

We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

6,900

Open access books available

185,000

International authors and editors

200M

Downloads

Our authors are among the

154

Countries delivered to

TOP 1%

most cited scientists

12.2%

Contributors from top 500 universities



WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index
in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?
Contact book.department@intechopen.com

Numbers displayed above are based on latest data collected.
For more information visit www.intechopen.com



Reclaiming the Lost Self in the Treatment of Bulimia Nervosa: A Neurobiological Approach to Recovery That Integrates Mind, Brain, and Body

Abigail H. Natenshon

Abstract

The pathology of bulimia nervosa reflects the ‘dis-integration’ of the structure of the self within the distributed nervous system, resulting in the patient’s impaired sense of self and incapacity to sense self-experience. The twenty-first century definition of self as ‘an embodied, sensory-based process grounded in kinesthetic experience’ not only refutes the long-held myth of mind-body dualism, but also sheds light on the influence of neurobiological factors in disease onset and on how people make recovery changes within psychotherapy. The capacity to create, or reinstate, self-integration is built into the nervous system through the neuroplastic brain’s ability to change its structure and function in response to thought, sensation, feeling, and motor activity. The introduction of neurophysiological (sensorimotor) and neurobiological (interpersonal, attachment-based) interventions into mainstream clinical treatment for bulimia nervosa increases exposure to embodied experience, fostering mind, brain, and body connectivity. By stimulating integrative neuronal firing and synaptic activity, top-down and bottom-up transactions enhance acuity in self-sensing, self-perception, and body image coherence, supporting the unification of the disparate self. The current focus of mainstream clinical eating disorder treatment on symptom reduction alone neglects the neurological underpinnings of the disease. This chapter describes a range of treatment options for bulimia nervosa designed to support sustainable changes at the brain level.

Keywords: bulimia nervosa, anorexia nervosa, eating disorders, self-image, body image, self-integration, neurobiology, neurobiological interventions, neurophysiological interventions, trauma resolution, interpersonal neurobiology, Feldenkrais Method, sensorimotor interventions, embodied self, disorganized attachment, mind-brain-body connections, vertical integration

1. Introduction

Bulimia nervosa (BN), described as “an ominous variant of anorexia nervosa” (AN) [1], is a disorder of the brain, the distributed nervous system, and the pathological ‘dis-integration’ of the core self, all indicators of mind, brain, and body

disconnection. Scientists propose that somatic, autonomic, and visceral information is aberrantly processed in people who are vulnerable to developing AN and/or BN [2]. Engaging the distributed nervous system in the treatment of BN through adjunctive interventions that combine top-down and bottom-up neurophysiological mechanisms, and/or through the psychobiological attachment bond of emotional communication and interactive regulation between the patient and therapist, heals neurobiological aberrations at their source by accessing the roots of these disorders, which are embedded in neurobiological dysfunction. By capturing images of the neuroplastic brain as it changes in real time, modern brain-scanning technology reveals that harnessing body-based movement and sensory experience in conjunction with psychotherapy facilitates the neurological convergence of the mind, brain, and body, which fosters the integration of the structure of the healthy self. The current focus of mainstream conventional BN treatment, however, is on the psychological and environmental origins of the disorder, neglecting the neurological underpinnings of disease. Scientific evidence points to the need to expand the parameters of the treatment field to promote the neurobiological reintegration of the recovering bulimic patient's healthy self through treatment modalities that sustain changes at the brain level. Recruiting brain circuitry enhances and promotes the integration of the nervous system. "It is around the concept of the core self that psychology crosses paths with the brain and body" [3].

The etiology of neurobiological disturbances leading to ED onset stems from genetic, metabolic, and other biological factors, in conjunction with ever-changing internal forces and external circumstances, compounded by the influence of co-occurring diagnoses. BN symptomatology, marked by behavioral excess and impulsivity, anesthetizes or otherwise reorganizes the patient's affective and internal states. Symptoms typically include bingeing, self-induced vomiting, fasting, food restriction, promiscuity, self mutilation, stealing, compulsive shopping, compulsive exercise, abuse of substances including alcohol, laxatives, diuretics, and/or diet pills, erratic sleep patterns, and the compulsion to prepare food for others.

Alike in their neurobiological underpinnings, AN and BN patients share disturbances in their capacity to experience the sensation of hunger, and typically relieve distress through symptomatic behaviors that create a sense of control over internal chaos and frightening emotions. Diagnostic distinctions between BN and AN are never well delineated. A subgroup of anorexic patients purges; a subgroup of bulimic patients restricts food in the presence, or absence, of bingeing and/or purging. Although abnormally low body weight is an exclusion for the diagnosis of BN, some 25–30% of individuals with BN have a prior history of AN [4]. The greatest levels of psychopathology are present in patients whose diagnoses cross over from AN to BN, or from BN to AN [5], a phenomenon seen in restricting-type AN patients who attempt to eat normally, then fearing the loss of self-control leading to weight gain, couple restrictive eating behaviors with episodes of bingeing and purging; and in BN patients who stop purging, then in an effort to maintain thinness, turn to food restriction or excessive exercise. The binge-purging behaviors of BN lead to a less favorable prognosis than that of restricting-type AN, as dangerous habit-forming and self-perpetuating behaviors lead to potassium depletion and other physical complications [1]. Fifty to eighty percent of the variance in AN and BN liability can be accounted for by genetic factors [2].

This chapter discusses a range of neurophysiological and neurobiological treatment interventions, which, when used as adjuncts to current traditional psychotherapeutic interventions, hold the potential to improve the efficacy and sustainability of ED healing. Because women are more likely than men to perceive their bodies negatively [6], the chapter's focus is on women, with particular attention, through case examples, to those whom I have treated through my practice of psychotherapy.

My concomitant training as a practitioner of the Feldenkrais Method of Somatic Education® has offered me powerful insights into the usefulness of neurophysiological interventions in facilitating healthy self- and body image development. I share some of these insights with readers through anecdotal case examples from my own practice, in conjunction with mindful meditation techniques and Feldenkrais interventions.

2. The neurobiology of AN and BN

“The brains of individuals who exhibit eating ED pathology are ‘wired’ differently [from non-ED brains], creating the need to define diagnosis by aberrations in brain circuitry and physiology, and then provide treatments aimed at correcting or ameliorating the aberrant circuitry” [7]. Neurocognitive and brain imaging studies suggest that ED patients have impaired neural systems implicated in executive functions, visuospatial processes, self-image perception, emotional regulation and reward processing [8]. “New brain-imaging technology provides insights into ventral and dorsal neural circuit dysfunction—perhaps related to altered serotonin and dopamine metabolism—that contributes to the puzzling symptoms found in people with eating disorders. For example, altered insula activity could explain interoceptive dysfunction, and altered striatal activity might shed light on altered reward modulation in people with AN” [2]. Patients with AN have shown overlapping brain networks involved in reward and behavioral compulsivity [9]. The AN individual’s trait toward an imbalance between serotonin and dopamine pathways may play a role in an altered interaction between ventral (limbic) neurocircuits, which are important for identifying the emotional significance of stimuli and for generating an affective response to these stimuli, and dorsal (cognitive) neurocircuits that modulate selective attention, planning and effortful regulation of affective states [2]. Dopamine-related reward circuitry, pathways that modulate the drive to eat, showed reduced activation in this network in BN women; the greater the frequency of binge-purge episodes, the less responsive was the brain [10].

Starvation and emaciation have profound effects on the functioning of the brain and other organ systems, causing neurochemical disturbances that could exaggerate premorbidity, giving rise to symptoms that maintain or accelerate the disease process. Restrictive eating behaviors have been shown to create adverse structural changes in brain regions that are part of the reward circuitry, and also cause shrinkage in the overall size of the brain, including both gray and white matter [8]. Studies of patients with AN show widespread gray matter decreases in the neocortex and in areas linked to emotion regulation and reward, such as the anterior cingulate, orbitofrontal cortex, insular cortex, hippocampus/parahippocampus, amygdala and striatum; studies also report gray matter increases in neocortical and limbic regions. Such volume alterations may, or may not, normalize following ED recovery, dependent upon the severity and endurance of pathology [8]. Puberty may play an active role in major reorganization of white matter during adolescence and early adulthood [8], and activation of a genetic predisposition for ED symptoms. Menarche is associated with a rapid change in body composition and neuropeptides modulating metabolism. It has been surmised that the rise in estrogen levels in pubescent females could affect neuromodulatory systems such as serotonin or neuropeptides that affect feeding, emotionality, and other behaviors [2].

Multiple and distributed brain regions have been implicated in the psychopathology of AN, implying a dysfunction of interregional brain connectivity [8]. A study of structural connectivity suggests that people with AN may have impaired “wiring” between parts of the brain that are involved in the formulation of insight

[9]. An example is brain network connective abnormalities that exist within the caudal anterior cingulate and the posterior cingulate, regions crucial for insight, error detection, conflict monitoring, and self-reflection. One study showed that in AN patients, these regions are poorly connected with the rest of the brain, as compared to healthy participants [9].

