

c0003

Neuroscience

Contributions to the Understanding and Treatment of Eating Disorders

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With all the money, and all the glamour and all the fame and attention and success, it doesn't mean anything if you can't fit into your own clothes. It means the fat won. You didn't win. Here I am one of the most visible people in the world trying not to be visible, trying not to appear on the cover of my own magazine. I'm mad at myself. I'm embarrassed. I can't believe I'm still talking about weight (Winfrey, 2008).

p0020 Oprah Winfrey's words illustrate how disordered relationships with food and weight can wreak devastating pain on even the strongest, most successful, and most visible. Most eating disorders (ED) have their onset during adolescence and arise from physical, psychological, cultural, and social factors that are dauntingly complex. The media and our thin-obsessed society certainly contribute. Also at play is the abundance and ease of access to a staggering variety of foods, many of them "fast" and void of nutrition. But the origins of ED are much more intricate. They lie in the elaborate biology and neurobiology of our bodies and in the tender and earliest attachment relationships that shape the very development of our brains and nervous systems. Early histories of those with ED often include trauma, psychic injuries that occurred without secure containment or repair. Clear and impressive evidence supports a correlation between ED and these early attachment difficulties (Armstrong & Roth 1989; O'Kearney 1996).

p0025 While consensus is that the treatments for ED must be extensive, specialized, and multidisciplinary, we currently know far too little about how to treat them effectively. This chapter translates findings from attachment research and from the field of neuroscience into a conceptual model of ED which emphasizes the unconscious, holistic, right hemisphere (RH), rather than the logical left hemisphere (LH) specifically targeted in approaches that utilize well-accepted techniques such as cognitive behavioral therapy (CBT). This neurodevelopmental, causal model of ED will draw from a multidisciplinary blending of developmental psychology and affective neuroscience to examine the role of the brain as the very "substrate on which eating disorders are built" (Treasure et al., p. 194), and may well improve treatment outcomes as it generates innovative protocols.

s0010 **UNCOVERING THE NEUROLOGICAL AND PSYCHOBIOLOGICAL
CORRELATES OF EATING DISORDERS**

p0030 The regulation of appetite and eating involves both peripheral (body-brain connections) and central (within the brain itself) pathways. Many neural center and biochemical irregularities are considered causal in the origins of ED. For example, altered brain metabolism in the locus coeruleus, a concentrated mass of norepinephrine-secreting neurons, may leave individuals vulnerable to surges of adrenaline and noradrenaline which in turn create a continual state of anxiety, arousal, and alarm (O'Donnell et al., 2004). Altered insula response to taste stimuli provides evidence that those with anorexia nervosa (AN) experience taste differently than a control group and that the insula and orbital frontal cortex (OFC) alter eating behavior by encoding changes in the value of food used as a reward (Wagner et al., 2008). Body image disturbances in those with AN may stem from underlying problems with right parietal lobe functioning (Grunwald et al., 2001; Ramachandran & Blakeslee, 1998). Reduced right dorsal ACC volume is observed in AN, and likely relates to deficits in perceptual organization and conceptual reasoning, (McCormick et al., 2008).¹

p0035 Hypofunctioning dorsal striatum have been implicated in obesity (Stice et al., 2008). In addition, the smaller size of the thalamus and thalamic perfusion changes in AN suggest that the thalamus plays an important role in mediating ED (Dusoir et al, 2005). Finally, OFC malfunctioning and the subsequent increases in impulsivity are a risk factor for ED (Wonderlich et al., 2004), and changes in the reward circuitry (ventral tegmental area, nucleus accumbens and the prefrontal cortex) have been found in those diagnosed with ED (Bergen et al., 2005).

p0040 In spite of impressive growth in the research on ED, little relates to the most commonly diagnosed type, Eating Disorders Not Otherwise Specified (EDNOS), which accounts for the majority of ED patients seen in the community (National Alliance on Mental Illness, 1996). This review also demonstrates the lack of a unifying theory to make sense of the specific neural correlates at play in both the origin and treatment of ED.

