observational in terms of not introducing harmful interventions). In fact, the detailed monitoring might allow quicker treatment of any emerging health concerns, which is an ethical plus.

Contingency Plans: Inevitably, not everything will go perfectly. Some data might be missed if an owner forgets, or a sample might be unusable. We have built redundancy by collecting multiple types of data; a missed stool score here or there won't critically harm the study. If a puppy is withdrawn (e.g., an owner can't continue), we'll use whatever data was gathered up to that point for partial insight. We'll also be mindful of external events: for example, if during the study a puppy has to go on antibiotics for an unrelated infection, we will document it and account for its impact on gut data. Rather than excluding that puppy, such events are actually informative to our inquiry about gut-health-behavior links.

By the end of the implementation period, we expect to have a rich longitudinal dataset. The team will then move into the analysis and dissemination phase: crunching the numbers, writing the results, and preparing publications or presentations. Because this study is breaking new ground by formally examining preventive gut health in behavior development, the findings can be shared in cross-disciplinary journals (veterinary behavior, animal nutrition, etc.) and at conferences.

In summary, the implementation plan emphasizes integration (we fit research into the puppies' lives with minimal intrusion), consistency (keeping variables like diet consistent across the cohort), and collaboration (leveraging the strengths of mentors, vets, and scientists). With this approach, we aim to demonstrate in practice how a mentorship-based, preventive health model can be systematically studied and validated.

Collaborative Opportunities and Applications

This research initiative sits at the intersection of veterinary medicine, animal nutrition, and behavioral science. As such, it presents rich opportunities for collaboration among professionals in these fields, including residents in veterinary behavior, veterinary nutritionists, and canine behavioral scientists. By working together, these experts can both enhance the study's quality and translate the findings into improved practices. Here we discuss the collaborative roles and how the research can inform and refine strategies for preventive behavior care through nutrition and health management:

- **Role for DACVB Residents (Veterinary Behaviorists in Training):** Residents of the American College of Veterinary Behaviorists are veterinarians specializing in animal behavior, and part of their training often involves conducting research or contributing to clinical studies. In this project, DACVB residents could take lead roles in designing the behavioral assessment protocols and ensuring they are clinically relevant. For instance, they might help select which temperament tests or anxiety scales to use, bringing in established instruments from behavior practice. During the study, these residents can participate in administering behavioral evaluations at the different age milestones, lending their expert eye to the observations. Their clinical perspective is invaluable for interpreting subtle behavior signs – distinguishing a one-off fearful reaction from a true anxiety trend, for example. Collaboratively, they might also compare the study's puppies to the typical cases they see in practice (often adult dogs with severe behavior issues) to identify what early differences are present in the Just Behaving group. This not only benefits our study but also gives the residents a preventive lens: instead of only treating pathological behaviors, they are examining how to prevent them in the first place. The data gathered can feed into their case discussions and maybe even count towards credentials (if published in a journal). Long-term, DACVB residents and specialists can use the findings to validate new

recommendations for puppy owners. If the research confirms, say, that puppies given routine probiotics and raised in a calm manner have significantly fewer aggression or anxiety problems later, behaviorists can confidently advise breeders and clients to incorporate these measures. It moves such advice from anecdotal to evidence-based. As one behavior researcher noted, *“It’s important to look at aggression and other behavior syndromes in terms of physiology... maybe there are underlying physiological causes we can address”*

news.oregonstate.edu. Our collaborative project embodies that principle, giving veterinary behaviorists concrete physiological factors (gut health metrics) to consider in their behavioral cases. For severe cases, a DACVB might even explore gut-targeted treatments (like prescribing a specific diet or probiotic) as adjuncts to behavior modification, and our research could provide a rationale for that.

- **Role for Veterinary Nutritionists:** Nutritionists (especially those board-certified in veterinary nutrition) would be key collaborators in both implementing the dietary aspects of the study and analyzing the results. They can help ensure that all puppies in the study are indeed on an optimal diet plan, adjusting portions or ingredients as the puppies grow to meet developmental needs. Their expertise can refine our “high-quality, diverse diet” into a standardized feeding protocol that can be replicated. For instance, they might specify how to gradually rotate foods to avoid GI upset, or how to safely incorporate fresh foods into a commercial diet. During analysis, nutritionists can examine whether certain diet variations correlate with outcomes. Perhaps they find that puppies who ate a diet including fish oil (omega-3) had higher focus scores – reflecting known benefits of omega-3 on cognition dvm360.com. Or they might observe that those who had more dietary fiber had firmer stools and possibly better behavior consistency (fiber can modulate the microbiome positively). These insights can lead to refined nutritional strategies: maybe recommending that all puppy diets include a source of omega-3 and prebiotic fiber to support brain and gut development. If the study identifies any nutrient deficiencies or concerns (say some puppies running low on B vitamins if they had parasites), nutritionists can devise supplementation protocols to test in the future. Moreover, veterinary nutritionists can champion the research findings in their sphere – for example, if results show a particular probiotic strain conferred measurable behavior benefits, nutritionists might work on incorporating that strain into a puppy diet formula or a supplement and then promote its use for behavior support. In essence, the collaboration allows nutritionists to base their dietary recommendations not just on physical health, but on demonstrated behavioral outcomes, moving toward truly holistic pet care dvm360.com.