Body image distortion may be coded in parietal, frontal, and cingulate regions that assign motivational relevance to sensory events [4]. The parietal cortex mediates perceptions of the body and its activity in physical space. “Recent research extends this concept to suggest that the parietal lobe contributes to the experience of the patient being an ‘agent’ of her own actions. The well-known distortion of body image in individuals with AN may suggest abnormalities of circuits through the postulated ‘self’ networks” [4]. Reindl [11] describes BN as a disorder of the self, involving the patient’s neurological incapacity to sense self-experience. Bulimic women in recovery report increasing accuracy in “sensing their own voice, sensing that they matter as human beings, sensing what to expect within the change process, and sensing their own curiosity [rather than fear] about their subjective experience” (in [11], pp. 281–282).

After engaging in treatment for BN, Emma began to develop a sense that her life matters, and that she has needs that deserve to be recognized by others. Feeling safer and stronger now, through her newly emerging sense of self, in response to her controlling husband’s insistence that she terminate treatment, she replied, “Therapy has become my world now. It is nothing that I plan to stop soon.”

3. Factors contributing to BN onset: genetics loads the gun; the environment pulls the trigger

A child with a genetic susceptibility to develop addictions, clinical eating disorders, depression and/or anxiety, having been exposed to the neurobiological effects of chronic early parent/child attachment disturbances, becomes vulnerable to the onset of AN or BN in later life. “The early years of a child’s life are the most pivotal time for ground floor development of identity and self-image. Failure of caregivers’ appropriate responses to a child’s needs deprives the developing child of the essential groundwork for acquiring her own body identity, with a discriminating perceptual and conceptual awareness of her own functions” (in [12], p. 57).

Emma, having been bulimic for many decades, reports that when, as an adult, she was 100 pounds overweight, she never experienced herself as being “a fat person.” Following bariatric surgery, at a normal weight, she was unable to perceive herself as having become thinner, which motivated her to begin restricting her caloric intake. “In an exercise class one day,” she reported, “I caught a glimpse of myself in the mirror and was surprised.... “Who is that person?” I thought. “Could that really be me?”

The awareness of oneself as a separate individual evolves only through *experiences* and *continuous interaction* with one’s environment (in [12], p. 57). “Attuned, empathic responses from caregivers to the child’s basic narcissistic needs are experienced by the child as part of the self, and are essential for the development of a healthy self-structure. For example, the caregiver needs to soothe when the child needs calming, enliven when the child needs stimulation, affirm when the child needs coherence” (in [11], p. 39). “When the child’s narcissistic needs are disregarded, she becomes vulnerable to an experience of fragmentation and depletion

(in [11], p. 39). “By not listening and responding appropriately to a child’s needs, parents deprive the child of the opportunity to learn how to listen and respond appropriately to *herself*” (in [11], p. 39). The child whose care-giver uses food as a reward for compliant behavior, or withholds it as punishment, will grow up confused and unable to differentiate her various needs, feeling helpless in controlling her biological urges and emotional impulses (in [12], p. 57). Non-secure relational attachment through neglect or abuse by caregivers in a child’s early experience interrupts the production of integrative neuronal fibers within the integrative regions of the brain, which include the amygdala, hippocampus, and prefrontal cortex, where the capacity for self-regulation is located [13].

When a child’s genuine needs and affects are consistently met with chronologically inadequate empathy by caregivers, these “needs and affects become disavowed, repressed, or split off from the total self-structure” within the nervous system (in [11], p. 35). The individual’s emotional development, once derailed, is unavailable to be integrated into the adult personality (in [11], p. 36). The child not only fails to internalize a healthy self-structure, but eventually creates a new self-system with the split-off aspects of the self. If the individual later begins to experiment with bulimic behaviors, the biochemical effects of the binge-purge cycle create an altered state, reinforcing the already existing split in the psyche, and further organizing the dissociated needs into a ‘bulimic self.’ Essentially, the BN individual invents a system by which disordered eating patterns, rather than people, are used to meet self-object needs (in [11], p. 36).

Without adequate self-structure, the child experiences herself as ineffective in communicating her internal states to others. Feeling worthless and unlovable contributes to the development of a deep sense of shame. Repeated shame-inducing interpersonal experiences in childhood, once internalized, become an enduring, core sense of shame, spreading throughout the self, shaping one’s emerging identity. Contained within the experience of shame is the piercing awareness of one’s self as fundamentally deficient, in some vital way, as a human being (in [11], p. 15).

Tess has struggled with BN for decades. Throughout her childhood, she endured her mother’s on-going judgment and criticism about her weight. Disagreeing with the pediatrician, Tess’ mother considered her daughter “fat,” and forbade her to eat the sweet and savory treats offered to her brothers. Tess experienced a searing sense of shame each time her mother warned her not to “let food cross her lips,” or forced her to cross her legs to prove that she hadn’t yet become too fat to do so. Tess reported, “She informed me in the third grade that when I reached grade five, I could attend Weight Watchers meetings.” Decades later, Tess explained, “Having food in my stomach still opens the floodgates of shame and embarrassment from my childhood, bringing me back to those immense feelings of inadequacy and incompetency. My greatest shame of all was in how unworthy I felt to be my mother’s child.” Early childhood feelings of helplessness and confusion reinforced Tess’ continued inability to control her urges and impulses and differentiate her needs and desires well into her adult years.

Dysfunctional family systems of BN individuals tend to generate greater mutual neglect, rejection, and blame, and less understanding, nurturance, and support than do more functional families. The obsessions and compulsions connected to BN symptoms provide the individual a protective shield against disintegration and internal collapse within the hostile and critical family environment, as well as a sense of internal coherence that calms, numbs, or stimulates, as needed.

Tess reports spending much of her childhood in her closet, hidden and isolated, shut off from her family’s chaotic world. “I felt invisible and safe there, muffling

the sounds of my family's screaming and arguing, protecting myself from having to witness my father physically abusing my brothers." Decades later, at the start of treatment, Tess was still seeking refuge from shame and disgrace behind closed (bathroom) doors now, hiding her purging behaviors from her husband and children. "My feelings of disgrace about needing to soothe myself by purging food and feelings have haunted, and followed me, throughout my life."

The quality of early caregiving "not only affects the child's subjective experience in the moment, but also influences the on-going development of her brain, effecting how her brain will process experience in the future" (in [11], p. 49).

3.1 BN onset typically postdates childhood

Setting the neurological stage for the onset of BN in later life, early childhood abuse or neglect impairs the structure of the self within the nervous system. The abused or neglected young child does not yet have the emotional, developmental, or environmental wherewithal to engage in compensatory behaviors, such as purging, substance abuse, or excessive exercise, all characteristic of BN pathology. BN onset usually emerges in later years, during adolescence or young adulthood, continuing into later years and decades if untreated and unresolved. Early life experiences that influence the mental and emotional characteristics of the child alter the anatomic, physiologic, and metabolic [neurobiological] characteristics of the adult [12]. As adults, BN individuals who have undergone early attachment disorganization impose various forms of abuse and degradation upon themselves, reminiscent of those sustained in childhood.

Women with BN avoid turning inwards to sense their needs, desires, feelings and aggressive strivings, for fear of encountering annihilating disgrace and inadequacy, compounded by guilt.

Emma considered engagement in any form of self-care as equivalent to "intolerable selfishness." Incapable of sensing her own needs and self-experience at the start of treatment, Emma could not discern whether her expressions of kindness or consideration towards her friends were based on honest feelings, or if they were merely "self-serving manipulations," designed to insure the friendship of women whose love and favor she felt she did not deserve.

Profoundly disconnected from their subjective psychic and physical experience, BN individuals feel the need to rely on externally based, rather than internally sensed, gauges to guide their actions.

Emma said, "Because my judgment about everything is so poor, and my thoughts and opinions are never right or acceptable, I have had to rely on my husband to know what is right for the two of us. For close to 25 years of marriage, I have had to 'suck it up,' accepting what he likes, and doing what he wants.... I am also well aware that if I were ever to cross him, the emotional costs for me would be high."

As a disorder of the self, BN is characterized by the individual's diminished self-control, self-regulation, self-attunement, self-trust, self-agency, self-reliance, self-perception, self-sensing and self-worth. As an escape from consciousness of the self, and in response to deficits in self-structure and self-regulatory capacities, BN behaviors separate [dissociate] the patient from her painful thoughts and feelings. "Dissociation implies that two or more mental processes or contents are not associated or integrated, with the result that consciousness, memory, identity, and perception are to some extent disconnected and not experienced as a whole" (in [11], pp. 15, 34).