s0015 **A UNIFYING THEORY: EATING DISORDERS AND THE
NEUROLOGICAL DEVELOPMENT OF AFFECT-REGULATION
CAPACITIES**

p0045 Affect-regulation refers to the way our nervous system manages the arousal in response to stress, or more simply, the way we manage energy. Brain researchers have examined why humans are so prone to dysregulated states, as in the chronic anxiety, anger, and depression

¹**An aside on Language:** For the practicing clinician the foreign-sounding, multi-syllabic complex terminology of neuroscience and neuropsychology pose a barrier to understanding. These language barriers arise principally from the need for technical terms in order to precisely describe complex anatomical and functional neural systems. While the use of technical terms renders this field less accessible, and though it is beyond the scope of this chapter to define every term used, I have included them nevertheless, as they appear in the literature, along with occasional brief explanations, and a list of references for those wishing to gain a more fluid working vocabulary.

that often accompany and underlie unhealthy relationships to food (Fernandez-Aranda et al., 2007; Keel et al., 2005). Through the lens of affect-regulation theory, ED can be thought of as strategies to manage excess and disruptive arousal.

p0050 Eating disorders are one of a subset of externalizing disorders, with a primary etiology being the failure of early attachment relationships to teach sufficient self-regulation and co-regulation capabilities. In the absence of a more direct or effective way to modulate arousal, those with ED rely on external regulators related to the seeking or avoidance of food. Some turn toward food as a source of comfort; others overeat in a futile attempt to “get enough” of what food can offer only fleetingly; while others turn just as obsessively away from food as the enemy. Thus, attempts to self-regulate externally can take the form of compulsive overeating, bulimic bingeing/purging to create a dissociative “numbing” state, anorexic avoidance of food, or a combination of all three.

s0020 Neural Pathways for Affect-Regulation

p0055 One of the basic psychobiological requirements of survival is the regulation of energy. Infants are born with a great deal of affect and little capacity to regulate their own rapid shifts between high and low arousal states. An infant’s self-regulating capabilities are limited to sucking, gaze aversion, and dissociation (an unconscious, neurologically mediated way of shutting down when an experience is too powerful or otherwise unbearable). They learn everything else about effectively self-soothing or modulating affect from the adults who comfort and nurture them. In other words, attachment relationships are critical because they facilitate the development of the brain’s self-regulatory mechanisms (Fonagy et al., 2002). Thus, attachment and self-regulation go hand-in-hand.

p0060 Parents who are regulated themselves can be responsively attuned, moving toward the child to attend to them, or picking up the infant to stroke, rock, or walk the child, while cooing soothing sounds or singing lullabies. These are all right hemisphere (RH) nonverbal communications; a child has no left hemisphere (LH) verbal processing until the age of two. By introjecting these soothing moments, the infant learns to internally self-soothe. For insecurely attached children, whose bodies are left unregulated too often and for too long, affect-regulation is impaired. Subsequent dysregulation can take the form of chronic hyper or hypoactivation and can leave the child predisposed to the eventual onset of psychiatric and psychosomatic disorders (Scaer, 2000; Schore, 1996, 1997). The child may grow to be a teenager who soothes himself or herself externally by using drugs, self-injuring, starving, gorging and then purging, or by eating when distressed.

p0065 Although our knowledge of functional neuroanatomy is far from complete, the connections between different areas of the cortex, and from the neocortex to lower brain structures, are well understood. Developmental studies elucidate how the brain structures involved in regulating energy are developed, and how they are impacted by our earliest relationships (Schore, 1994).

s0025 Neural Developmental Sequence

p0070 The capacity to regulate affect emerges in the very early months of life. An infant develops the ability to handle stressful changes in the external environment by experiencing the caretaker’s regulation strategies and his or her own subsequent calming down.

