

Review Article

Clinical Application of Neuroplastic Brain Research in Eating Disorder Treatment

Abigail H. Natenshon

Clinical director, Eating Disorder Specialists of Illinois 271 Hazel Ave, Highland Park, IL 60035, USA

Corresponding Author: Abigail H. Natenshon; email: abigailnatenshon@gmail.com

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Abstract. Eating disorders (ED) are disorders of the brain. As scientists acknowledge the genetic basis of ED and their deleterious impact on brain circuitry, practitioners need to recognize the importance of healing the eating disordered *brain*, along with the patient. The time has come for the ED treatment community to access the neuroplastic brain's capacity to heal itself through the introduction of non-invasive, integrative, adjunctive neurophysiological interventions into mainstream ED clinical practice. Eating disorder pathology marks the loss of the brain's capacity to integrate mind, brain and body, impacting the integrity of the core self. By re-defining the development of the self as an embodied, sensory-based process grounded in kinesthetic experience, 21st century brain research and technology has substantively expanded the breadth and depth of effective treatment strategies for ED and their co-occurring conditions to include various forms of somatosensory interventions. Neurophysiological and psychophysiological treatment interventions, by carving new neuronal pathways and creating connectivity that augments brain circuitry, carry the potential to remediate body image and self-image distortions, reintegrating the fragmented eating disordered core self. To date, intentional partnering between therapist, ED patient, and neuroplastic brain has been rarely applied in the clinical milieu and minimally referenced in the treatment literature. By bringing current neuroplasticity research into frontline practice, ED practitioners not only bridge the research/practice gap, but redefine new directions for future ED research.

Keywords: Neuroplasticity; Eating disorders; Eating disorder treatment; Neurophysiological interventions; Psychophysiological interventions, Somatosensory education; Feldenkrais Method; trauma-informed yoga, Body image disturbances; Self-image; Modern attachment theory; Empathic resonance; Mind/body connection; Body dysmorphic disorder

1. Introduction

Eating disorders (ED) are disorders of the brain. Within the context of ED treatment, the reintegration of a fragmented eating disordered self occurs through the stimulation of healthful neuronal creativity and synaptic connectivity within the neuroplastic brain, resulting in a global upgrade and integration of brain functioning in diverse domains.

Global integration of brain functioning enhances the re-integration of the core self, facilitating and reinforcing ED recovery.

Adjunctive neurophysiological treatment interventions, by connecting mind, brain and body, stimulate the creation of healthful neuronal pathways through activity in neurons that fire and wire together within and between domains that harbor the functions and structure of ED pathology and

co-occurring diagnoses. This essay advocates for a greater working knowledge of brain neuroplasticity research among clinicians as it impacts clinical ED treatment, providing them the practicable means and incentive to access and harness the resourcefulness of the neuroplastic brain to facilitate the reintegration and healing of the ED self.

ED are integrative dysfunctions, affecting the individual's neurological, physical, emotional, cognitive and social development. Effective treatment requires an integrative, interdisciplinary perspective, paralleling the nature of the disorder. Neurophysiological interventions are of particular relevance to the treatment of ED and associated body image disturbances. Techniques such as somatosensory education reach beyond the spoken word to awaken and integrate parts of the brain and body otherwise not addressed by current traditional cognitive behavioral 'best practice' treatment techniques. Facilitating connectivity within, and between, brain domains in a nervous system that is embodied as well as cranium-based integrates brain and body as well as the core self. Within the process of psychotherapy, a mindful therapeutic attachment between therapist and patient awakens right-brain to right-brain psychophysiological connectivity, increasing the patient's right brain hemisphere's capacity for self-regulation. It is through such interventions that both brain and the body become major players in healing ED, the most lethal of all the mental health disorders.

2. Eating Disorders are Disorders of the Brain

Eating disorders (ED) are bio-psychosocial disorders, their origins and functional pathology based in genetics and brain structure and function. In the year 2007, by declaring anorexia nervosa (AN) and bulimia nervosa (BN) disorders of the brain, Thomas Insel and the National Institute of Mental Health (NIMH) initiative set the stage for changes in the philosophical and clinical underpinnings of ED treatment and for the future of scientific research in the field. "There is good reason to think that the prefrontal cortex is the brain center for some ED, obsessions, addictive disorders, and alterations of body image [1]." There is "substantial evidence that individuals who exhibit ED pathology are 'wired' differently, ...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" [2]. "The days of being able to talk about psychology versus biology versus neurology are fading" [1].