Despite Tess' substantive progress in her BN recovery, her husband's "surprise attack" over dinner one night felt to her like an undeserved and highly demeaning insult. Tess described her immediate, entirely bodily-centered reaction; "I completely shut-down. I went into "blackout mode," totally disconnecting from him, my feelings, and my self. I purged my dinner, along with my feelings, which I had been completely unable to identify till I felt my stomach completely empty. It was only after the violence of that event that I became calm enough to realize what a fool I'd been for believing that he values me and the person that I am becoming."

Tess had little access to her thinking brain until after her stomach had had its way with her, a phenomenon demonstrating a rift in the fabric of her self-structure. Nervous system re-integration (i.e., healing) takes place over time and through therapeutic life experience, particularly when long-term dysfunction has been ingrained in neuronal development. Significantly however, Tess' capacity to bring her left-brain online in the face of traumatic memory was becoming appreciably more rapid and consistent. In starting to put words to her feelings, she had begun to create a coherent narrative that contained more constructive options for problem resolution.

4. Treating the human nervous system reintegrates mind, brain, and body

In describing how nervous system interconnections occur, Daniel Siegel defines the brain as "a self-organizing emergent process of electrochemical energy exchange between brain and body, and with other individuals" [14] and the human mind as "a relational and embodied process that regulates the flow of energy and information" [15]. The roots of the embodied mind exist in the somatic reality of the body. When the dynamic interaction between body and brain is activated, the regulation of energy and information flow happens "not only in the circuits and synapses of the skull-based brain, but also within the body, in the distributed nervous system" (in [15], p. 54). Feedback from sensory receptors throughout the body creates and re-creates the embodied self. Patients access the embodied self through sensing it, in response to self-experience. "The body, as represented in the brain by a map, may constitute the indispensable form of reference for the neural processes that we experience as the mind" [3].

Norman Doidge explains how it all works. "We tend to think of learning as having internal origins within the cranial brain in thoughts, ideas and feelings (top down, and 'from the inside out'). But this is only partly the case. Brain-changing electrical movements also originate in externalized behaviors, through experience and behaviors, affecting the brain 'from the outside in,' addressing different regions [16]. The brain is a feedback loop system, seeking balance and coherence through its own integration in order to achieve and maintain homeostasis [15]. It changes its structure and function with each different activity it performs, continually perfecting its circuits so as to be better suited to any task at hand [17]. "All experience encompassing thought, sensation, feeling, and behavior, be it conscious or unconscious, is embedded in neurons, with neuroplastic change occurring through the movement of ions in and out of brain membranes. Set off by a dynamic flow of electrochemical energy that creates electrical signals and patterns inside neurons, the movement of ions increases the density of brain circuitry within and between various regions of the brain where healing change occurs. Where attention goes, neural firing occurs, and where neurons fire, new connections can be made" (in [16], p. 18).

Contained within the nervous system and grounded in perception and kinesthetic experience, body image and self-image are "virtually interchangeable within the brain, each having mental and neurophysiological components embedded in

neurons. There is no valid distinction to be made between the “mind-self” and the “embodied self” (in [18], p. 18). Body image [and self image] change from action to action, built from sensory and psychic experiences that are constantly being integrated in the central nervous system (in [12], p. 87). “It is through self-awareness/consciousness of body and brain that we clarify self-image and body image, experiencing both as an inseparable whole. The unity of body and mind is an objective reality. All feelings and emotions have motoric antecedents initiated within the body” [19]. In other words, “emotions themselves are body phenomena,” [20] with the body experiencing emotions first, prior to the mental awareness of feelings. Experiencing emotions is therefore synonymous with experiencing body and brain changes; the development of self-regulation becomes synonymous with regulating changes in both the body and the brain. In BN individuals who have experienced trauma, the brain, which interprets the traumatic event as still happening, will become calmed only following the calming of the body, which under the right circumstances, becomes capable of healing itself, along with emotional wounds.

5. Defining mental health as nervous system integration

The best predictor of positive mental health is nervous system integration [14]. The mind seeks to achieve mental health through “self-organization, optimizing function by linking differentiated parts of the [nervous] system in the quest for harmony, flexibility, resiliency, adaptability, stability, coherence and energy... otherwise known as integration” [15]. In recognizing the body as the first responder to emotional stimuli, the task at hand in healing BN patients is to differentiate emotions from physiological activation. Cognitive self-regulation of emotional responses to aversive events is essential for mental and physical health. Emotion regulation involves a coherent relationship with the self... in other words, the effective, integrative communication between body, mind, and feelings [21]. “A prerequisite for successful emotion regulation is the awareness of emotional states, which in turn is associated with the awareness of bodily signals, or interoceptive awareness” [22]. “The human body needs to sense, process, and integrate different bodily signals in the premotor, temporoparietal, posterior parietal, and extrastriate cortices, in order to achieve self-identification, self-location, and body-part ownership” [23]. “Stimulating interoceptive sensing of body signals facilitates the differentiation of emotions from the physiological component of emotional experience, promoting self-regulation,” [22] a process central to healing sub-clinical, as well as clinical, eating disorders and dysfunctions of all kinds. A direct correlation exists between a full and integrative ED recovery, and the achievement of central nervous system integration within the treatment process. A survey of recovered ED patients identified “dimensions of psychological self-adaptability and resilience *within a complete and integrative* mental health model” as the fundamental criteria for having achieved recovery success [24]. In retrospect, it is not unusual for recovered ED individuals to express appreciation and gratitude for having experienced the twice-difficult ordeal of taking on the life-threatening challenges of illness, followed by the life-enhancing challenges of the psychotherapeutic healing process.

6. Integrative disorders require integrative approaches to treatment

Currently, conventional psychosocial, behavioral and pharmacological treatment interventions for adults with BN and AN have been shown to have limited efficacy [25]. Hilde Bruch, a pioneer in the field of ED treatment, contends that

unsatisfactory treatment results are related to inadequate conceptualizations of the underlying problems (deficits in self-perception and inner controls) (in [12], pp. 378–379). By re-defining the self as “an embodied, sensory-based process grounded in kinesthetic experience” [15], twenty-first century brain research and the field of interpersonal neurobiology have opened new possibilities for the treatment of the impaired BN self, shedding light on *how* people make changes within the context of psychotherapy. In healing the self, therapeutic interventions that access the embodied brain (sensory receptors embedded within, and distributed throughout the body), together with the cranial-based thinking brain, best address the broader neurobiological issues that underlie the inception and maintenance of eating disorders.

“Greater attention to improving the efficacy of existing ED treatment methodologies is critical, given the increasing prevalence of ED, the high risk of relapse, the effects of concurrent psychopathology, the high cost of care, and the greatest mortality rate of all the mental health disorders, which is one in ten patients [25]. Treatment outcome studies for cognitive-behavioral therapy (CBT), currently considered ‘best practice’ for the treatment of BN, reveal that only 50% of BN subjects stop bingeing and purging even under the very best conditions” [25]. Neurobiological solutions for the impairment of self-structure exist within the patient’s learned capacity to sense self-experience, a process defined as “attunement to one’s subjective felt experience... a ‘felt sense,’ being both psychic and bodily, beginning with the body and occurring in the zone between the conscious and the unconscious. Turning inward to consult this ‘border zone’ leads to the capacity to trust in one’s subjective experience, from which emotions, cognitions and memories arise, fostering deep therapeutic changes” (in [11], p. 12), and access to an ever deeper and more complex sense of self” (in [11], p. 99).

Clinicians enhance the patient’s capacity to integrate self-based consciousness through focusing on body-felt sensations connected to the emotions and underlying issues that bring her to treatment [15].

At one point during a therapy session, I felt I had lost connection with Emma, noticing her eyes beginning to divert from mine, and her increasing discomfort. “What are you feeling right now?” I inquired. Closing her eyes and grimacing, she sat forward on the couch and reported that what we were discussing was making her feel uncomfortable. In response to my inquiry about where in her body she might be sensing this discomfort, Emma replied that it was “in her stomach” and that she was starting to feel nauseated. Previously, she had relinquished responsibility for her purging, blaming her stomach for “dictating” when and where purging would occur. Now she would choose to take responsibility for preventing this from happening. “Why don’t we spend a few minutes breathing together,” I suggested. The experience altered her emotional state. At this point, with her left-brain on board she began to use words to communicate her feelings of distress, and was relieved to report that her stomach agitation was subsiding. The first stirrings of Emma’s feelings of relief, accomplishment, and self-agency were the result of her refusal to succumb to an interruption in the flow of that session by engaging in BN behaviors.

“The more completely a patient accesses and uses her entire muscular apparatus, the more the brain will become activated, with the activated regions further stimulating adjacent areas,” [26] increasing exposure to self-experience and the patient’s potential to sense it (in [11], p. 162).

Providing new ways “to pay attention within the integration of consciousness enables the client with an open and receptive mind to catalyze the integration of new combinations of previously isolated segments of his or her mental reality”

[27]. Studies show that “patients who have been trained to attend to bodily information display greater coherence between subjective experience and visceral responses during emotional episodes” [28]. Because the self, the brain, the mind, and the body are integrated entities, none will heal effectively and sustainably apart from the others.