- p0075 The amygdala and insula, both deep in the temporal lobe, begin to develop during the last trimester of pregnancy. Working together, they register all sensory and proprioceptive input and can trigger the body into high states of arousal by activating, through the hypothalamus, the pituitary and adrenal glands, and the autonomic nervous system (ANS), which signals danger or distress and can propel the body to fight, flight or freeze.
- p0080 These surges of energy begin to be internally modulated as the capacity for regulating affect is gradually transferred from the caretaker to the infant's brain through body to body, skin to skin contact, deep mutual gazing, facial expressivity, and the melodic prosody or "music of the voice" that we call "parentese." When adults consistently regulate the infant's shifting levels of arousal, they stimulate the infant's own regulatory centers to develop optimally. Neurological circuits of emotion regulation, the insula, then the anterior cingulate (AC), at 2 months, and the OFC at 12 months, come online and create cortical and subcortical pathways down into the amygdala. Activation of these pathways calms the child and inhibits the arousal and expression of emotional states (Schore 1994, 1997, 2001a). Extensive reciprocal connections exist between the amygdala and the prefrontal cortex (PFC) (Davidson, 1998), particularly the medial and orbital zones of the PFC, from which extend neurons of gamma-aminobutyric acid (GABA), a valium-like calming substance manufactured by the brain (Amaral et al., 1992). If early relationships are insecure, less than optimal connections are made within the OFC and AC and down into the insula and amygdala. The right brain is itself not as integrated; its regulating pathways may be too thin, its connections into the body not as good and greater amounts and higher frequencies of dysregulation will ensue (Schore, 1994, 1996, 2003a). This mis-wiring shows itself symptomatically as anxiety and affective disorders and in disordered relationships to food.

s0030 THE BODY AND A BIPHASIC SYSTEM OF AFFECT-REGULATION

- p0085 A child must eventually learn to calm him or herself when he or she is hyperaroused into excitement, anger, fear, or panic, and to bring themselves up from shame, despair, or boredom. Thus, a primary goal of these earliest attachment relationships is to instill in the infant a biphasic system of affect-regulation. To accomplish this, connections must form between the infant's own cortical regulating centers, and the rest of the child's body via the hypothalamic release of body-regulating hormones and through the autonomic nervous system (ANS), whose energizing sympathetic and calming parasympathetic branches move energy up from the body into the brain and back down again. When these neural connections have been wired well, the child can, by 24 months, begin to regulate their entire system when affect threatens to rise too high or fall too low for optimal functioning (Schore, 1994).

s0035 Chronic Hyperactivation via the Hypothalamic Pituitary Axis

- p0090 The hypothalamic pituitary axis (HPA) is a major stress-regulating circuit from the brain into the body linking the hypothalamus, the pituitary, and the adrenal glands. During stress, this circuit triggers the release of corticotrophin releasing factor (CRF), the brain's major stress hormone that, in turn, causes the pituitary gland to release adrenocorticotrophic hormone (ACTH) and, subsequently, the adrenal glands to release cortisol. Trauma seems

to leave this brain system prone to oversecreting CRF which bathes the brain and body in excess levels of cortisol, resulting in chronic hyperarousal and explaining many of the symptoms of post traumatic stress disorder (PTSD). Once this system has been hyperactivated and hypersensitized, an individual's stress regulation capacities, especially in response to relational injuries, launch more quickly and involve deeper dysregulation (Schore, 2003a, 2001b). Individuals who are poorer at emotional regulation show higher evening levels of cortisol (Davidson et al., 2007) and an exaggerated startle reflex.

p0095 Research (Treasure et al., 2005) utilizing the startle reflex as a measure of affective reactivity found that subjects with ED were not soothed by pleasant stimuli (such as pictures of baby animals) although those with bulimia nervosa (BN) were soothed by photographs depicting food. In contrast, when people with any type of ED viewed images of thin models, their defensive response increased. *"Thus, salient emotion [sic] cues differentially produce either an exaggerated or attenuated automatic reaction, depending on the form of the eating disorder"* (Treasure et al., 2005, p. 195).

p0100 Other studies have found hyperactive states of emotion, such as anxiety and anger are particularly important in the triggering of binges and are more likely to precede bingeing than depression (Agras & Telch, 1998; Arnow et al., 1992; Waller & Barter, 2005).

