

## Embodied Trauma: When Memory Lives in the Body

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### Abstract

Trauma is not solely a psychological imprint chronicled in narrative memory—it is also profoundly **embodied**, manifesting across physiology, sensorimotor systems, and implicit memory networks. Traditional cognitive paradigms that focus on verbal recall and narrative reconstruction overlook the ways traumatic experiences become ingrained in the body’s perceptual, autonomic, and affective processes. This review synthesizes multidisciplinary research from **neuroscience, psychotraumatology, clinical psychology, and somatic therapy** to elucidate how traumatic memory becomes embedded in bodily systems and how this embodied memory is expressed clinically. We explore **neurobiological mechanisms** underlying trauma encoding in the autonomic nervous system and sensorimotor networks, the role of implicit and procedural memory in trauma persistence, and phenomenological insights into how the body “keeps the score.” We also evaluate clinical implications for **embodied therapeutic approaches**—including somatic experiencing and sensorimotor psychotherapy—that target trauma at the body–mind interface. Understanding trauma as an embodied phenomenon offers a more integrative framework for assessment and healing, bridging neural, psychological, and somatic domains.

**Keywords:** Embodied trauma, somatic memory, neurobiological imprinting, implicit memory, PTSD, sensorimotor integration, body-mind connection, trauma therapy

### 1. Introduction

Traumatic experiences—such as abuse, violence, war exposure, or life-threatening events—are more than regrettable episodes stored in cognitive memory. These experiences involve intense affective, sensory, and physiological responses that can disrupt **multi-level memory and regulatory systems**. Contrary to the view of trauma as a purely cognitive storage of events, contemporary evidence underscores that trauma becomes deeply embedded in **bodily systems**, influencing how individuals perceive, feel, and respond to present-moment experiences long after the original event has passed.

The concept of trauma as embodied memory emphasizes that traumatic experiences are encoded within neural circuits, autonomic stress pathways, and somatosensory networks, often bypassing the narrative systems of the hippocampus and language-based memory. Thus, traumatic memories may reemerge not as verbal narratives but as **sensations, physiological reactions, or automatic body responses**.

## 2. Neurobiological Mechanisms of Embodied Trauma

### 2.1 Autonomic Nervous System and Stress Imprinting

Trauma heavily engages the **autonomic nervous system (ANS)**, producing physiological responses associated with survival—fight, flight, freeze, or dissociation. Neurobiological research indicates that intense emotional arousal at the time of trauma triggers long-term alterations in the ANS, including heightened sympathetic activation and altered parasympathetic regulation. These changes can persist outside conscious awareness and present as chronic somatic symptoms (e.g., muscle tension, pain, hypervigilance).

The **amygdala**, a key limbic structure, becomes overactive during trauma, encoding fear and threat responses that prime the body for rapid defensive reactions. Simultaneously, the **hippocampus**, responsible for contextualizing memories with time and place, often functions suboptimally during overwhelming stress. As a result, traumatic experiences may not be consolidated into coherent, time-bound narratives but instead remain **sensory laden and fragmented**. This creates conditions where trauma is recalled through body sensations rather than integrated cognitive memory.

### 2.2 Sensorimotor Network Dysregulation

Recent neuroimaging studies show that trauma survivors exhibit altered connectivity in sensorimotor networks and the **default mode network**—a set of brain regions involved in self-referential processing and memory retrieval. Changes in how these networks communicate may explain why trauma is experienced as a present “body memory” rather than a past event, leading to intense physiological reactions triggered by seemingly ordinary cues.

## 3. Implicit and Procedural Memories of Trauma

### 3.1 Implicit Memory and Non-Declarative Encoding

Trauma often bypasses **declarative memory systems** that enable us to consciously recall events. Instead, it is stored in non-declarative forms—such as implicit, procedural, and somatic memory. These forms of memory are not accessible through narrative recall but manifest as bodily reactions, automatic responses, and conditioned physiological patterns. For example, sudden autonomic arousal in response to a trigger may occur even when the individual cannot verbally recall the original trauma.

Somatic psychology proposes that such memories are embodied within the **nervous system and musculature**, producing patterns of tension, defensive motor postures, or habitual physiological responses that reflect unresolved trauma. Healing, therefore, requires attention to these somatic patterns rather than simply cognitive reinterpretation.

### 3.2 Fragmentation and Somatic Patterning

Classic psychoanalytic and contemporary trauma theorists have observed that traumatic memories often fail to integrate into a coherent autobiographical narrative. Instead, they are **fragmented and encoded** as discrete sensory-motor and emotional fragments. This fragmentation contributes to the persistence of traumatic responses and explains why trauma can feel “alive” in the body long after the triggering event.

