Integrating Neurobiological Findings Into Psychodynamic Psychotherapy Training and Practice

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New knowledge regarding the neurobiology of human development has enormous implications for the field of psychotherapy. Recent discoveries confirm the existence of mirror neurons, explain the intersubjective neurobiology of affect regulation, highlight the role of implicit/procedural memory in attachment processes, and document the fact that gene-environment interactions structurally change the brain throughout life. Addressing the fact that psychotherapeutic *techniques* have lagged behind in incorporating these findings, this paper describes one method of integrating these neuroscience findings and their implications for treatment into a graduate psychotherapy training course. Basic principles of attachment theory and psychodynamic psychotherapy are evaluated in light of these new neuroscience data.

In addition, interpersonal dynamics in the classroom can trigger instinctive neurological processes, especially when the subject matter is the impact of trauma in human lives. The students' potential for neurobiologically co-constructed learning experiences inform the lecturers' presentations of content and clinical material. For example, when employing photographic, auditory or video training materials involving trauma, the authors discuss techniques designed to help students maintain a self-regulatory state that keeps their pre-frontal lobes and self-reflective capacities active despite the potential of traumatic material to trigger non-conscious, affective responses that can block thought.

The authors' interactions with the students and with each other in the context of the course, contribute to students' non-conscious procedural knowledge, hopefully enriching the conscious, verbal, left hemisphere-dominant learning that is also taking place. In today's psychotherapy training program, the content and the context and the intersubjective experience are the message.

Integrating Neurobiological Findings Into Psychodynamic Psychotherapy Practice and Training

The real voyage of discovery consists not in seeking new landscapes but in having new eyes—Marcel Proust

Introduction

It is widely recognized that at the turn of the 20th century, a rapid expansion of knowledge occurred in many fields, including many related to human psycho-social development. Interestingly, a similar phenomenon is taking place at the turn of the 21st century: With the advent of neuroimaging techniques, new knowledge regarding the neurobiology of the human body, mind, and brain is emerging at a phenomenal pace, altering paradigms that have held sway for decades. Findings regarding the neuroscience of infant development, especially the "neuroplasticity" of the brain; the importance of affect regulation to attachment processes; the impact of trauma on human brain development, especially in terms of the role of implicit/procedural memory, as well as the better understood explicit/declarative memory; and the existence—and importance—of "mirror neurons;" all have contributed to a deeper understanding of human psychopathology and emotional health. Understandably, psychotherapeutic techniques have lagged behind in incorporating these findings. This article describes a small (8-10 student) graduate intern-training course taught by the authors that integrates new data from empirical neuroscience studies into the teaching of psychotherapeutic practice. It uses basic psychodynamic technique and principles of attachment theory as the starting point, and tenets of psychotherapy are evaluated in light of these new neuroscience data.

Traditional training programs teach new knowledge using readings, lectures, clinical examples, personal psychotherapy, and supervised clinical experience. All of these methods are employed in this course. However, this particular seminar is made markedly more complex to organize and conduct, in that we attempt to remain aware of the personal as well as professional implications of our new understanding of how learning takes place. The particular dynamics of the teaching process are hugely impacted by the principles of neurological development, especially the impact of trauma on the brain, and the fact that any time two or more people are in

physical proximity their communication will include the non-conscious, co-creation of procedural memories of the experience (K. Lyons-Ruth, 1999). The impact of employing training materials involving trauma – in particular those that are non-verbal in part or whole – needs to be held in mind by the lecturers, so presentations can be organized in such a way as to help students retain a reflective capacity to think about the material, despite its potential to trigger affective responses in those hearing or viewing the materials. Thus, in the classroom, we attempt to model the *process* of what would optimally occur in the consulting room.

In addition, optimal, integrated learning processes tend to be those that include implicit or procedural knowledge obtained when there is a moderate level of activation of the right hemisphere, mid-brain and limbic areas (Cozolino, 2002; Ogden, Minton, & Pain, 2006; A. N. Schore, 1994). This level of learning is nonconscious and non-verbal. While students may find that they have few or no words to describe their response to the new information, we, the lecturers, have exactly the same difficulty. We are aware that our interpersonal interactions with the students, with each other, and in response to training materials, will be part of a co-constructed unconscious memory of the course, at times to as great an extent as the conscious, verbal left-hemisphere and neo-cortex-dominant learning that will be taking place simultaneously. In today's psychotherapy training program, the content, and the context and the intersubjective experience are the message.