s0040 **Chronic Hypoactivation as Dissociation**

p0105 The brain is modular, comprised of well-defined systems, separate in structure and function, which must link up and work together in an integrated way to create our subjective experiences. The more traumatic an experience, the more energy is absorbed into the brain, resulting in a state of neural hyperactivation. The brain protects itself with a kind of circuit breaker system. When energy reaches a critical level, as in overwhelming trauma, neural connections are cut off between the prefrontal cortical and subcortical limbic structures, particularly in the right hemisphere (Schore, 2009), capping and trapping the intense energy beneath a deadened or numbed dissociative state (Porges, 1995).

p0110 Researchers have recreated this dissociative defense by using scanning technology and scripts of an individual's experiences, transcribed from their own verbal narratives. A 2007 study (Hopper et al., 2007), observed this neural response to trauma in real time. Hearing their own trauma scripts read back to them, 70% of the subjects went into hyperarousal states, and 30% dissociated. In the latter group, instead of elevating, their heart rates decreased and the cortex became hypometabolic.

s0045 **DISSOCIATION AND POST TRAUMATIC STRESS DISORDER IN THE DEVELOPMENT OF EATING DISORDERS**

p0115 In neuroscience, ED is often viewed as a product of affect that is either under or overregulated. Excessive bodily energy that cannot be regulated down using internal mechanisms can cause a person to reach out to food in order to feel calm. On the other hand, emotions that are overregulated, that are packed down or dissociated, leave the individual without connection to his or her own emotional and physiological states. Left in states of hypoarousal too often or for too long, individuals can lose the ability to sense their own corporeal selves. After years of

this defensive overregulation, strong feelings in the body may be unable to come up the neural chain into consciousness and may instead be regulated by reaching for something external like food (Allan Schore, personal communication, September 27, 2008).

p0120 Some degree of dissociation underlies most forms of psychopathology, including those related to food. Eating disorders are characterized by both immediate state dissociation and by more chronic trait dissociation (De Berardis et al., 2009; Hallings-Pott et al., 2005). For example, in people with AN, emotional blunting and apathy, a secondary effect of starvation, is more tolerable than arousal. *“For such individuals, ‘numbing’ is preferable to the overwhelming experience of anger, jealousy, envy or regret”* (Treasure et al., 2005, p. 197). There is a clearly and repeated established link between dissociation and bulimic behavior (Everill & Waller, 1995; Everill et al., 1995; Waller et al., 2003). Dissociation is both acute and chronic among bulimic women (Hallings-Pott et al., 2005), and binge eating and dissociation appear to serve the common function of blocking negative affect by distancing from it emotionally. Dissociative blunting also occurs during binges when sufferers eat without tasting and without the ability to stop. French researchers found alexithymic-like emotion-processing deficits (for example, the inability to identify and describe the subject’s own feeling states) as well as mindsight deficits (impaired ability to understand other’s emotional experience), in people with ED (Bydlowski et al., 2005). These test subjects also appeared to be easily overwhelmed by emotional circumstances, and appeared to use food to control intense affective experiences.

p0125 Dissociation is the neural mechanism of PTSD (van der Kolk & Fisler, 1995; van der Kolk, 2002). In a review of the ED and PTSD literature, Mantero and Crippa (2002) propose that ED may be a presenting complaint of an undiagnosed PTSD and suggest that clinicians who treat ED should be well-versed in the treatment of acute and chronic trauma. They point to the higher incidence of ED in the PTSD population, noting that ED and PTSD patients show similar trauma histories, which we know from the neuroscience literature, are etched into the RH. Subjects with a history of PTSD-related dissociation demonstrate an increase in body dissatisfaction, when compared to the controls; thus, traumatized individuals may use ED as a coping strategy (Beato et al., 2003).

s0050

ATTACHMENT THEORY, AFFECT-REGULATION THEORY, AND EATING DISORDERS

p0130 When attachment theory, the collective body of research around this early development, is seen as the bonding process that not only creates a strong emotional link between parents and their infants that serves to protect the infant’s life, but also the process that instills in the young the ability to self-regulate or modulate its own arousal, it becomes “affect-regulation theory” (Schore & Schore, 2008). As the name implies, Schore’s affect-regulation model posits that a developmental deficit in the capacity to regulate powerful affect underlies the major forms of psychological pathology and clinical symptomatology. Thus, through the lens of affect-regulation theory, and the neuroscience that informs it, ED can be thought of as affect-regulation disorders unconsciously devised to externally manage excess arousal, stress, and anxiety, in order to compensate for inadequate wiring in the emotion-regulating circuits of the brain, mind, and body, and in the neural reward centers of the brain. In this

way, food becomes an external regulator, a way to control intense affective experiences that otherwise threaten to overwhelm the individual.

