



The Ontology of Care in Disorders of Gut-Brain Interaction: Toward an Integrated Pedagogical-Clinical Paradigm in Medical Humanities

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Abstract

This article proposes an integrated clinical-pedagogical paradigm for the management of pediatric Disorders of Gut-Brain Interaction (DGBIs) and related functional somatic conditions. Drawing from clinical data and conceptual frameworks presented at the Pediatric Mind-Body Medicine Symposium (Harvard Medical School, 2026), we examine how the bidirectional communication of the gut-brain axis serves as an embodied language of childhood distress. Rather than claiming a definitive resolution to the metaphysical problem of Cartesian dualism, this paper explores how multidisciplinary care—integrating cognitive-behavioral approaches, expressive therapies, and trauma-informed pedagogy—bridges the historical gap between somatic treatment and psychological validation. By analyzing the neurobiology of allostasis and the epigenetics of resilience, we outline a pedagogical framework of care that empowers young patients to regain narrative agency over their bodies.

Keywords: *Gut-brain axis; Disorders of Gut-Brain Interaction; Trauma-informed pedagogy; Allostasis; Medical Humanities*

1. Introduction: The Pediatric Mind-Body Symposium as a Framework for Ontological Care

In contemporary pediatric medicine, the clinical approach to chronic illness is undergoing a gradual epistemological shift. Historically, the biomedical model has prioritized a reductionist, reparative framework where diseases are validated primarily through objective organic biomarkers. However, this model faces significant challenges when applied to pediatric functional conditions, particularly Disorders of Gut-Brain Interaction (DGBIs) and Functional Neurological Disorders (FND). Rather than viewing these conditions as diagnoses of exclusion, modern neurobiology and medical humanities reconceptualize them as complex, positive disorders of central sensitization and visceral hypersensitivity. This paper synthesizes clinical insights and pediatric outcomes presented at the *Pediatric Mind-Body Medicine Symposium* (Harvard Medical School, March 2026). The purpose of this conceptual review is twofold:

1. to outline the physiological and molecular mechanisms connecting stress, immunity, and gut-brain communication in pediatric populations;
2. to propose an integrated, pedagogical-clinical framework that translates these neurobiological insights into validating, person-centered healthcare practices.

By placing empirical findings from the 2026 symposium in dialogue with the medical humanities, we argue that effective clinical care for pediatric DGBIs must transcend physical symptom suppression. It requires a pedagogical alliance capable of restoring the patient's capacity for self-regulation, narrative coherence, and autopoiesis—the ability to actively reconstruct a meaningful life project despite the challenges of chronic illness.

1.1 Literature review- The Dialectic of the Body: Pathophysiology and Clinical Landscape of Pediatric DGBIs

Understanding pediatric DGBIs requires moving beyond linear, cause-and-effect clinical logic. According to the Rome IV diagnostic criteria, DGBIs are classified as a group of disorders characterized by persistent gastrointestinal symptoms related to any combination of motility disturbance, visceral hypersensitivity, altered mucosal and immune function, altered gut microbiota, and central nervous system processing.