Organization of This Paper

In the next sections of this paper we expand upon some of the core neurobiological concepts used in the current course. Following the introduction of each concept, we consider clinical implications for practicing and educational implications for teaching integrative psychodynamic technique. The final section of the paper is devoted to a discussion of ways one might maximize the potential for student learning through the application of psychoneurobiological principles.

Course Content

For the past 17 years, the authors have been teaching a course on psychoanalytic techniques that integrated findings from attachment research. Like a cascading waterfall, neurobiological findings have combined with the pool of our current knowledge, changing not

only how we do psychotherapy ourselves but how we teach psychoanalytic techniques. Thus, at present, the seminar can best be described as a course on psychoanalytic technique that is informed by neurobiology, attachment, and developmental research. It is our prediction that it will continue to change, because we believe that a well-designed course in psychotherapy techniques is a *dynamic* one: On-going careful consideration and integration of relevant, replicated research findings into an organized psychotherapeutic training paradigm encourages the development of thoughtful, competent, and effective clinicians.

Some of the neurobiological concepts that we now integrate include:

- "Neuroplasticity"—the ability to continue to develop new neural pathways throughout the life span—allows genetics and the environment to interact in brain development; the specific experiences an infant encounters will trigger a cascade of specific neurobiochemical reactions that can enhance or block gene expression; thus, experience continues to change the structure of the brain across the lifespan, making every human brain unique;
- Only the right hemisphere is fully functional at birth; it remains dominant for the first two to three years of life, thus, infants develop patterns of emotional communication prior to developing left-hemisphere-based verbal skills when that hemisphere becomes fully functional around the third year;
- From birth, right hemisphere functioning includes a type of implicit—also referred to as procedural or non-declarative—memory that may not be accessible to conscious declarative, explicit memory or the reasoning processes that later develop in the left hemisphere;
- Mirror neurons—which are activated in the brain whether one is observing an action or performing the action oneself—may impact non-verbal communication processes including the development of empathy and reading;
- The neurobiology of attachments results in the development of internal working models, which impact the development of later relationships; traumatic attachments—also referred to as disorganized/disoriented or D attachments—often involve an adult whose history includes unresolved trauma; in other cases, more subtle disturbance in the attachment relationship, such as role-reversal or emotional withdrawal, may result in a

traumatic attachment style developing; these early attachment patterns have been linked to adult states of dissociation;

- Early trauma disrupts the integration of right- and left-hemispheric connections—largely because chronic triggering of innate survival mechanisms located in the infant brain stem, right limbic system and hemisphere, results in an overdevelopment of these primitive areas of the brain—producing a fear response that is hypersensitive to negative affect;
- Internal imagery can activate and stimulate the same brain systems as do actual sensory perceptions; thinking or dreaming about an experience activates the same pathways as are active during the experience (Perry, 1993);
- The capacity to develop and utilize reflective, integrative brain processes in great part depends on interpersonal and environmental experiential history. As a result, this capacity may be available in some contexts but completely unavailable in others (Buss, Davidson, Kalin, & Goldsmith, 2004).

After students are introduced to these basic neurobiological principles, the new ideas are referred to and elaborated within a psychodynamic psychotherapy framework. In addition, a basic overview of Attachment Theory (Bowlby, 1969, 1980) and the implications of the dynamic nature of attachment relationships is introduced within the first few lectures. During each lecture, psychodynamic treatment principles are presented and then re-examined in light of neuroscientific and developmental research findings, especially those related to the impact of trauma on the brain and development. In each seminar, a student presents a vignette using a current case in which the dynamics may be related to the concepts discussed in the lecture of that meeting. The careful selection of new concepts and close supervision of clinical case material is essential to making certain that students do not inadvertently misuse ideas regarding modification of technique in experimental, potentially harmful ways. For example, inappropriately disclosing personal history in an attempt to articulate the therapist's own affective response to a patient's communication in order to illustrate the co-construction of a therapeutic interaction.