s0055 **Eating Disorders and Attachment**

p0135 A review of the literature linking disturbances in attachment with ED (Ward et al., 2000) found tentative but compelling evidence that children with dismissive parenting and subsequent avoidant attachment styles are more likely to develop AN, while those with preoccupied parenting, and the resulting anxious/resistant attachment styles, are more likely to develop BN.

p0140 A more recent study by Zhang et al. (2008) examined brain responses to facial expression by adults with different attachment styles, and found attachment to be a powerful predictor of emotional processing. Anxious individuals were more, and avoidant individuals less, reactive in various areas of their brains to emotional stimuli. The human face is one of the most powerful emotional triggers. In the study, the anxiously-attached subjects turned on more of their brain structures related to attentional processing than did secure subjects. Avoidantly attached subjects turned on fewer of those centers and with less metabolic activation, than did either their anxious or secure counterparts

p0145 When insecure attachment co-exists with trauma, especially in the first 18 months of life, neuroimaging shows impairment of the right hemisphere that predisposes children toward disorders of affect-regulation and thus may set the stage for the emergence of a disordered relationship to food (Schore, 2009).

s0060 **Eating Disorders and Emotion Processing Deficits**

p0150 Much of the research and clinical literature describes ED patients as easily overwhelmed by emotional circumstances. ED frequently coexist with anxiety disorders, and those who suffer from ED may either be less aware of emotions or have well-developed strategies to avoid experiencing their own affective states. Thus, people with ED often exhibit impaired ability to identify their own emotions (alexithymia), as well as deficits in judging others' emotional experience (mindsight) (Bydlowski et al., 2005; Speranza et al., 2005; Treasure et al., 2005; Troop et al., 1995).

p0155 Davis and Marsh (1986) found that anorexic patients were less able to differentiate between hunger and satiety, and had difficulty differentiating their physical sensations from their emotions, which they also had difficulty describing. Their bulimic subjects often responded to stress with symptoms such as vomiting, even while they had difficulty correlating their ED behavior with any emotional stimulus.

s0065 **Affect Disregulation and the Right Hemisphere**

p0160 A dramatic contribution of neuroscience has been to demonstrate that a single human skull houses two virtually separate brains, distinct in both structure and functioning. There are major differences between our rational, logical, analytic, conscious left hemisphere (LH) and our largely unconscious, affective, nonlogical right hemisphere (RH). The latter is dominant for empathy, attachment, and affect-regulation, and stores an internal working model of

the earliest attachment relationships and the strategies of affect-regulation that were learned in them (Allan Schore, personal communication, November 19, 2005). Mounting evidence (Lacey, 1986; Meyer et al., 1998; Schore, 2003a) supports an affect-regulation model of ED as a primarily RH phenomenon.

p0165 Although the etiology is complex (McManus & Waller, 1995), many, if not most, ED triggers originate in the unconscious subcortical RH. Experimental studies (Meyer & Waller, 1997, 1999; Waller & Mijatovich, 1998) have found that subliminal abandonment cues, presented too rapidly to be detected or reported consciously (Bornstein, 1990; Silverman, 1983), are processed unconsciously in the RH, and result in higher levels of food consumed. This effect was not observed when the presentation of the threat cue was longer, and perceived consciously. The subliminal perception of abandonment may lead to increased bulimic behavior, and binge eating may reduce negative affect through an “anesthetic” effect, a kind of spacing out, or escape behavior, that inhibits the learning of more mature coping (i.e., affect-regulation) strategies (Hallings-Pott et al., 2005). Inversely, the subliminal presentation of unification cues, such as “friendship,” decreased the amount of food consumed (Waller & Barter, 2005).