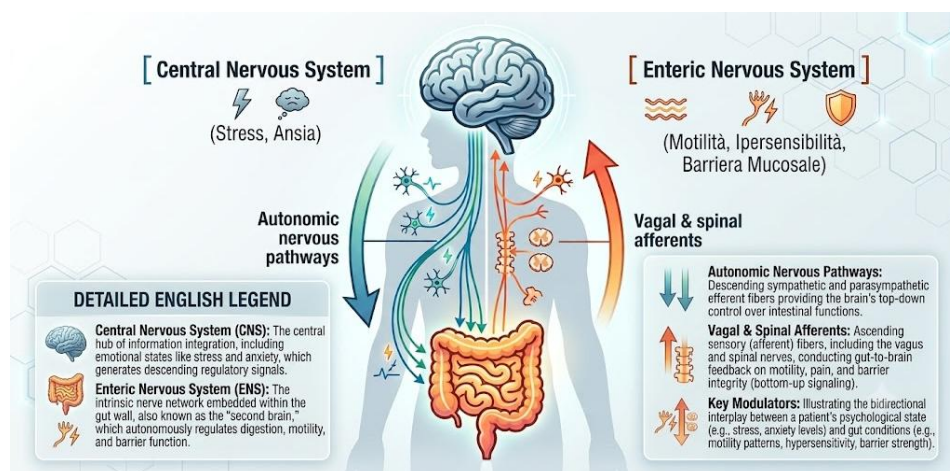


Fig.1. A graphical representation of the gut-brain axis

In pediatric populations, functional abdominal pain disorders (FAPDs), including irritable bowel syndrome (IBS) and functional dyspepsia, represent a substantial epidemiological challenge, with global prevalence rates estimated at approximately 13.5% among children and adolescents. The pathophysiological core of these disorders involves a bidirectional dysregulation of the gut-brain axis:

Visceral Hypersensitivity: A lowered pain threshold where physiological enteric processes (such as peristalsis or mild gaseous distension) are registered by the central nervous system as painful stimuli.

Central Sensitization: A state of hyperexcitability of sensory neurons in the central nervous system, which amplifies peripheral nociceptive inputs.

As discussed by Salvatore (2026), this "global hyper-responsivity" makes the pediatric body a physical resonator for emotional and environmental stress. Psychiatric comorbidities are intrinsically linked to this state. Longitudinal data suggest that anxiety disorders often precede the onset of abdominal pain by several years, and once established, the pain recursively fuels emotional dysregulation.

To illustrate this transdiagnostic complexity, Table 1 compiles descriptive data from a cohort of pediatric patients (N=90) evaluated within the Pediatric Mind-Body Medicine clinical registry (2025–2026), highlighting the high overlap of psychiatric and functional diagnoses.

Diagnosis	Prevalence (%)	Treatment Impact / Clinical Target	Source
Anxiety Disorder	91%	Requires early integration to CBT target hypervigilance.	O'Donnell (2026)

Mood Disorders	40%	Addresses social withdrawal, physical fatigue, and isolation.	Holt (2026)
ADHD	40%	Influences and guides the structure of mindfulness exercises.	Wayne (2026)
Emetophobia	22%	Specific target for interoceptive exposure protocols.	Salvatore (2026)
PTSD / Complex Trauma	16%	Necessitates a trauma-informed clinical framework.	Watanabe (2026)

Tab.1. **CLINICAL DASHBOARD: PREVALENCE AND THERAPEUTIC TARGETS.** An illustrative and analytical framework engineered to optimize therapeutic approaches, visually delineating the prevalence of comorbidities alongside their respective clinical focal points.

Addressing this clinical reality is an ethical imperative. When treating children with chronic pain, clinicians must avoid reductionist statements that imply the pain is "only in the head," as this dismisses the child's lived experience and can disrupt their emerging sense of identity. Integrating gastroenterologists, child psychiatrists, and clinical psychologists provides a cohesive clinical environment that prevents the fragmentation of the young patient's care. This approach supports their "integral formation"—defined as the balanced, simultaneous development of their physical, emotional, and cognitive resources.

2. Research questions

II. Neurobiology of Stress and Allostasis: The Epigenetics of Resilience

To validate the somatic reality of pediatric DGBIs, the clinical narrative must be grounded in the biological mechanisms of stress adaptation, or allostasis—the process through which the body maintains stability through physiological and behavioral change.

The Cellular Cost of Chronic Stress

When psychosocial or physiological stressors become chronic, the prolonged activation of the autonomic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis results in allostatic load. This allostatic load causes wear and tear on tissues, disrupting gut barrier integrity, altering mucosal immune responses, and contributing to systemic low-grade inflammation.

On a molecular level, this process is driven by the Conserved Transcriptional Response to Adversity (CTRA), a genomic program identified by Cole (2019). In individuals experiencing chronic social threat, isolation, or high adversity, the sympathetic nervous system stimulates immune cells to undergo a specific transcriptional shift:

1. Upregulation of pro-inflammatory genes (such as those encoding IL-1 β , IL-6, and TNF- α).
2. Downregulation of genes involved in type I interferon antiviral responses and antibody synthesis.