Under his leadership, in 2008 NIMH developed Research Domain Criteria (RDoC), (Strategy 1.4 of the NIMH Strategic Plan) which "provides a framework for conducting research in terms of fundamental circuit-based behavioral dimensions that cut across traditional diagnostic categories. While an important aim of the project is to validate particular dimensions as useful for eventual clinical work, an equally important goal is to provide information and experience about how to conceive and implement an alternative approach

to future diagnostic practices that can harness genetics and neuroscience in the service of more effective treatment and prevention" [3]. The advent of positron emission tomography (PET) scans and other neuroimaging devices capable of tracking and recording even the smallest brain changes have shed significant light on *how* people make changes in psychotherapy.

Quantitative neurophysiological studies involving modern attachment theory, and disciplines such as kinesthesiology and somatic education have converged to reveal principles relevant to ED recovery. However, their notable absence from the ED literature makes them inaccessible to ED practitioners. Qualitative studies of integrative treatment approaches have demonstrated the merits of promoting neuroplastic changes in the ED brain through exposure to kinesthetic, 'bottom up,' somatosensory interventions such as the Feldenkrais Method [4] or trauma-informed yoga [5]. However, such studies are typically considered 'anecdotal' and beyond the purview of pure science. They are rarely, if ever, featured in ED professional journals. As a result, relevant adjunctive neurophysiological treatment practices that support neuroplastic brain change currently remain absent from mainstream ED clinical practice.

In bridging this research/practice chasm, treatment interventions need to access and support the eating disordered brain, as well as the ED patient. This essay illustrates the advantages of combining adjunctive, integrative, body- and brain-centered treatment strategies with traditional 'best practice' clinical treatment approaches to access and heal the brain directly. This discussion spotlights: 1) Somatosensory techniques that call for bodily movement with mindful attention and self-awareness, creating sensory connectivity between mind and body, and within and between diverse domains of the brain. 'Bottom up' neural connectivity between embodied, and cranium-based sensory receptors facilitates re-integration of the core self [4]. 2) Empathic resonance, a dynamic process created through right brain hemisphere connectivity between patient and psychotherapist within the context of a mindful psychotherapeutic attachment; empathic resonance facilitates the ED patient's emotional development and capacity for self-regulation [6].

3. The ED Clinician who Treats the ED Patient also Treats the ED Brain

Until the mid-twentieth century, scientists believed that the brain was "hard-wired" and unchanging, and that humans were born with predestined potential and limitations. It was not until the 21st century that brain research and imaging technology overturned the doctrine of the unchanging brain. Evidence-based scientific studies of the brain today have validated and legitimized 2500 years of Buddhist beliefs and practice, as well as the thinking and work of the earliest neuroplasticians of the 20th century. Sigmund Freud and Moshe Feldenkrais considered the unity of mind, brain

and body to be an objective reality, recognizing no valid distinction between the three elements. Feldenkrais observed that without a change in muscular habits of action, a person in Freudian psychoanalysis would often revert back to a habitual way of acting even when their therapeutic insights should have helped them change their behavior [7]. He believed that all subjective experience activates a bodily component, and all bodily experience activates a mental component [8]. “Emotions are themselves body phenomena. We cannot be conscious of a feeling before it is expressed by a motor mobilization...they are not two states but two aspects of the same state” [9]. Eckhart Toole concurs in describing body awareness as a “doorway into inner space” and an “awakening of consciousness” which “counteracts the loss of self in thinking, in emotions, or in external situations” [10]. He contends that primarily identifying with the mind to the exclusion of the body creates “an opaque screen of concepts, labels, images, words, judgments, and definitions” capable of blocking “a sense of oneness,” the relationship between man and himself” [11]. In other words, “the mind is embodied, built in part from roots in somatic reality” [12]. Nowhere in the field of mental health is the concept of embodied healing (with aspects of the self embedded in bodily-based sensory receptors) as significant as in the treatment of ED and body image disturbances.

21st century magnetic resonance imaging (MRI) technology has provided scientific evidence of the relationship between the brain’s motor cortex and its visual system, language systems, memory, attention and cognitive processes [13]. Implications of the brain’s capacity to integrate sensing, perception and motor activity are far-reaching; because the brain does not differentiate action from thought, the power of imagination and self-awareness can become as potent in stimulating neurological change as the physical act of doing. Moshe Feldenkrais, a physicist by training, understood that the human brain is capable of regenerating, reconfiguring and healing itself through non-invasive, somatosensory interventions, creating healthy, integrative awareness and connectivity between the body, brain, and mind, thereby facilitating global brain development.