7. Neurophysiological interventions integrate mind, brain, body, and self

Logic will not change emotion, but body movement will [13]. Straddling verbal and non-verbal input, and “breaking through to feeling,” (in [12], p. 46) neurophysiological interventions use the body to create changes in the brain, and the brain to create changes in the body, through top-down and bottom-up processing. Top-down brain processing refers to perception driven by cognition, including mechanisms initiated via mental processing at the level of the cerebral cortex [29, 30]. “Bottom-up brain processing refers to the processing of sensory information as it is coming in [29]. Bottom-up mechanisms are initiated by stimulation of various somato-, viscer-, and chemo-sensory receptors that influence central neural processing and mental activities via ascending pathways from the periphery to the brainstem and cerebral cortex. All mind-body therapies actually involve a combination of top-down and bottom-up mechanisms, creating ‘vertical’ integration, which brings the emotional and thinking brain online together [30]. Bidirectional autonomic and neuroendocrine pathways serve as mind-body pathways between the central nervous system and the periphery, facilitating the expression of affective, autonomic, hormonal, and immune responses, enhancing mental and physiological functioning [30].

As adjuncts to traditional ED treatment techniques, top-down and bottom-up “neurophysiological interventions have been shown to diminish symptoms associated with ED” [31], contradicting feelings of helplessness and fear, and facilitating a sense of empowerment [13].

During her assessment session, it became apparent that Suellyn, who had struggled with BN and major depression for several years, had undergone significant trauma in her past. At 22, she described herself as “always suicidal, feeling way too fat, and frequently being too depressed to get out of bed.” She refused to speak of events in her past, believing that doing so would “send her back under the covers.” Her mother had recently forced her to leave her home, friends and job, to live temporarily with her father in another state. Seeking a breakthrough to a window of communication, I invited her to consider deep breathing together with me, further awakening her body-felt sensibility through spine twisting, accompanied by differentiated eye movements. Her initial response to the movement was to feel “totally disconnected” from her body, and from me. After about 5 minutes of movement in her chair, she reported, “I am here now,” a reality that had become clearly apparent in her eyes and facial expression. She left the session in an elevated mood, planning to return soon.

Bottom-up interventions have been shown to be more successful in addressing “the repetitive, unbidden, physical sensations, and movement inhibitions, than are top-down interventions” [34]. Providing a non-threatening way to intercept trauma-based memory pathways, bodily-based movement reverses the sensorimotor intrusions of unresolved trauma by conveying to the patients that sensations come and go, leading to their acceptance, and to feeling safer [13].

In the next section, I discuss two types of interventions through which nervous system re-integration fosters the repair of the impaired self. The first involves

neurophysiological sensorimotor bodily-based movement *with mindful attention and intention*, (differentiating it from rote, 'mindless' bodily exercise). Examples include the Feldenkrais Method, trauma-informed yoga and EMDR. The second is *neurobiological* in nature, repairing the impaired self within a top-down, bottom-up attachment theory model that harnesses the power of empathy within the interpersonal psychotherapeutic connection through empathic resonance. Within this interpersonal neurobiological model, "the top-down process involves cognitive perspective taking, while the bottom-up process, achieved through neuronal mirroring representation systems, plays a key role in the direct sharing of the emotional state of the other" [32]. Rapid Resolution Therapy (RRT) represents a form of neurobiological intervention, specifically designed to achieve the resolution of trauma. Within the context of a trusting relationship, the therapist's focus during RRT is on a neurolinguistic use of oneself within the therapeutic relationship, with the intention of facilitating the patient's self-integration by turning traumatic memories into strengths and resources through memory consolidation [33].

7.1 Sensorimotor psychotherapy

Sensorimotor treatment is a movement-based neurophysiological intervention that combines cognitive and somatic techniques to address physical symptoms of a dissociative nature. Sensorimotor interventions foster healing through the organic, non-reductionist process of 'embodied learning,' which, rather than separating the organism into its anatomical parts, joins those parts into one continuous feedback loop [19]. "In sensorimotor psychotherapy, top-down, cortically mediated functions are harnessed to observe and facilitate sensorimotor processing where patients observe and report the interplay of physical sensation, movements, and impulses, noticing internal reactions as they try out new physical actions. Patients also learn to observe the effects of their thoughts and emotions on their body, recognizing which parts of the body respond to the impact of a particular thought, and/or how the body organizes a particular emotion. Meaning-making emerges from such observation, [resulting in] subsequent transformation of habitual response tendencies" [34]. The process of embodied learning has been shown to "repair and re-integrate perceptual-sensory dysfunction, increase interoceptive attention and/or proprioceptive awareness (the internal awareness of body parts), and produce a more accurate body perception and undistorted body representation" [35]. "Combining sensorimotor bottom-up processes with top-down processes activates the dynamic state of body and brain interaction where the regulation of energy and information flow happens within the circuits and synapses of the skull-based brain, within the body through the distributed nervous system, [and between the brains of two people in the context of a mindful relationship]... all are unifying elements of a disparate self" (in [15], p. 54).

7.1.1 *The Feldenkrais Method of Somatic Education© integrates the self and body image coherence*

Sensory stimuli are closer to our unconscious, subconscious, or autonomous functioning than to any of our conscious understanding: "Words can obscure intentions; kinesthetic truth gets right to our core" [19]. The Feldenkrais Method promotes self-integration by fostering conscious reconnection with one's unconscious sensorimotor repertoire through expanding the movement repertoire [17]. Directed mindful attention brings previously unfamiliar body parts systematically into awareness, moving the individual and brain toward integration, and offering a concrete means by which to change one's state of being. During or following movement sequences, the essentially non-verbal movement experience might be

enhanced through open-ended, insightful verbal cueing that prompts the sensing of self-experience by promoting a coherent narrative within the process, i.e., “Do you sense a place in your body that feels more comfortable and safe...more unfamiliar and unsafe? What is it like for you to explore yet unknown parts of your body and self?”

Within the Feldenkrais sensorimotor movement experience, the clarification of self-image requires the patient’s felt-sense during the action, through focused attention on self-awareness (self consciousness), variation (change and novelty), differentiation (the capacity to sense and create differences,) and integration (the capacity to bring the learning to a meaningful coherence). The differentiation and integration of coherent movement coordination provides the critical interface between brain and body, allowing global mapping to be maintained, refreshed and altered by continual motor activity and rehearsal” [3]. Differentiation of the smallest possible sensory distinctions between movements while paying close attention to injured or distorted body parts allows people to subjectively experience these parts through larger, more accurate and refined brain maps (in [18], p. 171).

During Feldenkrais Awareness through Movement [ATM] group classes, conducted on yoga mats, the floor becomes an invaluable feedback system. The practitioner guides participants through scripted sequential movements, facilitating their introspective sensing of self-experience. Feldenkrais Method practice has, through the past eight decades, become increasingly accessible worldwide. It has also become available free-of-charge through easy-to-follow 5 to 20 minute Awareness through Movement© UTube demonstrations presented by expert Feldenkrais practitioners who bring adjunctive sensorimotor movement interventions directly into the clinical treatment office, and/or into patients’ homes for independent practice. The Feldenkrais Functional Integration [FI] technique offers hands-on, gentle, pleasurable body movement, promoting self-integration through movement provided through human touch. While the patient lies on the treatment table, the practitioner’s nervous system, in connection with the patient’s nervous system, imparts sensory information directly to the patient’s brain through the patient’s embodied sensory receptors. The following examples illustrate the efficacy of the Feldenkrais Method’s Awareness through Movement© and Functional Integration© modes as adjuncts to traditional mainstream treatment for patients in recovery from BN.

7.1.1.1 Feldenkrais Awareness through Movement [ATM] as part of mainstream BN practice

Marion, a 43-year-old bulimic woman who grew up in a chaotic, dysfunctional family, was diagnosed with BN restricting-type, bi-polar disorder, dissociation, and self-mutilation after having been gang raped by her brother and his friends when she was 16. For close to two decades, she had been treated in hospital programs for BN and post-traumatic stress disorder (PTSD) before joining an outpatient movement-based ED support/therapy group for adults with clinical ED, which I facilitated. Each group session included a guided Feldenkrais Awareness through Movement© lesson, followed by participants processing their movement experience as it relates to relevant therapeutic issues. Though in a food-restrictive phase of her disorder, attunement to her inner bodily experience during group movement sessions led Marion to report that after group sessions, she would go to a grocery store and bring home “a four course dinner.” “While eating, I visualize the food as it enters my body as no longer being ‘the enemy.’ I imagine it traveling around and throughout my entire body, nourishing and giving life to all my cells and tissues.” In reconnecting with parts of herself that had previously seemed unsafe, she experienced her self as becoming increasingly “whole.” In individual psychotherapy, she began to access

feelings and issues that she ordinarily would not have felt comfortable facing or disclosing. Describing her Feldenkrais experience, she said, "I know I am safe. I know where I am in my body, and I know that I am learning to know myself better. This work makes me feel that it is okay, and not so scary, to be changing." Following group sessions, she slept more soundly. Ultimately, her purging and cutting behaviors ended completely.