This genomic shift provides an empirical link showing how chronic psychosocial stress can promote a state of systemic inflammation, thereby contributing to the visceral hypersensitivity observed in DGBIs.

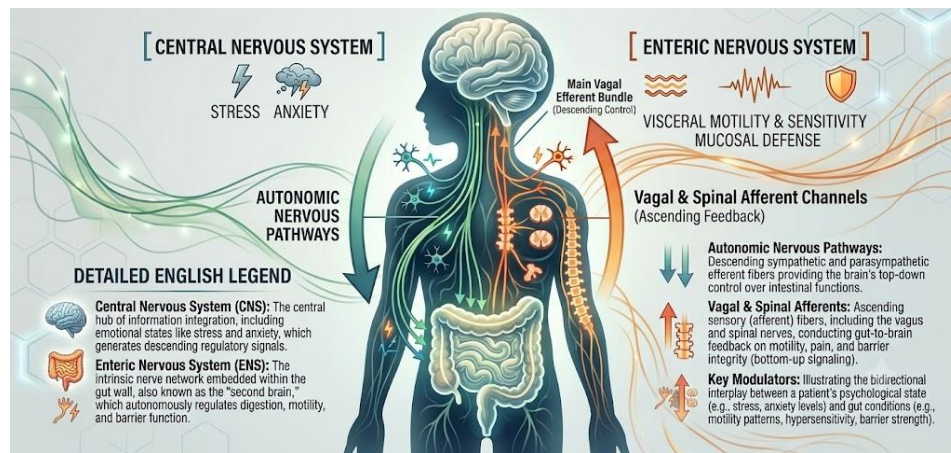


Fig.2. Unravelling nexus as treatise Gut-Brain Axis

The Relaxation Response as a Biological Counterweight

Conversely, the Relaxation Response (RR), a term coined by Herbert Benson, represents the inducible physiological counterpart to the stress response. Elicited through practices such as mindfulness, deep diaphragmatic breathing, and tai chi, the RR induces temporal transcriptome changes that downregulate the nuclear factor-kappa B (NF- κ B) inflammatory pathway and optimize mitochondrial energy metabolism.

Furthermore, neuroimaging studies by Lazar (2005) have demonstrated that long-term meditation is associated with increased cortical thickness in the prefrontal cortex and the insula—brain regions critical for executive cognitive control, emotional regulation, and interoceptive awareness. Rather than a passive state of rest, regular mindfulness practice functions as an active cognitive exercise that supports neuroplasticity.

Through the *Resilient Youth* curriculum developed by Henin, Chudnofsky, and Wells (2026), children are taught cognitive restructuring and somatic relaxation techniques. By helping youth identify stressors and systematically ask, "Is there anything I can do about this stressor?", the curriculum encourages a shift from passive vulnerability to active problem-solving. Table 2 presents pre- and post-intervention outcomes from this curriculum (N=170).

Clinical Indicator	Pre-Intervention Score (T-Score)	Post-Intervention Score (T-Score)	Statistical Significance (p)	Source
Psychological Stress	61.8	55.2	$p < 0.05$	Henin (2026)
Anxiety Symptoms	59.4	53.4	$p < 0.05$	Henin (2026)
Depressive Symptoms	59.2	52.7	$p < 0.05$	Henin (2026)

Table 2: Post-Intervention Improvements in the Resilient Youth Curriculum (N=170)

Note: Self-reported and parent-reported clinical T-scores before and after a 12-session mind-body

intervention.

These results suggest that childhood and adolescence represent key developmental windows during which targeted mind-body interventions can positively influence prefrontal-limbic regulation, helping to mitigate the systemic effects of allostatic load.

3. Article structure

Aesthetics of Care: Expressive Therapies and the Humanities in Clinical Practice

To address the subjective experience of illness, medical humanities incorporate expressive arts into the clinical paradigm, helping young patients articulate pain that is difficult to describe with words alone.