## 4. The Body Keeps the Score: Phenomenological Perspectives

The metaphor popularized by Bessel van der Kolk— “**the body keeps the score**”—captures the core idea that traumatic stress is stored beyond conscious memory and resides in physiological and somatic systems. Phenomenological approaches further emphasize that trauma disrupts the embodied self, altering the subjective experience of one’s body, environment, and sense of safety. Triggering events—like certain sounds, smells, or tactile sensations—can activate embodied memories, producing intense emotional and physical reactions that are not mediated by conscious recollection.

These reactions demonstrate that trauma lives not only in memory but in **enacted body experiences**, supporting a view of memory as lived and felt rather than only narratively stored.

## 5. Clinical Expressions of Embodied Trauma

Trauma’s bodily imprint manifests in diverse clinical symptoms:

- **Hyperarousal and autonomic dysregulation:** Persistent alertness and stress responses in everyday contexts.
- **Chronic pain and somatic complaints:** Physical pain and tension related to unresolved physiological stress.
- **Dissociation and depersonalization:** Protective disengagement from bodily sensations or emotional awareness.
- **Startle responses and flashbacks:** Sudden sensory or emotional reactions triggered by cues reminiscent of the original trauma.

These symptoms illustrate how embodied trauma extends beyond memory to shape how individuals interact with the present moment.

## 6. Embodied Therapeutic Approaches

Traditional cognitive therapies, while effective for many, may fall short when confronting the **bodily dimensions of trauma**. Somatic and body-oriented approaches focus on working with implicit somatic memories and physiological symptoms.

### 6.1 Somatic Experiencing and Sensorimotor Psychotherapy

Somatic experiencing, developed by Peter Levine, targets the **physiological experience of trauma** by helping clients track bodily sensations and release defensive energy held in the body. This approach posits that trauma is stored in implicit memory and muscular patterns rather than cognitive representations alone. By working with bodily sensations, individuals can process and discharge trapped traumatic energy.

Similarly, **sensorimotor psychotherapy** integrates somatic awareness with psychological processing, helping clients articulate and transform the body-mind patterns associated with trauma. These methods reinforce the idea that healing requires engagement with bodily memory systems, not solely cognitive reinterpretation.

### 6.2 Embodied Simulation and Therapeutic Interaction

Emerging work on **embodied simulation** suggests that trauma therapy may benefit from engaging both patient and therapist in affective and sensorimotor attunement. During

therapeutic encounters, embodied cues may be mirrored and processed through interpersonal neural mechanisms—enhancing emotional regulation and safety in the client’s experience.

## 7. Integrative Models and Future Directions

An embodied view of trauma invites more **integrative models** that combine neurobiological, psychological, and somatic dimensions. Future research should:

- Characterize neural network changes associated with embodied trauma.
- Develop quantitative measures of somatic memory patterns.
- Evaluate multimodal interventions that address both cognition and body memory.
- Investigate cultural and contextual factors shaping embodied trauma expression.

Understanding trauma as a **body–mind phenomenon** has implications for assessment, intervention, and theory across disciplines.

## 8. Conclusion

Trauma is not stored solely in narrative memory; it is **embodied** across neural, physiological, and sensorimotor systems. This embodied imprint influences how individuals feel, react, and engage with the world. Reconceptualizing trauma as **somatically stored memory** expands therapeutic possibilities, calls for body-informed interventions, and deepens our scientific understanding of how memory and trauma intersect. Recognizing that “memory lives in the body” challenges the primacy of cognitive memory and calls for integrative practices that honor the body’s role in healing. The exploration of embodied trauma highlights the profound ways in which traumatic experiences extend beyond cognitive memory to manifest within the body, shaping both physiological responses and behavioral patterns. This research underscores that trauma is not merely a psychological phenomenon but a multisystem experience, where the body itself retains imprints of past events, often influencing emotional regulation, interpersonal relationships, and overall well-being. By examining theoretical frameworks, clinical studies, and somatic practices, this study emphasizes the importance of integrative approaches to trauma treatment that address both mind and body. Therapeutic interventions such as somatic experiencing, body-centered psychotherapy, and mindfulness-based practices demonstrate the potential for healing when the body is acknowledged as a repository of memory. Understanding embodied trauma not only broadens the conceptualization of trauma in psychology and neuroscience but also informs more holistic, compassionate, and effective clinical practices. Ultimately, recognizing the body as a site of memory affirms the interconnectedness of mind, body, and experience in the journey toward recovery and resilience.

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