The Feldenkrais Method takes adults back to infancy, mobilizing developmental processes at a fundamental level. "Through manualized movement sequencing a process of organic learning is stimulated which enables a sort of post-maturation and leads to the formation and integration of new, more functionally appropriate responses. The progression and promotion of the kinesthetic sense is, as our first and basic ability to perceive, deeply connected with our self-identity" [36].

7.1.1.2 Feldenkrais Functional Integration© as part of mainstream BN practice

As an adjunct to psychotherapy, I engaged Lana in a hands-on Feldenkrais Functional Integration "lesson," described as such for its being a form of nervous system education. Having spent many months in residential treatment facilities, Lana, who had been sexually abused by her grandfather from ages 3 to 8, suffered from BN-restricting type with co-occurring bi-polar disorder type II, fibromyalgia, substance abuse, promiscuity, and self-mutilation. Though human touch is typically a delicate issue for victims of sexual abuse, through our secure 2-year therapeutic attachment and her trust in the healing process, she described my hands-on work as "a comfort, helping me to feel myself directly, and to feel myself in control." Through these lessons, she began to discern parallels between her undifferentiated expressions of emotional rage, and her body's undifferentiated and painful immobility during fibromyalgia flare-ups. As her body became increasingly flexible, differentiated, and ultimately re-integrated through her movement experiences she became more adept at differentiating and reintegrating her emotions as well, becoming calmer and increasingly regulated. Lana spoke of her Feldenkrais experience as "clearing out the cobwebs in my brain." At the end of one Feldenkrais session, in response to my lifting her leg off the treatment table in order to assess her degree of neuro-skeletal integration, Lana described feeling a sense of "overwhelming relief and gratitude" for the now seemingly apparent weightlessness in her leg, in contrast with her own self-perception. "This is the first time I can remember feeling good about living inside this body of mine"].

Lana's sensation of physiological lightness was the result of her brain having uploaded novel sensory information through her newly reorganized nervous system. Embodied learning awakened Lana's sensory epiphany, followed by an increasingly integrated sense of self and identity. Though positive sensorimotor sensations might initially appear to be fleeting, the nervous system's brain and body 'own' these changes, with continued practice deepening the sustainability of learning and healing.

7.1.2 Sensorimotor interventions designed to address and heal trauma

A 2007 study revealed that trauma is significantly associated with the onset of ED, particularly BN and binge eating disorder. Traumatic experiences may include physical and emotional neglect (including food deprivation); physical, sexual, and emotional abuse and assault; teasing; and bullying [37]. The following are two additional forms of sensorimotor movement interventions shown to offer beneficial results for BN individuals who have experienced trauma.

7.1.2.1 Trauma-informed yoga

It is not unusual for ED individuals with restrictive eating disorders to attempt to control symptoms by using strenuous exercise to increase caloric expenditure. Trauma-informed yoga offers these individuals a safe avenue for the engagement in physical activity while providing an outlet for disease-associated symptoms [38]. Trauma-informed yoga reprograms the brain through activating novel movement, breathing, and action patterns and their psychological correlates. Facilitating sensorimotor processing and mitigating stress responses through combined top-down and bottom-up influences, yoga practice provides “a non-threatening means by which to unearth previously disavowed emotions stored in the ‘emotional’ limbic system, then cortically mediates traumatic pathways and thoughts through psychological appraisal methods” [38]. Teaching the use of breath facilitates close attention to present-moment awareness of self, bringing the nervous system from a dysregulated state to a unified, centered state by shifting the sympathetic nervous system to a balanced parasympathetic sense of calm and relaxation, while offering patients a sustainable relationship with the internal body. [39] By associating bodily states with emotional experiences, yoga gives rise to conscious feelings that occur through changes in the nervous system, fostering increased interoceptive awareness, thereby increasing emotional regulation in response to negative affect [22].

7.1.2.2 Eye Movement Desensitization and Reprocessing (EMDR)

Given the correlation between trauma and the onset of BN, Eye Movement Desensitization and Reprocessing (EMDR) offers an alternative interpersonal, experiential and body-centered therapy approach that treats the BN patient’s co-occurring PTSD. Through EMDR, the patient processes and resolves sensations and emotions connected to traumatic memory stored in the limbic brain. The technique uses a unique procedure in which the therapist exposes the patient to rhythmic bilateral stimulation (BLS), using alternating bilateral visual (eye movement), auditory, or sensory stimulation [40], (e.g., tactile stimulation, such as the therapist’s sequential touching of the patient’s right knee and left knee). The technique relieves affective distress, reformulates negative beliefs and reduces physiological arousal. EMDR allows faster and more highly effective processing for trauma than does psychotherapy, as the neural substrate of rhythmic movement has more direct links to the limbic system than to language-based regions. Once disseminated (dissociated) fragments of traumatic memory have been reconnected, they become capable of integrating a new personal semantic memory network with new cognitive schemas, thus fulfilling the goal of EMDR treatment [41].

8. The neurobiology of mindful human attachment repairs impaired self-structure

“Energy and information can flow within the brain and between brains, profoundly shaping the flow of energy and information within and between people” [13]. The self-organization of the infant’s developing brain occurs in the context of a relationship with another self, another brain” [42]. Allan Schore defines psychotherapy as “an attachment relationship that affects underlying neuronal structure and function” [43]. His developmental model places particular emphasis upon “the experience-dependent maturation of a system in the orbital prefrontal cortex that regulates psychophysiological state and organismic energy balance” [43]. “When the therapist’s mind and embodied-self come together in relationship with those

of the patient, implicit systems of the therapist interact with implicit systems of the patient, rendering psychotherapy the ‘talking’ cure. Talking to neurons alters neuronal networks and the functional sphere of influence of the prefrontal lobes” [16].

“By means of reverie and intuition, the sensitive empathic clinician’s monitoring of unconscious process, rather than content, calls for right brain attention to matching the patient’s implicit affective-arousal states, a process that lies at the core of the therapeutic relationship. Through the subconscious processing of information, the clinician uses an expansive attention mechanism that includes free association, while the left brain, more involved in the conscious processing of information, focuses on local detail” [43]. The resulting ‘empathic resonance’ is an embodied, sensed connection, typically experienced between therapist and patient as a dynamic, spirited, vibrant, and often loving mutual attachment, in which the patient’s right brain hemisphere becomes altered in form and function in response to a mindful, energetic connection with the therapist’s right brain hemisphere. Resonance exists ‘outside our skin,’ giving rise to a therapy relationship in which ‘a mind is being changed by a mind” [44]. Deeply ensconced in psychophysiology, empathic resonance may be considered ‘sharing a common brain,’ with the intersubjective field between two individuals including far more than two minds, to include two bodies” [45].

According to Schore, “emotional healing takes place primarily in the circuitry of the right brain hemisphere, which is dominant for attachment, intense emotionality, and the knowledge of how to be in relationships” [46]. “Right brain to right brain emotional processes are central to emotional development, psychopathology, and psychotherapy. The functions of the emotional right brain foster the self-exploration process of psychotherapy, especially of unconscious affects that can be integrated into a more complex and implicit sense of self. Emotional communication between therapist and patient lies at the psychobiological core of the therapeutic alliance. Therapist affect facilitation is a powerful predictor of treatment success” [47]. Studies show that the more successful the treatment, the greater the neuroplastic change [48].

The brain’s mirror neuron system is the foundational building block for empathy, a major component of healthy [resonant] psychotherapeutic attachment. Leading to a new theory of empathy that is bottom-up and top-down in nature, “mirror neurons reveal the fundamental integration within the brain of the perceptual and motor systems with limbic and somatic regulatory functions” [27]. It is through the therapist’s empathy and genuine caring that patients come to feel listened to, heard, seen for who they are, and even loved, sometimes for the first time in their lives.

Thinking back, Tess revealed that after our first therapy session, she felt frightened, yet at the same time, compelled to continue treatment. “It was as though you could see right through me. It was terrifying for me to feel so totally transparent to you, with all of my defects. Yet at the same time it was thrilling for me that you actually saw goodness in me, strengths and even excellence in parts of my life, none of which I had ever before recognized. I was afraid that you would eventually see through to my inadequacies and feel repelled by me, rejecting me as your patient. As the weeks passed, I knew in my heart that this would be the only chance I’d ever have, to understand who I am and who I could become, why I am sick, and how to get better so that my life could become my own for the first time ever”].

“It is through the relationship that deficits in internal working models of the self and the world are gradually repaired” [43].