Clinical Music Therapy and "Cultural Humility"

Music therapy in pediatric environments is increasingly recognized for its role in regulating autonomic activity, reducing salivary cortisol levels, and promoting the release of endogenous endorphins. However, as noted by Slaughter (2026), pediatric music therapy requires clinical cultural humility—defined as a commitment to self-reflection that respects the family's cultural background, avoids clinical paternalism, and centers the child's personal identity.

An example of this practice is the development of "Songs of Kin"—a therapeutic process where families collaborate with music therapists to write original songs or adapt traditional lullabies. By weaving family narratives, ancestral histories, and comforting themes into the therapeutic setting, these songs help preserve relational connections and reduce the acute distress of hospitalization.

Art Therapy and Visual Metaphors

Similarly, clinical art therapy has been shown to significantly reduce physiological distress. In a study by Kaimal, Ray, and Muniz (2016), 45 minutes of creative art-making resulted in a significant reduction in cortisol levels in a majority of participants. Within the Pediatric Intensive Care Unit (PICU) and chronic pain clinics, art-making serves as a safe medium for non-verbal expression.

Furthermore, clinical practices benefit from structured visual metaphors to bridge communication gaps:

The "Mind Jar": A psychoeducational tool consisting of a sealed jar filled with water, glycerin, and glitter. When shaken, the turbulent glitter represents an agitated, anxious mind where thoughts cloud clear vision. As the child practices slow, deep breathing, they watch the glitter slowly settle to the bottom, visualizing how a mindful pause can restore cognitive and emotional clarity.

Graphomotor Language: As discussed by Fermani (2025), the physical act of drawing and writing retains a critical neurodevelopmental and proprioceptive value in a digitized era, assisting in motor-kinesthetic coordination and providing a structured creative outlet for emotional processing.

a. *Functional Neurological Disorder: Reconceptualizing the Neurobiology of Disconnection*

Functional Neurological Disorder (FND)—characterized by motor or sensory symptoms that present a clear incompatibility with established neurological disease—shares significant pathophysiological overlaps with DGBIs, particularly regarding central sensitization and the amplification of somatic signals.

Shifting from Outdated Metaphors to Predictive Processing

Historically, FND was explained to patients using a simplistic "software vs. hardware" metaphor (e.g., *the computer hardware is intact, but there is a glitch in the software*). However, modern neuropsychiatry has moved away from this comparison, as it can inadvertently sound dismissive to patients, implying their symptoms are insubstantial or simulated.

Instead, contemporary models explain FND through the lens of predictive processing and functional network dysregulation. FND is understood as a real, neurobiologically measurable disruption in the brain's predictive network:

Aberrant Prior Beliefs: The brain's "top-down" predictive models of movement or sensation override the actual "bottom-up" sensory signals coming from the body.

Salience Network Hyperactivity: Under the influence of chronic stress, high levels of cortisol, and inflammatory mediators, the brain over-allocates attention (high negative salience) to specific bodily sensations or motor pathways, making these aberrant connections rigid and persistent.

Interdisciplinary Physical and Occupational Rehabilitation

To help "unlearn" these pathways, rehabilitation requires a coordinated, interdisciplinary approach:

Physical Therapy (PT): Re-establishes normal movement patterns by utilizing functional, goal-directed tasks that distract the patient's conscious attention away from volitional motor control.

Occupational Therapy (OT): Addresses sensory processing profiles using Dunn's four-quadrant sensory processing model. This model assesses a child's unique sensory thresholds (passive or active sensation seeking, avoiding, sensitivity, or low registration), allowing therapists to design a tailored "sensory diet"—a customized routine of sensory strategies designed to help the child maintain an optimal state of neurological arousal throughout the day.

Table 3 below outlines common pharmacological strategies used within this clinical registry (N=90) to target central sensitization and manage psychiatric comorbidities, highlighting the role of neuromodulation in comprehensive care.