- **Role for Canine Behavioral Scientists (Ethologists/Research Psychologists):** Scientists who study dog behavior and cognition (in academic or research settings) would find this study of great interest, as it ties together developmental psychology and physiology. They can contribute by shaping the study design to ensure scientific rigor (for example, advising on sample size, control conditions, or blinding of observers to reduce bias in behavior scoring). They might also suggest additional behavioral tests to probe cognitive development – such as memory tests or problem-solving tasks – thus expanding the scope of behavioral metrics. Their analytical skills can help with complex data, like performing multivariate analyses to see which combination of factors best predicts a behavior outcome. Importantly, behavioral scientists can help generalize the findings to broader contexts. If our study focuses on Golden Retrievers in a particular program, a behavioral researcher might set up a parallel study on another population (perhaps a different breed or shelter-rescued puppies) to see if similar patterns hold. This cross-validation would strengthen the case that it's the preventive practices, not just breed or individual idiosyncrasies, causing the positive outcomes. Additionally, they can dive into the mechanistic questions: for example, if we see correlation between certain gut microbes and attention span, a behavioral neuroscientist might follow up with an experiment in a lab setting (maybe gnotobiotic mice or other models) to test causality, or even a pilot trial giving a probiotic to a subset of puppies to see if a behavior improves relative to controls.

Interdisciplinary Validation and Refinement: The ultimate aim of collaboration is to take the practical wisdom of the Just Behaving model and validate it through science, then refine it where needed. Each collaborator brings a perspective that can challenge and improve assumptions. A DACVB might question, “Are we sure these puppies are actually less anxious, or are we possibly misinterpreting high confidence as low fear? Let’s validate with an objective test.” A nutritionist might point out, “One puppy struggled with recurrent loose stool when too many diet changes were made in a week – maybe we refine our diet diversity approach to be a bit slower for sensitive individuals.” A scientist might suggest, “Let’s include a measure of short-chain fatty acids in the stool samples, since these metabolites can directly affect the brain dvm360.com, to see if higher levels correspond to calmer behavior.” These inputs ensure the study doesn’t just confirm biases but truly tests and hones what works.

As findings emerge, collaborators will interpret them for their fields. For example, suppose the data show that puppies with no incidents of Giardia or Coccidia in their first 6 months scored significantly better on fearfulness (i.e., they were less fearful) than those who had even one infection. This would validate Just Behaving’s heavy emphasis on parasite prevention. Veterinary behaviorists and general practitioners could take this

evidence and advocate that breeders invest more in early parasite control as part of behavioral prevention. Nutritionists might then also emphasize that post-parasite gut restoration (with diet and probiotics) is critical to mitigate any negative effects on behavior. Conversely, imagine the data show that all puppies turned out well behaviorally *regardless* of minor variations in diet or parasite exposure, as long as they had the mentorship and some baseline good nutrition. That might indicate the mentorship aspect itself is hugely important – meaning the social environment and training could outweigh some physical factors. In that case, behavioral scientists would highlight how crucial calm human-canine interactions are, and maybe push for more widespread adoption of mentorship-style rearing alongside health care.

One concrete output could be guidelines or best practices that are co-authored by this interdisciplinary team. For instance: a guide for breeders titled “Optimizing Gut Health for Behaviorally Sound Puppies – Evidence-Based Recommendations,” listing proven strategies (e.g., “probiotic supplementation from week 3 onwards correlated with X benefit; thus we recommend doing so in breeding programs”). Likewise, a position statement in a veterinary journal could emerge, endorsed by behaviorists and nutritionists, saying that preventive nutrition and behavioral mentorship should be integrated into puppy raising to improve outcomes. This research can thereby *refine nutritional strategies in behavior prevention* by providing concrete data on what works. If previously a vet might vaguely say “a good diet might help his behavior,” after this research they could say “I recommend a diet with these components (for example, high in omega-3 and fermentable fiber) because studies show it supports a calm, focused disposition in developing dogs.” It gives teeth to nutritional advice in the behavioral context.

Collaborative Impact: For DACVB residents, being part of this study can shape their approach to cases. They may start asking more about a dog’s diet and gut history when seeing a behavior patient, looking for underlying issues to fix (echoing the idea that aggression or anxiety could have a physiological basis news.oregonstate.edu). For nutritionists, the collaboration highlights that diets aren’t just about physical health or appearance, but also about mental health – an interdisciplinary consideration that can inspire new diets formulated specifically for behavior support (some companies are already exploring “calming diets” with nutrients like tryptophan or casein; our research could add probiotic and fiber components to that mix with evidence). For researchers, the project opens up new questions: it might validate some principles but also reveal new ones (perhaps a surprising microbe-behavior connection) that spur further scientific inquiry.

Finally, while the study focuses on Just Behaving’s dogs, the broader applicability cannot be overstated. If these puppies show superior outcomes, it suggests that any breeder or organization raising puppies in a similarly holistic way could achieve the

same. Service dog programs, for example, could incorporate these gut health practices to improve the success rate of their dogs (since even mild anxiety could disqualify a service dog, preventing that through diet/health management would be invaluable). Shelters raising litters of rescued puppies could use probiotics and stable routines to give those pups a better chance at becoming well-adjusted pets. In essence, the collaborative research will provide a *template for preventive behavior care* that bridges typically separate domains (medicine and training). By validating the Just Behaving model scientifically, we not only help refine that model for those specific dogs, but also pave the way for its principles to influence puppy-rearing at large. This means healthier, happier puppies growing into dogs that live harmonious lives with their families – the ultimate win-win for animal welfare and human-canine companionship justbehaving.com.