8.1 The therapist's versatile and empathic use of self fosters patient self-reintegration

For BN individuals who failed to experience the benefits of healthy attachment during childhood, an effective therapeutic attachment offers a second real-time opportunity to feel the intrapersonal gratification that can be derived from a secure and trusting interpersonal attachment relationship with another human being. The healing therapeutic relationship becomes the prototype for healthful, quality relationships, both within, and beyond, the treatment dyad. "The highest human functions... including stress regulation, humor, empathy, compassion... are all right brain functions. An expanded capacity for right, not left, brain processing lies at the core of clinical expertise" [46]. The skillful and knowledgeable psychotherapist needs to maintain a mindful, pro-active and viable presence within each therapy moment, using himself or herself with intention, versatility, flexibility, courage, intuition and creativity [49]. Because ED represent changes within neural systems that mediate reward responses, decision-making, and social behaviors, effective treatment requires individualization based upon the specific constellation of symptoms presented, as well as their neurobiological underpinnings. As psycho-educators, practitioners need to keep patients informed about anticipated neurobiological changes in brain function related to impaired nutrition, such as fatigue, concentration and learning deficits, mood swings, insomnia, and impulsivity [2]. Patients also need to become aware of the positive changes in brain function that occur side-by-side with, and as result of, BN recovery.

The therapist's openness to his or her own bodily state is a crucial requirement for establishing interpersonal attunement with the patient [27]. "The therapist who is not intimidated, and who feels comfortable disclosing his or her own self-experience in appropriate, boundaried and clearly intentional ways, offers patients the opportunity and permission to bring forward more of their own seemingly intolerable experience. Therapist receptivity assures patients that they need not censor themselves, so that difficult emotions lose some of their threat" [44]. For purposes of role modeling in promoting the patient's learning and self-discovery, the clinician's self-revelation potentially fills gaps in the patient's emotional and self-development. Immediate, in-the-moment inquiry about the patient's counter-transferential reactions to the therapist's disclosure enhances the patient's sensing of self-experience and interpersonal trust building. "So, what's it like for you that I have chosen to share this information with you today?" "As an interactive regulator of the patient's psychological state" [47], the therapist's trust in, and acknowledgment of, the patient's strengths, resiliency, and potential to achieve recovery inspires and sustains the patient's belief in herself, fortifying her capacity to withstand the challenges of navigating the BN recovery process...as well as life without an ED.

Secure attachment relationships are based in mutual trust.

Emma shared, "You are the first person who has ever really listened to me, seeing beneath the surface to who I really am." Feeling stressed for having to leave town and therapy for several weeks, she texted me from afar about her disappointment in herself for having purged. "I hope I am not intruding on your time in reaching you like this," she wrote. "I genuinely care about you, and am glad to hear from you whenever and however it works best." I replied. "It is important for you to understand that the 'failure' you describe is not a failure at all, but a normal part of every stage of the recovery process. Knowing you as I do, I trust that you will continue to go from strength to strength, just as you've done your entire life, from early childhood onwards. And, if you are assessing the quality of your recovery,

please don't forget to consider the newfound clarity of your empowered voice in communicating with your husband, and his response, which has been respectful and loving in return. I look forward to one day soon when you will begin to recognize your own growing strengths and much deserved self-trust. She responded, "Thanks. You're right. I appreciate your thoughts."

"Because empathy accounts for as much, and probably more, outcome variance than does the specific intervention, the quality of the therapy alliance is more important to treatment outcomes than the particular treatment method or theory embraced by the therapist" [48]. This becomes increasingly so, as patients internalize and own dyadic gains.

Trust-building secures therapeutic relationships outside the professional office.

Tess had planned to observe a religious holiday that would have required a day's fasting. Prior to the holiday, between therapy sessions, it occurred to me that she might consider the alternative of reframing her commitment to observance this year by spending this day eating healthfully, instead. I phoned her to share my thoughts. "You think about me outside our sessions?! That's the best gift you could ever give me!" She was proud to report having been successful at fulfilling this unique challenge.

The therapist's clearly defined boundaries and skilled navigation of complex transference and countertransference issues are essential in reinforcing the effective use of self in what, in some instances, becomes a process similar to re-parenting. In reinforcing a loving, secure, healthy, and trusted attachment, the therapist re-visits, refreshes, and re-inspires the patient's healthfully continuing self-development.

9. Trauma resolution occurs through neurobiological reintegration of the distributed nervous system

Independent of its etiology, any traumatic assault on, or insult to, the brain impairs brain integration. A recent study found that "the vast majority of women and men with AN and BN reported a history of interpersonal trauma, with approximately one-third of BN women meeting criteria for lifetime PTSD [50]. Another study reported that sexual abuse occurs in 30–65% of women with ED, and that women with BN and substance dependence disorder had the highest frequency and most severe history of sexual abuse [51]. High stress levels leading to an overactive amygdala and hippocampus suppress the activities of the prefrontal cortex...the thinking brain, that helps to regulate the emotional brain.

The psychosomatic expressions of trauma experiences are held as bodily sensations, which become embedded in a broad variety of psychopathological and intersubjective phenomena [52]. Unprocessed traumatic memories stored in the mid-brain region become recycled when triggered, creating undischarged energy in the nervous system. Because traumatic memories are encoded subcortically, the process of healing trauma requires gaining leverage within the structural coding of the brain. Psychotherapeutic "interpretation" has been shown to have limited effectiveness with pathologies arising from the verbal phase related to explicit memories, and no effect on the pre-verbal phase implicit memories" [52]. Trauma speaks through the body. Trauma has been described as a "disorder of arousal." Its resolution lies in creating a psychophysiological state associated with decreased adrenergic activity, decreased muscular neuromuscular arousal, and cognitive quieting [53].

Rapid Resolution Therapy (RRT), illustrated in the examples in Section 9.1, is a body-based talk therapy technique shown to alleviate negative effects of trauma and PTSD without requiring the patient to recollect painful memories. Within the context of a trusted relationship, the technique connects problems to solutions through the human nervous system by consolidating memories of past and present human strengths and resourcefulness [54]. “Trauma resides in the limbic system (responsible for emotional systems and defensive responses) and in the perceptual world within a neural network that has sufficient functional boundary thresholds to largely ‘dis-integrate’ it from the rest of the nervous system. When negative feelings become dissociated or ‘split off’ [as they do with the bulimic pseudo-self], the potential exists to reintegrate them through the patient’s connection with a better state, her best self, by sensing and owning her resourceful self through solution-discovery, or rediscovery, both past and present” [33]. Trauma resolution “accesses neuroplasticity, through which neural networks that become lit-up at the same time as the neural network associated with the problem, result in the problem’s loss of definition. This dynamic allows for a free flow of communication with the rest of the nervous system, as the brain re-interprets new combinations of neural connections to create meaning” [54]. Because the effects of past trauma are revealed in the present, they become accessible, and thereby, available for remediation.

9.1 Sensing, recall, and consolidation of resourcefulness memories heal trauma

Trauma occupies the right side of the brain where it creates a hyperactive cortisol network; the processing of trauma needs to occur within the left side of the brain, where some form of resolution can be reached. The healing process becomes reinforced through connections to real-life experience, as the therapist guides the patient to access her already existing internal resourcefulness.

Having grown up in a dysfunctional, chaotic family environment during which her father spent years in prison, Lillian is a highly functioning divorced woman struggling with BN, depression, anxiety, and alcohol addiction. Her impaired self-perception, self-regulation, and distrust in her judgment and decision-making have kept her resentfully tied to a long-term, disorganized relationship with a boyfriend upon whom she relies to provide compensatory external controls. Though considering herself to be “helpless and hopeless,” this day she spoke of her excellent performance in her new job, the gratifying relationships she’d established there, and her improved relationship with her adolescent son. “When you are feeling good about such experiences, have you ever sensed where inside your body you notice sensations of pleasure or gratification?” I asked. She had not noticed. I invited her to probe her sensory recall, calling up past fulfilling experiences where she might have sensed an internal body-felt ‘lightness of being.’ She could not. Upon parting, she randomly commented that the Botanic Garden in which we had walked and talked that day had offered a delightful and uplifting experience. Capturing that opportunity, I replied, “Try to observe where in your body you might be sensing your positive feelings now, right at this moment.” Lillian pointed to her heart. “Perhaps the next time you notice yourself feeling inadequate, out of control or fearful, you might want to try to bring up your body’s sensory memory of your feelings of contentment right now, in this beautiful place. You might just come to discover that the same body that has long been your worst enemy could possibly become your greatest ally”.

Tapping into old ‘feel good’ moments facilitates positivity in the experience of now.

“Eating disorders, which are dysfunctions of multisensory body integration, are the outcome of primary disturbances in the way the body is “experienced” and

“remembered” [55]. Memory consolidation puts the experience of body phenomena into the thinking brain, securing it there through the creation and re-creation of healthy neurobiological circuitry and neuronal connections between mind, brain, and body.