s0070

THERAPEUTIC IMPLICATIONS

p0170 Such RH subliminal activation of the thoughts and affect underlying disordered eating implies the need for deeply relational and intersubjective therapeutic approaches, with an emphasis on RH resonance, rather than an exclusive reliance on LH cognitively constructed analysis and verbal interpretations (Waller & Barter, 2005). Thus, the goal of psychotherapy should be to enhance the ability for affect-regulation in our ED patients with approaches that activate the RH.

p0175 By the age of three, we largely rely on LH functions of thought, language, and the capacity to consciously analyze our experiences. But throughout life, cortical and deep subcortical RH information about what to expect, and “how to be” in relationships continues to exert powerful influence over both behavioral and emotional aspects of our lives, though it remains largely outside our conscious awareness, encoded in implicit (unconscious) procedural (body) memory (Schore, 2003b). In other words, we do not just think or reason our way through life, we also feel and sense our way, with our affective wisdom shaping the choices that we make (Demasio, 1999). Much of our behavior merely emerges from old patterns and attachment templates, rather than logical choice. In addition, traumatic experiences are stored largely in our RH and, if they remain unresolved, can emerge later in life as dysregulated energy and/or as compensatory patterns of behavioral acting-out that we label as psychopathology.

p0180 Effective treatment of ED requires the fostering of affect-modulating centers in the prefrontal cortices that developed relationally in infancy. This wiring of one brain through interaction with another brain extends well beyond childhood and is the psychoneurobiological basis for the healing potential of important relationships, including the deeply attuned dyad in psychotherapy (Safran & Muran, 2000). Evidence is accumulating that poorly wired circuits of interactive regulation, especially those between higher and lower centers on the right side of the brain, can literally be rewired in the therapist/patient dyad (Schwartz &

Begley, 2002; Linden, 2006). This can lead to an individual's increased ability to modulate their own emotional experiences.

p0185 The key is to connect with our patients' nonverbal, emotional RHs. For psychoanalytically oriented psychotherapists, this means more emphasis on "the primacy of affect" and less on cognitively-constructed analysis and verbal interpretations (Allan Schore, personal communication, November 19, 2005). In general, psychotherapy must include more than verbal, investigative, and insight-based approaches to change; it must activate the deep subcortical recesses of the unconscious mind where our attachment templates have been laid down and trauma has been stored. The effective therapeutic dyad uses the same processes that occur between parents and infants in secure attachments (attunement, empathy, and resonance), to reactivate and rewire RH procedural templates from childhood. Through this exquisite attunement and timely coregulation within the therapeutic dyad, the ED individual's capacity for regulation, discernment, and impulse control improve, as higher centers become better at turning down lower centers of primitive arousal (Beer & Lombardo, 2007). To achieve this, psychotherapy must be an emotional, affective, somatic experience in the context of an intimate relationship and environment safe enough to experience emotions and body sensations, even those that prove frightful or full of pain.

s0075 Left Hemisphere Cognitive, Conscious Strategies for Affect-Regulation

p0190 During its earliest, formative years, the infant has no verbal processing LH; ~~he or she~~ does not begin to myelinate until the end of the second year of life. Once LH neural pathways are in place, given sufficient processing time, the slower LH can exert a regulating influence over the more emotional RH. We can use the verbal capacities of the LH to both dysregulate ourselves with anxious thoughts and imagined catastrophes, and to regulate ourselves and one another through calming soothing thoughts, and verbal reassurances. Other LH calming strategies include intentional distraction, deliberate suppression, reappraisal, or reframing.

p0195 Since Aaron Beck introduced cognitive psychotherapy in the 1970s (Beck, 1972; Beck et al., 1979), clinicians have focused on the beliefs that individuals have about present or future events and the perceptions they have about their abilities to cope with these occurrences. LH-based cognitive therapy strategies have traditionally focused on evaluating the rationality of negative appraisals and beliefs, substituting more realistic, rational, or evidence-based viewpoints in their stead. In addition, the behavioral components of CBT for ED utilize patient education, self-monitoring, dietary records, shape and weight checking restraints, and verbal assessment questionnaires. Alone, or in combination with psychoactive medication, CBT has become a popular treatment model for ED (Fairburn, 2008; Waller et al., 2007).