Pharmacological Category	Utilization (%)	Clinical Rationale and Target	Source
SSRIs (e.g., Escitalopram)	61.3%	Primary target for comorbid generalized anxiety and depression.	Hirshfeld-Becker (2026)
TCAs (e.g., Amitriptyline)	22.7%	Used in low doses to target visceral hypersensitivity in chronic abdominal pain.	Salvatore (2026)
Buspirone / Mirtazapine	13.6%	Combined total (6.8% each) targeting gastric accommodation, motility, and sleep.	Salvatore (2026)
SNRIs (e.g., Duloxetine)	6.8%	Second-line therapy targeting descending pain inhibitory pathways.	Goldfinger (2026)
Gabapentin Poids	<5.0%	Selected cases targeting severe, refractory central neuropathic pain.	Goldfinger (2026)

Table 3: Pharmacological Treatment and Neuromodulation Patterns (N=90)

Note: Compiled from the Pediatric Mind-Body Medicine clinical registry to illustrate the use of neuromodulation to target central sensitization and autonomic hyper-responsivity.

In this clinical context, communication is therapeutic. Using validating language—such as, *"Your nervous system is stuck in a protective, hypersensitive pattern, but we can work together to help it get unstuck"*—helps build trust with families who may have previously felt

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4. Method

a. The Hermeneutics of Resilience: Trauma-Informed Models and the Pedagogy of Listening

To fully address the social and emotional context of pediatric somatic disorders, clinical practice must incorporate a trauma-informed perspective.

Recontextualizing Stress in a Hyper-Connected Era

Revisiting the concept of collective trauma requires historical nuance. While past generations lived through devastating physical hardships (such as plagues and major wars), the 21st century is characterized by a unique digital hyper-connectivity. Today's youth are exposed to a constant stream of global crises, climate anxiety, and digital social pressures. This persistent exposure can create a chronic state of low-grade stress, which manifests physically as a high systemic allostatic load.

b. To address these challenges, the DBT-Elementary (DBT-E) model, presented by Watanabe (2026), offers a clinical framework for children with severe emotional dysregulation and somatic symptoms. DBT-E focuses on teaching parents how to create a highly validating domestic environment and introduces children to "TIPP" skills to assist with distress tolerance:

1. Temperature (using cold water or ice to stimulate the mammalian dive reflex and slow down a rapid heart rate).
2. Intense physical exercise (to release accumulated muscular tension).
3. Paced breathing (slowing the breath to activate parasympathetic pathways).
4. Progressive muscle relaxation (systematically tensing and releasing muscle groups).
5. Bottom-Up and Top-Down Integration

Pediatric depression often presents atypical somatic symptoms, such as chronic headaches or abdominal pain, before a child can articulate feelings of sadness. A trauma-informed approach integrates "bottom-up" interventions (using somatic grounding and breathwork to regulate the nervous system) with "top-down" cognitive strategies (cognitive behavioral therapy to reframe catastrophic thoughts).

Programs such as the LIFE (Living In Families with Emotions) initiative aim to foster family mentalization and self-compassion, helping to reduce the long-term impact of early adversity on brain development. Within this framework, clinical and educational environments can work together to support children, ensuring that schools offer flexible, supportive structures that accommodate chronic health conditions.

Conclusion: toward an Integrated Epistemology of Care

Pediatric mind-body medicine offers a useful framework for a more comprehensive approach to clinical care. Disorders of gut-brain interaction and functional neurological manifestations highlight the limitations of purely reductionist medical models, showing that physical symptoms are often closely connected to a patient's emotional life and social environment.

Moving from a focus solely on "curing" (eliminating physical symptoms) to "caring" (supporting the whole patient) requires both clinical and pedagogical humility. The body communicates a story of adaptation, stress, and resilience. The role of the healthcare team is to provide patients and families with a range of supportive tools—including somatic relaxation, expressive arts, cognitive-behavioral strategies, and appropriate neuromodulation—to help them regain control over their health. By integrating clinical science with the insights of the medical humanities, medicine can move closer to an ideal of care that respects and addresses both body and mind.

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