The Importance of the Right Hemisphere in Receiving and Communicating Affective Information

In recent years, evidence of the importance of the right hemisphere in the therapeutic process has been accumulating. Because the right hemisphere of the brain (with the exception of the right prefrontal cortex) is functional at birth and the left hemisphere develops gradually over subsequent months and years of life, (Chiron et al., 1997; A. N. Schore, 1994; A. N. Schore, 1996) the earliest neural circuits in the infant brain carry affective, auditory, visual-spatial, and sensory-motor information. Initial experience of the world, relationships, and internal working models are therefore encoded in non-verbal channels. Despite later development of verbal communication skills, these non-verbal neural pathways remain operable. Thus, communication between the therapist and the patient will always include non-verbal expressions, i.e., subtle gestures, changes in vocal tone or tempo, as well as enactments. The therapist's ability to perceive and to respond contingently to these affective communications is crucial to the development of the therapeutic alliance and the process of change in psychotherapy. Through a process which Schore (A. N. Schore, 2001; 2007) refers to as "right brain-to-right-brain communication," essential data are conveyed. Pally (1998) explains this process:

> Analysts and patients may influence one another's body sensations, imagery, thoughts, behaviors and even words by unconscious processes, nonverbal cues of emotion, such as autonomic changes (i.e. flushing, dry mouth) and behaviors (i.e. facial expression, posture, gesture). How the analyst feels, both "in the body" and "in the mind" may be as important an indicator of what is going on in the patient as whatever the analyst is thinking. How the analyst communicates may be as important as what the analyst says (p. 360).

Meissner (2007) elaborates on Pally's statement, "These aspects of analyst behavior seem to reflect involvement of right hemisphere activity as opposed to dominant or left-hemisphere-dependent verbal and interpretive activity" (2007, p. 339). Clearly, it is not only the patient's communications that are important. The therapist's verbal and non-verbal communications are imperative in helping the patient feel seen, understood, and accepted. It is only under these affectively responsive conditions that the patient can take the risks necessary to make changes.

Implications for teaching psychodynamic technique.

Clinical intuition cannot be taught. What can be taught is the importance of noticing one's bodily sensations, internal cues, and feelings while doing psychotherapy. Students are asked to pay careful attention to their body sensations throughout a session and to take detailed process notes after the session, so that these feelings can be thought about and discussed with a supervisor. Formerly considered as countertransference, this type of experience is now understood to be ubiquitous in all interpersonal interactions. If words are the focus of the therapy to the exclusion of attention to affect, essential parts of the communication may be missed. A mismatch of modal communication can, at times, be the source of therapeutic impasses in psychotherapy. The therapist's increased awareness of non-verbal processes is also useful in working through what has been referred to as "resistance" in early psychoanalytic literature. If students are trained to note their own affective states when the patient is reluctant to share verbal information, then it is likely that the sources of the "resistance" will be more quickly perceived.

Compassionate imparting of this affective information, what Bollas has called the "unthought known" (Bollas, 1987b) —whether through verbal or nonverbal means— is likely to deepen the therapeutic work and the therapeutic alliance. Schore (2007) describes the relevance of right brain communication to the therapeutic alliance: "Just as the left brain communicates its conscious states to other left brains via linguistic behavior, so the right brain communicates its unconscious states to other right brains that are tuned to receive its communications. Clinical sensitivity thus relates to the depth and breadth of the therapist's capacity to psychobiologically attune to an array of conscious affects, and especially unconscious affective states." (p 9)

Sensitive, verbal reference to the therapist's countertransference may tacitly and procedurally demonstrate to the patient the capacity to consider nonverbal aspects of interpersonal patient/therapist communication (Ginot, 1997). The authors believe this should be done with extreme care. Bollas (1987a) emphasizes that "the clinician should <u>not</u> make a direct use of his/her countertransference without establishing over time meaningful precedents for the occasional examination of the analyst's subjective states." (p. 231)