p0200 Even psychoanalytic approaches have traditionally relied more on LH-based, cognitively-constructed analyses and verbal interpretations to encourage insight and the subsequent emergence of the unconscious realm into conscious thought. Neuroscience research, however, demonstrates that the neural mechanisms for affect-regulation exist primarily in the unconscious RH, and it is there that we must work to foster more permanent and automatic regulatory capabilities (Schore, 2003b). In short, cognitive strategies that encourage reappraisal of a stimuli triggering threat, and ~~training~~ awareness to accurately read "bottom-up," limbic system reactions of fear, anger, sadness, or shame, can improve the

capacity to regulate, but a greater emphasis on RH modalities could well be the key to *in* improving previously disappointing outcomes in ED.

p0205 RH modalities are already at play, at least peripherally, in LH-based therapeutic approaches like CBT. Ideally, all therapeutic contact, including CBT, occurs in a deeply affective, attuned, sensitive, and caring RH-to-RH bond between patient and therapist. Such synchronous, empathic, and transference interactions create greater integration within the patient's own RH. Neural networks that had been dissociated connect again and eventually create stronger top-down, frontal lobe influences. As these high right neural centers send soothing extensions down into affective subcortical ones, affect-regulation and resiliency emerge.

s0080 Language of the Right Hemisphere

p0210 The conscious LH is not only structurally and functionally distinct from the mostly unconscious, affective RH, but *it ses* a different system of language as well. Information is communicated through words in the LH, while in the RH, affect is transmitted by the primary process communications of the face, gesture, posture, and prosody.

p0215 Beebe and Lachmann (1994) demonstrated that mothers engage in a synchronous dance of this primary-process attunement with their infants, yet are not aware, and cannot describe, what they are doing because it is happening too quickly for consciousness to track. Templates of secure attachment are built through repeated affect synchrony, as the child is met and amplified into positive peaks of joy and excitement and soothed or calmed out of states of fear or pain. In the absence of this attuned resonance, the child is left in extended states of dysregulated affect and the attachment that evolves is insecure.

p0220 Psychotherapists who want to modify those early neural patterns must work simultaneously in both left and right hemisphere modalities. The RH synchrony of psychotherapy develops as we learn the unique rhythms of each patient and form a dyadic system with them. This requires listening carefully to track the patient's movements, to find their rhythm, to match their tempo and to reflect it back. We pace ourselves unconsciously to stay with them; we soften our voice, fall silent; join them in moments of humor or joy; fall into a hushed reverence. We speak with our posture, our eyes, our entire face. We are there to engage when they look up for us, wait patiently when they turn away, allow them time to recover and reengage, and sometimes reach out to them if they have moved too far away. In doing this, we form an empathic bond using our own bodies, our own somatic countertransference, and we match our own internal states with theirs so that they feel increasingly safe to drop defenses and open both to us and to their own deepening understanding of themselves. Affect gradually deepens as together we gain access to material stored deep in their emotional right brain. In this state of dyadic synchrony, interpretations or other interventions are experienced more deeply and their effects are more permanent (Allan Schore, personal communication, May 6, 2006).

p0225 Powerful empirical evidence suggests that the dyadic relationship contributes the majority of healing in psychotherapy, and it is now generally acknowledged that "*...the therapeutic alliance is among the most robust predictors of treatment outcomes*" (Karver et al., 2006, p. 35). When

patients gradually learn to regulate, to stay more coherent, dissociating or fragmenting less during moments of heightened intensity, shifts occur in implicit relational patterns deep in the subcortical RH, which the LH may then later be able to translate into words. It is not, however, the words that make the changes. Rather, it is subcortical RH shifts that make the verbal awareness possible. Just moving emotional material into the left hemisphere does not suffice. If the affective material is regulated when it arrives in the LH, it becomes a coherent narrative. If it is still unregulated when it shifts left, it is disruptive and the individual may become confused, go blank or lose their train of thought (Allan Schore, personal communication, May 30, 2009).