4. ED are Diseases of an Exiled and Fragmented Core Self

“The domain of core self seems to be where psychology crosses paths with brains and bodies” [14]. Brain research points to a dynamic, experientially-based notion of the healthy self as an embodied process, grounded in somatosensory and kinesthetic experience, that stimulates the formation of new and diversifying neuronal pathways [7, 12]. The healthy self has been recognized to be a wholly integrative fabric with no one single element separated from any other, the product of a neurophysiological interrelationship between moving, thinking, feeling, and sensing [7]. “*The cohesion of*

movement and sensing plays an extensive role in how the nervous system coordinates a coherent sense of self” [14]. Feldenkrais described the self as “never static...as changing from action to action. There is no life without movement” [15]. Eating disorders, too, are never static. Essentially taking over the functions of the self within the afflicted individual, ED, if not actively healing, are actively securing a more profound and pernicious foothold within the function and structure of the patient’s brain. “BN stems from the absence of an authentic self” [16].

Though movement fuels the processes of neuronal creativity that lead to healthy self integration, rote, mindless, undifferentiated movement, such as the mechanical repetition of an action through repetitive exercise, will not produce self-image change. Clarifying the self-image requires the re-shaping of neuro-circuits through attention and self-awareness, mindfulness of each part of the action, the patient’s experience during the action, and the perception of the total body image during and following the action [4]. “Where attention goes, neural firing occurs, and where neurons fire, new connections can be made. In this manner, learning a new way to pay attention within the integration of consciousness enables the client with an open receptive mind to catalyze the integration of new combinations of previously isolated segments of his or her mental reality [12].” “The repetition of novel, ameliorative behaviors alters neuronal pathways within the structure of the brain by “shaping” or “training,” molding new behaviors in very small steps [7]. Daniel Siegel describes attention paid to behavior as the “specificity scalpel into the brain to re-carve neuro-circuits” [17].

5. Self-Image and Body Image Disturbances are Disturbances of the Brain

Self-image and body image, each having mental and neurophysiological components embedded in neurons, become virtually interchangeable within the neuroplastic brain [7]. Self-image has been defined as a kinesthetic, embodied experience influenced by heritability, the socio-environment, and self-education (the engagement of the patient in healing techniques outside the treatment milieu) [4]. “The relative proportion of positive to negative self-schemas (functional memory structures) available in memory may be the cognitive foundation of observed differences in global self-esteem, the affective component of the self-concept” [16]. “Interventions that promote the development of new positive self-schemas have been identified as an important factor in identifying alternative sources of motivated behaviors, promoting recovery for ED” [16]. The integrated fabric of the re-emerging healthy core self becomes a pivotal benchmark of ED recovery.

Anorexic patients have been shown to experience an altered capacity to process and integrate bodily signals; the

sensation of body parts becomes distorted, experienced as dissociated from their holistic and perceptive dimensions [18]. “When a sensory function becomes disturbed, the body part affiliated with it stops sending normal sensations from it to the brain. The brain then alters its representation of that body part” [8]. It is likely that not only perception, but memory, and in particular sensorimotor/proprioceptive memory, shapes bodily experience in anorexic patients. AN, a disorder of sensing and self-perception, is linked to neural processing in the insula cortex, which monitors bodily sensations and the strength of responsiveness to them; this is where taste is sensed, and integrated with reward to help determine whether an individual feels hungry or full. Four separate regions within the insula cortex have been found to connect to social-emotional, sensorimotor, olfacto-gustatory, and cognitive networks of the brain. Functional systems overlapping within the insula reflect a linkage between them “necessary to integrate different qualities into a coherent experience of the world and setting the context for thoughts and actions” [20].

6. How Neurophysiological Experience Integrates the Neuroplastic Brain

“Set off by a dynamic flow of electrochemical energy that creates electrical signals and patterns inside neurons, the neuroplastic “language” of learning and change occurs solely through experiences that result in the movement of ions in and out of brain membranes. There are no visual images, sounds, smells or feelings moving inside our neurons” [7]. “All experience encompassing thought, sensation, feeling, and behavior, be it conscious or unconscious, is embedded in neurons [7]. Brain-changing electrical movements originate either in externalized behaviors, through experience and action, effecting the brain ‘from the outside in’ (and ‘bottom up,’) and through thoughts, imagination and feelings, ‘from the inside out’ (or ‘top down’) [7].