<u>The Contribution of Mirror Neurons</u>

The discovery of mirror neurons elucidates a small part of the amazingly complex process through which non-verbal communication of affect might occur. Mirror neurons were

first observed in a laboratory in which researchers were studying a particular area of the motor cortex of macaques which is associated with hand to mouth movements (Gallese, Fadiga, Fogassi, & Rizzolatti, 1996). In the course of the study, researchers noted a distinct set of neurons that discharged with each particular motor act. They then made a startling observation. When a macaque observed a researcher holding a piece of food, its motor neurons fired in the same way they did when the monkeys themselves grasped food. The researchers concluded that "the pattern of neuron activity associated with the observed action was a true representation in the brain of the act itself, regardless of who was performing it" (Rizzolatti, Fogassi, & Gallese, 2006). These neurons were dubbed "mirror neurons" because they fire in response to an observation of another's action as if one was performing the action (Cozolino, 2002). This mirroring process has now been demonstrated to occur not only with motor actions but also emotions and intentions. "Scientists think that this capacity for neural mirroring helps us interpret other people's actions and feelings, and may be the neurophysiological basis for empathy" (Wylie & Simon, 2002, p. 28). Rizzolatti, et. al. (2006), citing functional Magnetic Resonance Imaging (fMRI) studies conducted using the emotions of disgust and pain, posited that "humans may comprehend emotions, or at least powerful negative emotions, through a direct mapping mechanism involving parts of the brain that generate visceral motor responses." (p. 60) This suggests that one can experience the emotions of another by observing facial expressions, hearing vocal intonations, or watching body language as well as hearing words

Implications for teaching psychodynamic technique.

Since similar neural circuits may be activated in the brain of a sensitive therapist and her patient, it is extremely important that students are taught the art of observation. A combined focus on the content of a session, the patient's affect, the therapist's own affect, and any memories that may be kindled by the evoked affect is likely to reveal nonconscious aspects of the patient's communication. The neural circuits that are activated in the brain of the therapist may be linked to the therapist's own experiences that resonate with the experience the patient is trying to relay.

Students are also encouraged to recognize mirror neuron function and right brain communicative process in general as a two-way street. Just as the therapist may be both consciously and unconsciously aware of the patient's unconscious affect, the patient is likely to

be able to perceive the therapist's affect at least unconsciously, if not consciously. Despite an attempt to maintain a neutral emotional response, most therapists communicate affect through subtle changes in gesture, posture, facial expression, vocal tone, and verbal feedback (Pally, 2001). These communications occur extremely quickly. This rapid interactive process is instinctive and is the basis of non-verbal communication between babies and parents. Infant research indicates that a parent and an infant can detect and react to affective or physical changes in the other in as little as a fraction of a second. This incredibly rapid, innate, reactive response is completely non-conscious, based in right hemisphere process, available even to the neonate (Beebe, 2006; Murray & Trevarthen, 1985).

When a therapist or trainee is aware of this capacity for interpersonal communication of affect, it can be employed consciously and non-verbally to help regulate a patient's affect. For example, if the therapist perceives how overwhelmed the patient is with a particular affective state, it may be possible through self-regulation (i.e. taking a deep breath, slightly leaning back) to help the patient down-regulate, as the patient's mirror neurons and limbic processes contingently respond to the therapist's subtle down-regulating behaviors. Because this requires a great deal of self-reflection and self-control on the part of the therapist, students are encouraged to develop these capacities within themselves.

The authors believe that mirror neurons may be found to play a role in a number of interactive processes, including the intergenerational transfer of trauma (Balbernie, 2007), the development of childhood depression as a result of interacting with a depressed parent, and the continuation of an abuse cycle –by producing nonconscious learning by mirroring of the implicit affective state of the perpetrator as well as that of the victim. Procedural, or implicit, memory (see below) also plays a crucial role in these examples. Students are encouraged to consider these possibilities in the treatment of their patients and to keep abreast of the research in this area to see if these hypotheses are borne out.