A 6-year-old Honduran child, whose mother had brought him to the U.S. seeking asylum, underwent sustained trauma during his one-month detention in a cage at the country's border, separated from his mother. Having seen a film clip of their reunion on television, Tess watched the agonized child convulsing and crying in anguish and recrimination. “You gave me away. You don't love me. You are not my mom anymore, and I don't want to be your son. I want to go back to the jail.” Tess, having been abused and neglected by her own mother, instantaneously succumbed to re-experiencing her own traumatic childhood feelings of rejection. She purged immediately after viewing the program and awoke the following morning with an aching body, and a pain that “took up all the space in my stomach.” In an emergency therapy session that morning, Tess sat on my couch with bent knees tightly drawn up to her chin, arms tightly encircling her legs, her body language expressing a somatic narrative that portrayed fear and the need for self-protection. She described her previous night's experience, “where my dissociated bulimic self harangued me about how repulsive, despicable and worthless I am. I became painfully aware that all of my progress in treatment had gone up in smoke, becoming ‘unreal’ to me, as though it never happened.” During our treatment session, Tess became aware of how her mother currently and consistently continues to fuel her shame and psychic pain, into the present. She also became able to recognize her own co-dependent fear and reluctance to erect a viable emotional boundary between them. Having become fully present in the here and now within our secure attachment, our solution-based dialogue during that session countered her right-brain activation by creating a coherent, left-brain narrative, consolidating and reintegrating more recent body-felt remembrances of her healthy Self. Within two hours time, her face and body had visibly relaxed to a state of calm as she shifted out of the past into the fulfillment and gratification of her present life. Tess left that session with a smile on her face, expressing an overwhelming sense of relief and gratitude.

Tess's successful resolution of this traumatic incident held out the promise of change within her nervous system reflecting a greater and more spontaneous capacity to access her internal resiliency in the face of future resurgences of traumatic memory. The process of trauma resolution in working with BN patients is no different from healing trauma in any other context, with the exception that in light of the integrative nature of an ED, attention to trauma resolution needs to become part of a greater fabric of pathology, all aspects of which demand resolution and healing if ED recovery is to be complete and sustainable.

10. Conclusion

Characterized by biochemical, neuromuscular, and sensory imbalances, BN fosters internal chaos and system rigidity, disrupting the integrity of the patient's core self. Clinicians and patients alike need to understand and anticipate that BN treatment and recovery processes are never linear. Tess describes her treatment as being “highly successful...my eating lifestyle, coping abilities, relationships, life quality, and over-all sense of well-being have all significantly improved...yet my BN is still and always lurking within arm's reach, capable of stopping me in my tracks when I am least expecting it.” Integrative disorders demand integrative treatment approaches.

The capacity for self-correction is built into the nervous system through the brain's ability to integrate sensing, perception, and motor activity. Effective treatment needs to support changes at the brain level, with attention paid to mental, somatic, and relational issues. The creation of neural firing patterns that awaken the brain enables newly established synaptic connections, promoting self-awareness of one's internal world, which modulates and modifies it [27], promoting self-integration.

According to Allan Schore, a significant paradigm shift in psychotherapy is occurring, marked by clinical modes now moving from left brain to right brain, from the mind to the body, and from the central to the autonomic nervous system [52]. "After three decades of cognitive approaches, motivational and emotional processes have roared back into the limelight...cognitive interventions have been proven short-lived in their efficacy, and limited in the problems to which they can be applied" [47]. The right hemisphere is dominant in the change process of psychotherapy. Body-based right brain affect, including specifically unconscious affect, is best accessed through updated, adjunctive psychotherapeutic interventions [47]. Psychobiological attachment-based empathic resonance between the patient and therapist, and the use of adjunctive top-down and bottom-up neurophysiological interventions in appropriate situations and with clarity of intention, address the neurobiological roots of disease, beyond symptoms, in fostering mind, brain, and body connections that promote integration of the structure of the self.

Though we live in an era of psychotherapy research and practice where specific modes of psychotherapeutic treatment have been recognized as targeting specific sites of brain functioning [56], mainstream clinical eating disorder treatment continues to focus on symptom reduction alone, neglecting the neurological origins and underpinnings of these disorders. Clinicians need to become better prepared to resolve these lethal disorders at their source by accessing the brain and distributed nervous system, fostering the sustainability of ameliorative change. In so doing, they stand on the precipice of a new age of treatment, moving patients, the field, and eating disorder research, forward.

Acknowledgements

Heartfelt thanks and gratitude go to my dear friend and fellow writer, Lyn Haber, whose brilliant edits and much-appreciated tenacity were so supportive and uplifting to me throughout this project.

Many thanks go to 'Tess,' for having provided astute insights and contributions as I put this chapter together. As a soon-to-be psychotherapist herself, and a joy and pleasure to have worked with in treatment, she has my love, respect, and gratitude.

Abbreviations

AN	anorexia nervosa
BN	bulimia nervosa
ED	eating disorders
CBT	cognitive-behavioral therapy
EMDR	eye movement desensitization and reprocessing
RRT	rapid resolution therapy
ATM	awareness through movement
FI	functional integration
PTSD	post-traumatic stress disorder
BLS	bilateral stimulation

IntechOpen

IntechOpen

Author details

Abigail H. Natenshon
Eating Disorder Specialists of Illinois, Highland Park, Illinois, USA

*Address all correspondence to: abigailnatenshon@gmail.com

IntechOpen

© 2019 The Author(s). Licensee IntechOpen. This chapter is distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/3.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. 

References

- [1] Russell G. Bulimia Nervosa: An ominous variant of anorexia nervosa. *Psychological Medicine*. 1979;**9**(3):429-424
- [2] Kaye WH, Fudge JL, Paulus M. New insights into symptoms and neurocircuit function of anorexia nervosa. *Nature Reviews Neuroscience*. 2009;**10**(8): 573-584. DOI: 10.1038/nrn2682
- [3] Russell R. Movement and the development of sense of self. In: *Proceedings from the International Conference on the Feldenkrais Method*; August 2004; Seattle, Washington.
- [4] Kaye W. Neurobiology of anorexia and bulimia nervosa purdue ingestive behavior research center symposium influences on eating and body weight over the lifespan: Children and adolescents. *Physiology & Behavior*. 2008;**94**(1):121-135. DOI: 10.1016/j.physbeh.2007.11.037
- [5] Mickalide AD, Anderson AE. Subgroups of anorexia nervosa and bulimia: Validity and utility. *Journal of Psychiatric Research*. 1985;**19**(2-2):121-128
- [6] Whiteman H. Why are women more vulnerable to eating disorders? Brain study sheds light. *Medical News Today*. 2016
- [7] Moseman S. *Understanding Neurobiology and Eating Disorders*. Tulsa, Oklahoma: Laureate Eating Disorders Program; 2014. <http://www.eatingdisorderhope.com/treatment-for-eating-disorders/types-of-treatments/neurobiology-can-play-key-role-in-treating-eating-disorders>
- [8] Via E, Zalesky A, Sanchez I, Forcano L, Harrison BJ, Pujol J, et al. Disruption of brain white matter microstructure in women with anorexia nervosa. *Journal of Psychiatry & Neuroscience*. 2014;**39**(6):367-375. DOI: 10.1503/jpn.130135
- [9] University of Illinois at Chicago. Abnormalities found in 'Insight' Areas of the Brain in Anorexia. *ScienceDaily*. 2016. www.sciencedaily.com/releases/2016/07/160719123857.htm
- [10] Frank G. Eating disorders impact brain function, new brain research suggests. *Science News*. University of Colorado Denver; 2011. <https://www.sciencedaily.com/releases/2011/07/110711144944.htm>
- [11] Reindl SM. *Sensing the Self: Women's Recovery from Bulimia*. Cambridge, MA: Harvard University Press; 2001
- [12] Bruch H. *Eating Disorders. Obesity, Anorexia Nervosa and the Person Within*. New York: Basic Books, Inc., Publishers; 1973
- [13] National Institute for the Clinical Application of Behavioral Medicine NICABM. Master Strategies in the Treatment of Trauma: The Latest Interventions can Reduce Symptoms and Speed Healing [Internet]. 2018. Available from: <https://www.nicabm.com/tag/treating-trauma-master-series/> [Accessed:2018-11-07]
- [14] Siegel DJ. *How to Understand your Mind* [Internet]. Leadership Online Training Program; 2017
- [15] Siegel DJ. *Mindsight: The New Science of Personal Transformation*. New York: Bantam/Random House; 2010
- [16] Doidge N. *The Brain that Changes Itself: Stories of Personal Triumph from the Frontiers of Brain Science*. New York: Viking; 2007
- [17] Feldenkrais M. *Awareness through Movement: Health Exercises for Personal Growth*. New York: Harper and Row; 1972