Neurophysiological interventions transmit information from the body’s sensory receptors, via sensory nerves in the spinal cord, to the motor cortex. Most of the neural circuitry from the cerebellum are ‘outbound,’ influencing other parts of the brain involved in memory, attention and spatial perception. Notably, “the part of the brain that processes movement is the same part of the brain that promotes learning” [13]. Studies have shown that (mindful) voluntary exercise improves “patterns of gene expression which enhance factors that support the encoding and transfer of data, synaptic structure, and the activity and plasticity of neurons, facilitating learning” [13]. “The aim of the talking cure (from the psychophysiological point of view) is to extend the functional sphere of influence of the prefrontal lobes. Psychotherapy works by going deep into the brain and its neurons and changing their structure by turning on the right genes” [7].

Donald Hebb proposed that “learning links neurons;” that when two neurons fire at the same time, (or when one fires causing the other to fire) chemical changes occur in both, so that the two connect more strongly. The neuro-scientist Carla Shatz summarized the concept: “Neurons that fire together, wire together” [7]. The more often the respective neurons “talk” to each other, “the greater the capacity for learning to become solidified” [7]. The brain 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. According to Feldenkrais, “so smart is the human brain, that learning to do something with ease and facility once, can be sufficient to bring about change even after the brain has done that thing ineffectively a thousand times.” If one “part” of the brain fails, than other parts can take over. If brain cells die, they can at times be replaced, or other parts can be recruited to take over their function” [21].

7. Neurophysiological and Psychophysiological Interventions Integrate the Brain and the Core Self

By increasing brain circuitry through bodily movement with attention and self-awareness, somatosensory education...in connecting body with mind, and brain with body... fosters the neurophysiological reintegration of the core self that is embodied.

7.1. The Feldenkrais Method of Somatic Education©. Recognizing that sensory stimuli are closer to unconscious functioning than to conscious understanding, Feldenkrais devised his Method of Somatic Education, which allows patients to consciously reconnect with their unconscious sensorimotor repertoire through somatosensory training. Accessing the brain in domains where talk therapy alone cannot reach, the Method provides a form of self-education facilitated through verbally guided directives of a Feldenkrais practitioner (Awareness through Movement©), or through gentle, non-verbal, hands-on facilitation applied to the sensing body and brain (Functional Integration©). Both forms of treatment are becoming increasingly accessible and affordable; the Internet provides free access to a plethora of short practitioner-guided demonstrations of the Feldenkrais Method. Of the various forms of somatosensory movement interventions relevant to ED treatment, the Feldenkrais Method stands out uniquely for its excellence in guiding participants to engage in intentional, mindful awareness of sensation, thought, and feeling within, and following, movement...all components required to stimulate integrative neuroplastic brain change.

In facilitating self-awareness, the practitioner might inquire of the ED patient: “How does it feel to sustain contact with your body as you gently move and transition into the unknown?” “Is there a place inside of your body where you can go to feel fully safe...or unsafe?” “Can

you sense your transition into the unknown as you move?” “Having discovered new options for moving your body through space, do you ever find yourself discovering novel options for decision making and problem-solving in other life spheres?” Participation in adjunctive Feldenkrais treatment of ED inpatients within a multimodal treatment program in Germany was shown to increase the patients’ contentment with problematic zones of their body, foster acceptance and familiarity with one’s own body, and develop a ‘felt’ sense of self and self-confidence within a general process of maturation of the whole personality” [4].

7.2. Psychophysiological attachment/Empathic resonance. Psychophysiological right brain hemisphere connections made between the patient and therapist within the dynamic process of the mindful therapeutic relationship create neuronal pathways within the patient’s right brain hemisphere, shown to improve self-regulatory function [22]. It is through the human relationship that “deficits in internal working models of the self and the world are gradually repaired” [23]. “The healing impact of the therapeutic relationship occurs through transactions where “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” [6]. By means of reverie and intuition, the therapist listens with the right brain directly to the patient’s right brain, [6] facilitating knowledge of the patient “from the inside out” [17]. “Implicit right-brain to right-brain intersubjective transactions, existing ‘outside our skin,’ lie at the core of the therapeutic relationship, mediating the “moments of meeting” between patient and therapist. They give rise to a therapy relationship so deeply ensconced in psychophysiology as to be considered sharing a common brain... “a mind being changed by a mind” [6]. This renders psychotherapy a potentially powerful neuroplastic treatment tool. Brain scans before and after psychotherapy confirm that the brain plastically reorganizes itself in treatment. The more successful the treatment, the greater the change [7, 24].