<u>The Contribution of Procedural/Implicit Memory</u>

Grigsby and Hartlaub (1994) introduced the idea that memory systems, learning, and the formation of specific neural pathways strongly influence the development and maintenance of character. Using Cohen's (1984) categorization of memory into procedural and declarative mnestic processes, they describe two different memory systems: "Declarative memory" is

knowledge of content and events while "procedural memory" is the knowledge for experiences. While acquired skills such as swimming, riding a bike, or playing a musical instrument are commonly used when giving examples of procedural memory (also referred to as non-declarative or implicit memory), this type of implicit knowing encompasses many other types of processes. The ones that are most relevant to this paper are those concerned with the understanding of how relationship patterns work in particular contexts. This type of learning begins with the very earliest relationships. For example, a hungry infant who cries and is responded to quickly and appropriately by his caretaker learns that he can rely on this particular caretaker in this particular situation to fulfill his needs. Similarly, a hungry infant whose cries are met with anger or aggression learns that crying in the presence of *this* caretaker is a dangerous, frightening, and perhaps life-threatening proposition. This infant is likely to learn to be silent when he is in need. Grigsby and Hartlaub (1994) state:

> "In practical terms, when an organism's activity is effective, that activity is likely to recur in the future. This facilitation of specific behaviors is generally nonconscious and does not necessarily occur because an animal knows that it should behave in a particular manner. Instead, an activity that previously has been adaptive is likely to recur because the nervous system functions automatically to produce that activity in similar circumstances. To a certain extent, each repetition of a response has the effect of making the same response more likely in the future." (p 357)

Therefore, the more generally adaptive the response, the more likely it will be to be repeated. "Repetition increases the strength of the changes and the longevity of the neural networks, particularly in the hippocampus & cerebral cortex. Neglected neural patterns fade away" (Wylie & Simon, 2002, pp. 28-29). Early infant-caretaker interpersonal interactions form the basis of what is called an "internal working model" of relationships (Bowlby, 1969) or "RIG's" — "Representations of Interactions that have been Generalized" (Stern, 1985). What has occurred in the past defines expectations. (Sander, 1975; Siegel, 1999)

When these interactions occur, an individual forms a network of neural pathways that encodes sensory, limbic, situational and cognitive data associated with specific relationship patterns. Once a pathway has been forged, it increases the likelihood that other interactions will follow the same pattern. In later development, these interaction patterns are activated with the

unconscious expectation that others with whom that individual interacts in similar situations will behave in similar ways.

Implications for teaching psychodynamic technique

In a majority of interactions, an individual is likely to expect interpersonal relationships to follow patterns previously encoded from experience. The therapeutic situation is not an exception. What is referred to as transference is, in part, a manifestation of procedural memory. A neurobiologically-informed definition of transference and the working through of the transference may lead students to more direct interventions that are supported by empirical findings of changes in brain circuitry. These might include:

- Consciously altering unconscious interpersonal procedural expectations when the patient is in an optimal affective state, by verbally exploring the nature of the interaction, the context in which it was developed, and the potentially maladaptive nature of the pattern both in present interactions and in interactions with the therapist.
- Comparing the maladaptive interaction patterns to others that the patient has observed or can imagine.
- Imagining acting differently in an event that has previously taken place. (Cappas, Andres-Hyman, & Davidson, 2005)
- Encouraging the patient to employ conscious, effortful new behaviors in interpersonal relationships or new interactions thereby modifying habitual relationship patterns (Grigsby & Stevens, 2002).

Another clinical implication of understanding procedural memory is that it may complicate the therapist's deeply engrained expectation that relevant issues and material will mainly be explored verbally with the patient. Typically in the psychotherapeutic process, we ask that patients recall or describe events to facilitate the therapist's understanding of their current and past conflicts. While traditional psychoanalysis has long held that the curative aspect of the therapy lies in the development and analysis of the transference, most of our understanding of the process comes from what the patient says. Psychoanalytic psychotherapy training prescribes that interventions and interpretations be made verbally. Recent, innovative studies by the Boston Change Group and other contemporary schools have begun to explore the crucial, non-verbal change mechanisms in treatment (Stern et al., 1998). While verbal processes and verbal memory

are extremely important, students sometimes neglect non-verbal aspects of the treatment. Experienced child therapists know that a question they pose to a child at the beginning of a session may be poignantly answered in play themes throughout the remainder of the session. It is often easy to forget that adult patients who initially answer our questions with "I don't know" will unconsciously, non-verbally answer our questions through subsequent enactments during that session. While psychoanalytic training has carefully focused on listening to subsequent themes, less emphasis is placed on noticing subsequent implicit, affective interactions with the therapist.