- [18] Doidge N. *The Brain's Way of Healing: Remarkable Recoveries and Discoveries from the Frontiers of Neuroplasticity*. New York: Viking; 2015
- [19] Cheever OL, Cohen LJ, Leskowitz E. In: Micozzi MS, editor. *The Feldenkrais Method; Complementary and Alternative Medicine in Rehabilitation*. USA: Elsevier Science; 2003. pp. 39-50
- [20] Feldenkrais M. *Embodied Wisdom: The Collected Papers of Moshe Feldenkrais*. Beringer ed. Berkeley, CA: Somatic Awareness and North Atlantic Books; 2010
- [21] Price CJ, Hooven C. Interoceptive awareness skills for emotion regulation: Theory and approach of mindful awareness in body-oriented therapy (MABT). *Frontiers in Psychology*. 2018;**9**:798. DOI: 10.3389/fpsyg.2018.00798
- [22] Fustos J, Gramann K, Herbert BM, Pollatos O. On the embodiment of emotion regulation: Interoceptive awareness facilitates reappraisal. *Social Cognitive and Affective Neuroscience*. 2013;**8**(8):911-917. DOI: 10.1093/scan/nss089
- [23] Ionta S, Gassert R, Blanke O. Multi-sensory and sensorimotor foundation of bodily self-consciousness—An interdisciplinary approach. *Frontiers in Psychology*. 2011;**2**:383. DOI: 10.3389/fpsyg.2011.00383
- [24] de Vos AJ, Lamarre A, Radstaak M, Bijkerk CA, Bohlmeijer E, Westerhof GJ. Identifying fundamental criteria for eating disorder recovery: A systematic review and qualitative meta-analysis. *Journal of Eating Disorders*. 2017;**5**(1): 1-14. DOI: 10.1186-s40337-017-0164-0
- [25] Hill L, Knatz Peck S, Wierenga CE, Kaye WH. Applying neurobiology to the treatment of adults with anorexia nervosa. *Journal of Eating Disorders*. 2016;**4**(31):1-14. DOI: 10.1186/s40337-016-0119-x
- [26] Riva G. the neuroscience of body memory: From the self through the space to the others. *Cortex*. 2017;**104**:241-260. DOI: 10.1016/J.Cortex.2017.07.013
- [27] Siegel DJ. An interpersonal neurobiology approach to psychotherapy; awareness, mirror neurons, and neural plasticity in the development of well-being. *Psychiatric Annals*. 2006;**36**(4):248-256
- [28] Sze JA, Gyurak A, Yuan JW, Levenson RW. Coherence between emotional experience and physiology: Does body awareness training have an impact? *Emotion*. 2010;**10**(6):803-814
- [29] OpenPSYC. [Openpsyc.blogspot.com/2014/06/booem](http://openpsyc.blogspot.com/2014/06/booem)
- [30] Taylor AG, Goehler LE, Galper DI, Innes KE, Bourguignon C. Top-down and bottom-up mechanisms in mind-body medicine: Development of an integrative framework for psychophysiological research. *Explore*. 2010;**6**(1):29. DOI: 10.1016/j.explore.2011.12.005
- [31] Fuglset TM, Landro NI, Reas DL, Ro O. Functional brain alterations in anorexia nervosa: A scoping review. *Journal of Eating Disorders*. 2016;**4**(32):1-13. DOI: 10.1186/s40337-016-0118-y
- [32] Janowiak-Siuda K, Rymarczyk K, Grabowska A. How we empathize with others: A neurobiological perspective. *Medical Science Monitor*. 2011;**17**(1):RA18-RA24. DOI: 10.12659/msm.881324
- [33] Connelly J. The Institute for Rapid Resolution Therapy. <https://www.floridacenterforrecovery.com/addiction-glossary/rapid-resolution-therapy>
- [34] Ogden P, Pain C, Fisher J. A sensorimotor approach to the

treatment of trauma and dissociation. *Psychiatric Clinics of North America*. 2006;**29**(1):263-279, xi-xii. DOI: 10.1016/j.psc.2005.10.012

[35] Eshkebari E, Rieger E, Longo M, Haggard P, Treasure J. Persistent body image disturbance following recovery from eating disorders. *The International Journal of Eating Disorders*. 2014;**47**:400-409

[36] Laumer U, Bauer M, Fichter M, Milz H. Therapeutic effects of the feldenkrais method (awareness through movement) in eating disorders. *IFF Academy: Feldenkrais Research Journal*. 2004;**1**:2

[37] Brewerton TD. Eating disorders, trauma, and comorbidity: Focus on PTSD. *Journal of Treatment and Prevention*. 2007;**15**(4):285-304 www.nationaleatingdisorders.org/blog/eating-disorders-trauma-ptsd-recovery

[38] Hall A, Ofei-Tenkorang NA, Machn JT, Gordon CM. Use of yoga in outpatient eating disorder treatment: A pilot study. *Journal of Eating Disorders*. 2016;**4**(38):1-8. DOI: 10.1186/s40337-016-0130-2

[39] Kinser P, Goehler L, Taylor AG. How might yoga heal depression? A neurological perspective. *Explore*. 2012;**8**(2):118. DOI: 10.1016/j.explore.2011.12.005

[40] Korn D, Leeds AM. Preliminary evidence of efficacy of EMDR resource development and installation in the stabilization phase of treatment of complex posttraumatic stress disorder. *Journal of Clinical Psychology*. 2002;**58**(12):1465-1487

[41] Coubard OA. Eye movement desensitization and reprocessing (EMDR) reexamined as cognitive and emotional neuroentertainment. *Frontiers in Human Neuroscience*. 2015;**8**:1035. DOI: 10.3398/fnhum.2014.01035

[42] Mahler MS, Pine F, Bergman A. *The Psychological Birth of the Human Infant: Symbiosis and Individuation*. New York: Basic Books; 1931

[43] Schore AN. The experience-dependent maturation of a regulatory system in the orbital prefrontal cortex and the origin of developmental psychopathology. *Development and Psychopathology*. 1996;**8**:59-87

[44] Schore JR, Schore AN. Modern attachment theory: The central role of affect regulation in development and treatment. *Clinical Social Work Journal*. 2008;**36**(1):9-20. DOI: 10.1007/s10615-007-0111-7

[45] Schore AN. Early organization of the non-linear right brain and development of the predisposition to psychiatric disorders. *Development and Psychopathology*. 1996;**8**(1):59-87

[46] Halasz G. In conversation with allan schore. *Australian Psychiatry*. 2011;**19**(1):30-36. DOI: 10.3109/10398562.2010.530757

[47] Schore AN. Right brain affect regulation: An essential mechanism of development, trauma, dissociation, and psychotherapy. In: Fosha D, Siegel DJ, Solomon M, editors. *Papers by YellowBrick Leadership. The Healing Power of Emotion: Affective Neuroscience, Development, and Clinical Practice*. New York City: WW Norton; 2009

[48] Germer CK, Siegel RD, Fulton PR. *Mindfulness and Psychotherapy*. Guilford Press; 2005

[49] Natenshon A. Eating disorders: A treatment apart. In: Jauregui-Lobera, editor. *Eating Disorders: A Paradigm of the Biopsychosocial Model of Illness*. Intech; 2017. pp. 165-187

[50] Mitchell KS, Mazzeo SE, Schlesinger MR, Brewerton TD,

Smith BN. Comorbidity of partial and subthreshold PTSD among men and women with eating disorders in the National Comorbidity Survey-Replication Study. *The International Journal of Eating Disorders*. 2012;**45**(3):307-315. DOI: 10.1002/eat.20965

[51] Deep AL, Lilenfeld LR, Plotnicov KH, Pollice C, Kaye WH. Sexual abuse in eating disorder subtypes and control women: The role of comorbid substance dependence in bulimia nervosa. *The International Journal of Eating Disorders*. 1999;**25**:1-10

[52] Ogden P, Pain C, Minton K, Fisher J. In: Schore AN, editor. *Including the Body in Mainstream Psychotherapy for Traumatized Individuals*. Vol. 25(4). Psychologist-Psychoanalyst. 2005. Retrieved from: <http://www.sensorimotorpsychotherapy.org/article%20APA.html>

[53] Everly GS Jr, Benson H. Disorders of arousal and the relaxation response: Speculations on the nature and treatment of stress-related diseases. *International Journal of Psychosomatics*. 1989;**36**(1-4):15-21

[54] Quintal JS. Trauma resolution treatment...and more; rhizomatics and the processes of change. In: *Proceedings of the SelahFreedom: Bringing Light into the Darkness of Sex Trafficking*. Conference; 8-9 November 2018; Winnetka, Illinois. p. 4

[55] Riva G, Gaudio S. Locked to the wrong body: Eating disorders are the outcome of a primary disturbance in multisensory body integration. *Consciousness and Cognition*. 2018;**59**:57-59

[56] Gabbard GO. A neurobiologically informed perspective on psychotherapy. *The British Journal of Psychiatry*. 2000;**177**:117-122. www.ncbi.nlm.nih.gov/pubmed/11026950