Allan Schore’s developmental model of the mindful psychotherapeutic relationship places particular emphasis upon “the experience-dependent maturation of a system in the orbital prefrontal cortex that regulates psychophysiological state and organismic energy balance. This frontolimbic system is expanded in the nonlinear right hemisphere that generates stress-regulating coping strategies...” [22]. “The intersubjective field co-constructed by two individuals includes not just two minds but two bodies” [22]. “Current interest in affective bodily-based processes, interactive regulation, early experience-dependent brain maturation, stress, and non-conscious relational transactions has shifted attachment theory to a regulatory theory” [6], increasing its relevance to ED research and practice. The right brain hemisphere contains the most comprehensive and integrated map of the body state available to the brain [12].

8. Neurophysiological Interventions also Heal Co-occurring Conditions

8.1. Trauma-informed yoga. Trauma is a commonly occurring co-morbid condition that can contribute to the onset and duration of ED and body image disturbances. Trauma is stored in somatic memory and expressed as changes in the biological stress response, creating undischarged energy in the nervous system [25]. Traumatic memory stays “stuck” in the brain’s nether regions, in the nonverbal, unconscious, subcortical regions (amygdala, thalamus, hippocampus, hypothalamus, and brain stem), where they are not accessible to the frontal lobes, the understanding, thinking, reasoning parts of the brain [25]. Chronic physiological arousal and unregulated body experience give rise to recurring symptoms of posttraumatic stress. “Because traumatic memories are encoded subcortically, rather than in conscious autobiographical memory, the role of insight and words in the treatment of trauma-based eating disorders is limited” [26]. In seeking psychic change, “interpretation is limited in effectiveness with pathologies arising from the verbal phase related to explicit memories, with no effect on the pre-verbal phase where implicit memories are to be found” [27]. ‘Bottom up’ neurophysiological interventions more effectively address “the repetitive, unbidden, physical sensations, movement inhibitions, and somatosensory intrusions of unresolved trauma” [28]. Regulating the overwhelmed nervous system by bringing unconscious content from trauma-related neurological and muscular patterns into consciousness, trauma-informed yoga has been shown to promote affect tolerance of physical and sensory experiences associated with fear and helplessness [17].

8.2. Eye Movement Desensitization and Reprocessing (EMDR). EMDR processes and resolves the experience, sensations and emotions around traumatic memory that are stored in the limbic brain [28]. As an integrative psychotherapy approach involving interpersonal, experiential and body-centered therapies, EMDR is a treatment practice effective in healing disorders of desire, compulsivity, anxiety, affect dysregulation, affect avoidance, dissociation, and posttraumatic stress. Positive effects have been observed in a recent study focusing on binge eating, depression, anxiety, impulse control over rage, and acting out [28].

8.3. Sensorimotor psychotherapy. Sensorimotor psychotherapy is an embodied relational psychotherapy practice that has not yet found its place with ED treatment techniques. Sensorimotor psychotherapy is a mindful psychodynamic psychotherapy that includes the body as central in the therapeutic field of awareness. It has been shown to improve self- and affect-regulation by incorporating somatosensory practices (touch, movement and breathing) within treatment [29]. Promoting the same goals as psychotherapy, its practice blends theory and technique from cognitive and dynamic

therapy with straightforward physical interventions, facilitating body awareness, sensation tracking, and empowerment. In identifying trauma reactions physically, it decreases the client's arousal level to "a window of tolerance," allowing the body itself to lead the client into a necessary resolution and calming of the physical experience [27].

8.4. Music therapy. A recent study demonstrated that music therapy decreases related anxiety and stress in ED inpatients following meals [30]. The brain regions that process listening to music (along with accompanying foot-tapping, humming, and singing) have been shown to stimulate additional neurological functions, such as language processing, auditory perception, attention, memory, executive function and motor control [31].