Ginot (2007) and Bromberg (2006), among others, articulate this process in their clinical descriptions of enactments that occur in the treatment and may be used to produce change, once they are understood by both parties. It is important for students to remember that when change is made in the therapeutic relationship, new neural networks are likely to be formed. These networks may have to be traversed multiple times before new behavior emerges. Sander articulated this same complex approach to understanding a patient's communication, when he stated that in therapeutic interactions, "it is not the past that we seek, but the *logic* of the patient's own *state-regulating strategies*." [emphasis added] Schwaber quoting Sander (Schwaber, 1990, pg. 238).

The Complexity of Attachment Processes and Interpersonal Trauma

Along with psychoanalytic theory, we include attachment theory as a principal framework in this training course. Long before brain-scan based neurological evidence was available, it was clear that infant attachment relationships set up unconscious expectations regarding patterns of interpersonal behavior forming a template—Bowlby's 'internal working model'—for subsequent relationships (Bowlby, 1969). This has obvious implications for understanding both transference and countertransference dynamics.

In addition, we teach three key issues that are related to attachment and trauma. These issues are so closely related and synergistic in their expression that we teach them as an integrated unit, with applications to every other concept we present. Briefly stated, these are the three concepts: First, human infants share with other mammals specific innate survival mechanisms that are functional from birth: flight, fight, and (importantly) freeze responses (Perry, Pollard, Blakley, Baker, & Vigilante, 1995) (Damasio, 1994). Second, trauma –

especially interpersonal trauma—has a profound impact on the developing structure and neurobiology of the brain (A. N. Schore, 1994, 2002b; Siegel, 1999; van der Kolk & Fisler, 1994). Third, traumatic attachments – often called D or Disorganized/disoriented attachments (Main & Hesse, 1990; Main & Solomon, 1986, 1990) are seen as a precursor to some adult posttraumatic stress disorders and dissociative states of mind (Carlson, 1999; K. Lyons-Ruth, 2003; Yehuda & MacFarlane, 1995).

A major proportion of the clinical population seen by mental health workers in all settings, is comprised of patients who have a history of interpersonal and/or disaster-related trauma. Whatever the age or gender of these patients, whatever the particular setting within which psychotherapy is provided, each individual's history of interpersonal trauma will impact the quality of their relationships. For the clinician, certain particular difficulties in the treatment of traumatized patients –e.g. countertransference feelings of incompetence and shame or the experience of secondary trauma as part of the therapeutic process—are widely acknowledged (Bromberg, 1998, 2006; Chefetz & Bromberg, 2004; Lanyado, 2004; A. N. Schore, 2007). What is not stressed enough, in our opinion, is the fact that within broad guidelines, a therapist's provision of a successful treatment for an individual patient must take into account both the patient's and the therapist's *specific* history of trauma. This holds true both at a conscious level, in terms of conscious treatment planning, and in terms of the therapist's attention to the potential for the therapeutic dyad to become enmeshed in nonconscious enactments fueled by the unconscious interaction between the patient's implicit interpersonal traumatic memories and the therapist's own unconscious interpersonal procedural memories (Cozolino, 1997; Grigsby & Stevens, 2000).

Implicit or procedural memories associated with perceived life threats are held almost "indelibly" LeDoux, Romanski, & Xagoraris, 1989) in the right hemisphere (Cozolino, 2002, p. 97. Balbernie (2007) links mirror neuron function to the interpersonal dynamic often labeled intersubjectivity in the following manner: we are "inherently 'designed' to have visceral reactions to each other's actions, mishaps and feelings." (p 308) It follows that a patient's implicit memories of unresolved trauma will often be communicated initially to the therapist in terms of level and quality of affect, rather than in words (Bromberg, 1998; Ginot, 2007; Grigsby & Hartlaub, 1994; Meissner, 2007; Perry et al., 1995; A. N. Schore, 2002a).