s0085 **The Body in Psychotherapy**

p0230 The recognition that psychotherapy must be an affective experience in order to activate the subcortical limbic regions of the RH implicates the body as well into psychotherapy since the RH, far more than the left, is deeply connected into the body through the HPA axis and the ANS (Schore, 2003a; Allan Schore, personal communication, November 19, 2005). The neurological and trauma literature have thus expanded the definition of psychotherapy from a “mind-to-mind, thought-to-thought” connection to one that communicates “body-to-body” as well. Schore says repeatedly that trauma is about dissociation (Schore, 2009), neurologically disconnecting oneself as a means of self-defense from an experience that is too powerful or otherwise unbearable. Thus, trauma recovery is about coming out of dissociation and back into awareness of the external energy coming in and the energy arising up interoceptively from one’s own corporeal self.

p0235 Healing from ED means improving the capacity to both individually and interactively regulate externally- and internally-arising energies, rather than reaching for external regulators like food, laxatives, or obsessive exercise. We differ in our capacities as therapists to notice our patients’ subtle or micro facial expressions (faster than the 500 ms it takes to be consciously seen), changes in skin color, body posture, breathing patterns, or shifts in auditory prosody. The more accurately we track these and, simultaneously, our own somatic replies, the greater our capacity to affectively resonate and know when, and if, to move in and lend a regulating hand. Thus, a major outcome of good treatment in individuals with ED is a decrease in dissociation through an increased awareness of, tolerance for, and openness to, affect and sensation arising from the body in real time.

s0090

CONCLUDING THOUGHTS

s0095 **The Therapist, More Than the Theory, Is the Agent of Change**

p0240 Advances in neurological research have confirmed that a deep, safe, affective (and ideally affectionate) therapist/patient relationship is one of, if not *the*, central change element in psychotherapy; and, further, that the subcortical limbic system (that part of the brain that processes emotion, and is the center of the attachment relationship), is the

key. Beneath the conscious models and techniques that distinguish the various schools of psychotherapy lies the therapist's ability to create the attachment intimacy of the patient/therapist bond, a relational process, a deep intersubjective being with that is *"beyond technique, frequently undervalued and mediated primarily by their and our more inexplicable and baffling RH"* (Allan Schore, personal communication, September 27, 2008). The source of effective therapy is not so much what the therapist does for the patient, or says to the patient, as how to be with the patient, especially at moments of therapeutic rupture or when the patient's state of being is disintegrating in real time (Safran, 2003). When patients are in an overwhelmed state of terror, hopelessness, or despair, it is the therapist's job to be able to enter into, and hold that state with them. Although this can be enormously challenging, it is imperative, and so we do our best to stay present in our own bodies, to allow those feelings to be truly felt, and to stay connected in the relationship so the patient is not alone with them (Allan Schore, personal communication, February 11, 2006).

p0245 Significant gaps in our knowledge of the neurobiology underlying ED (as well as other mental disorders) persist, due to the difficulties of mapping the complex neural circuitry of higher brain functioning, and the complexity of sorting genetic and epigenetic developmental contributions (Hyman, 2007). Despite these limitations, neurobiological research will be an increasingly essential tool in helping us rethink our current approaches to the treatment of ED. In the meantime, it is safe to conclude that it is in relationships that we first emerge into our full neural complexity, and it is in relationships that we must heal.

BOX 3.1

ABBREVIATIONS

ACC , anterior cingulate cortex	fNIRS functional near-infrared spectroscopy
ACTH , adrenocorticotrophic hormone	fMRI , functional magnetic resonance imaging
AN , anorexia nervosa	GABA , gamma-aminobutyric acid
ANS , autonomic nervous system	HPA , hypothalamic pituitary axis
BED , binge eating disorder	IFT , internal family therapy
BMI , body mass index	LH , left hemisphere
BN , bulimia nervosa	OFC , orbital frontal cortex
CBT , cognitive behavior therapy	MPC medial prefrontal cortex
BPD , borderline personality disorder	PET , positron emission tomography
CRF , corticotrophin releasing factor	PFC , prefrontal cortex
DBT , dialectic behavior therapy	PTSD , post-traumatic stress disorder
DSM , Diagnostic and Statistical Manual	RH , right hemisphere
ED , eating disorder	
EDNOS , eating disorder not otherwise specified	

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