8.5. Cognitive restructuring. Brain studies of individuals with AN suggest that cognitive impairments, which include visuospatial ability, attention, memory and cognitive flexibility, may be the result of 'trait' characteristics, rather than a temporary state due to malnutrition or starvation. Prolonged symptom duration post-recovery may be the partial product of impaired cognitive processing. "Clarifying the processes that underlie cognitive inflexibility in ED will facilitate the development of novel cognitive retraining strategies designed to target specific mechanisms that have salience to particular ED symptoms" [32]. "Using more precise behavioral tasks, as opposed to multidimensional clinical neuropsychological measures will help to clarify which aspects of cognitive inflexibility are most salient to adolescent ED" [32]. It has been suggested, "Examining changes in behavioral and neural facets of attentional set-shifting and reversal learning over time will help elucidate the role of cognitive flexibility in the early progression of ED symptoms [32].

8.6. Neurofeedback or EEG biofeedback training. Neurofeedback or EEG biofeedback training remediates the patient's self-regulation. Neurofeedback is biofeedback applied to the brain directly, a non-invasive approach to operant conditioning of the electrical activity emanating from large groupings of cortical neurons with the purpose of normalizing deregulated EEG activity. The technique represents an effective alternative for modifying the neurophysiological activity in the brain that contributes to specific cognitive processing, and emotional and behavioral dysregulation [33].

8.7. Deep Transcranial Magnetic Stimulation (DTMS) . Another form of non-invasive technological brain intervention used successfully with ED patients for co-occurring depression includes deep transcranial magnetic stimulation, a high frequency repetitive transcranial magnetic stimulation applied to the left dorsolateral prefrontal cortex. This intervention sends low dose magnetic pulses to parts of the brain associated with treatment resistant depression (TRD) [34].

9. Conclusion

Evidence from the synthesis of various disciplines within science and contemplative practices has converged to demonstrate that adjunctive neurophysiological treatments, by stimulating intra- and inter-personal neuronal connections, foster the human brain's capacity to heal itself. By forging a dialogue between psychodynamic models of the mind and somatosensory therapeutic models of the body, a more interdisciplinary perspective on brain/mind/body systems holds the potential to increase timeliness and sustainability in ED recovery. In treating the ED patient, clinicians require a greater working knowledge and increased awareness and understanding of the brain that they treat, along with willingness to access and engage the brain in healing the mind and body... and the mind and body in healing the brain.

Keeping pace with neuroscience, ED clinicians require a broader knowledge of relevant brain plasticity studies and methodologies *within related fields* in order to access and apply relevant principles of brain plasticity to front-line ED practice. In so doing, they serve their ED patients, while becoming instrumental in defining new directions for quantitative ED research.

Abbreviations

ED	Eating disorder, Eating disorders
AN	Anorexia Nervosa
BN	Bulimia Nervosa
NIMH	National Institute of Mental Health
RDoC	Research Domain Criteria
PET	Positron emission tomography
MRI	Magnetic resonance imaging
EMDR	Eye movement desensitization and reprocessing
EEG	Electoencephalogram
DTMS	Deep transcranial magnetic stimulation
TRD	Treatment resistant depression

Competing interests

The author declares that she has no competing interests.

Author's contributions

AN researched, designed and solely authored this essay. The ideas were her own, developed through her expertise as an eating disorder treatment specialist for 46 years and as a Guild Certified Feldenkrais Practitioner since 2006. She assumes all responsibility for what is written in this article.

She has performed her own qualitative studies of adjunctive, somatosensory treatments interventions with eating disordered patients, individually and in groups, in conjunction with traditional 'best practice' eating disorder treatment. Positive outcomes enhanced traditional approaches and facilitated recovery sustainability.

Recently, through her personal and professional association with neuroplastician and author, Dr. Norman Doidge, she has become increasingly inspired to bring the eating disorder treatment field to an awareness of relevant brain neuroplasticity research, with the aim of bringing this cutting edge research into front-line practice.

Author's information

Natenshon is a psychotherapist who has specialized in the treatment of eating disorders for forty-six years. The founder and director of *Eating Disorder Specialists of Illinois: an outpatient team of expert treatment professionals*©, Natenshon is the author of *When Your Child has an Eating Disorder: a Step-by-Step Workbook for Parents and Other Caregivers* (Wiley and Sons 1999) and *Doing What Works: an Integrative system for the treatment of eating disorders from diagnosis to recovery* (NASW Press 2009). Natenshon, who resides in the U.S.A., provides psychotherapy for eating disordered patients and families, and professional consultation for psychotherapists and other outpatient professionals in the eating disorder treatment field. Her online webinars are soon to be published by The World Continuing Education Alliance.

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