The neonate is able to recognize and implicitly remember human and environmental perceived threats to life. Neural processes including activity in the right hemisphere amygdala (Sarter & Markowitsch, 1985) support the development of early attachment relationships, in which being able to discriminate familiar from strange is a part of the capacity to seek safety and avoid danger (Hamilton, 1985). Traumatic experience, associated with intense primitive affect such as terror or rage, can have a huge impact on the development of specific areas in the brain (Perry, 1997). When the areas that become over-developed are involved in innate responses to perceived threat to survival, a secondary result is the development of a hypersensitivity to negative affect communication that may distort the potential for optimal development of healthy, adaptive patterns of interpersonal interaction in such an infant (Buss et al., 2004). For example: An infant whose innate distress signals are responded to with either rage or fear by an attachment figure will react to the parent's primitive affect implicitly, without thought, since the infant's left hemisphere is undeveloped and nonfunctional until many months after birth. If this affective pattern of interaction recurs frequently for the dyad, the infant brain will repeatedly activate and use the amygdala-based neuronal pathways in "limbic resonance" (Dobbs, 2006) based on fear and/or rage, thus, over-developing those areas in the brain, inhibiting the development of the less rapidly triggered conscious responses and modulated affect in the left hemisphere (Balbernie, 2007; Beebe, 2000).

An infant whose early brain development included repeated experiences of traumatic emotion and was a target for primitive affects projected by attachment figures, faces a developmental progression to an adult who exhibits dissociative psychopathology. This can be understood as a shift from "state" to "trait" over time (Perry et al., 1995). In our use-dependent human brain, experience determines which areas of the brain are activated with what intensity and frequency. We recognize that the infant brain is designed to react to experience in a moment–to-moment manner, with no capacity to *know* or predict the future, except by *remembering* the implicit experiences the brain has recorded during past experience. And, while the adrenergic reactive responses of "flight" and "fight" can be triggered by perceptions of life-threat in infancy, the infant has no actual way either to flee or fight if the adults interacting with the infant increase the danger to the infant's life, rather than decreasing it, in response to the infant's innate distress signals. (See example above.)

The neonate and infant do not have access to a left-hemisphere capacity to think about things or make sense of others' behavior, but there is a third innate survival response that can be triggered in the brain when "fight" or "flight" responses become linked in the infant's experience to *increased* threat. This innate reaction, parasympathetic in nature, allows the brain to "dissociate" awareness of body sensations of pain, hunger, temperature, etc., and to adopt a "freeze" state in which the sympathetic responses involving action to resolve distress are shut down.

We can easily recognize that the younger the infant, the less capable he or she may be to use active defenses in the face of repeated traumatic threats and experiences. Thus the most extreme innate reaction of "freeze" will involuntarily be triggered again and again in the face of another's extreme negative affect. With the huge amounts of growth hormone that are circulating in the infant brain during the first few years of life, each activation of the brain will reinforce the development of neural pathways that are involved in experience. As the individual infant develops into a child and then an adult, the overdeveloped limbic areas involved in triggering freeze responses to perceived threat during infancy will result in a hypersensitivity to communications of implicit negative affect in interpersonal communications—even those that are minimal in intensity or incipient in nature—such as when brows are unconsciously pulled together while listening to another or when a question is raised, changing vocal tone.

The innate responsiveness of human brains to each other's implicit affect, in conjunction with the function of mirror neurons that allow members of a dyad to observe and anticipate – as well as experience internally — another's unconscious communication, results in the continual reinforcement of previously overdeveloped neural pathways. What were initially affective/biophysical "states" become organized personality "traits."(Perry 1995) When hypersensitized dissociative states are repeatedly triggered by negative and assumed threatening interpersonal affect—rather than the more active "flight" or "fight" reactions—over time they become organized, characterological defenses. Though they remain a nonconscious and involuntary part of intersubjective, procedural interactions, the mere existence of these over-developed, instantaneous reactive patterns becomes the neural pathway of least resistance, and, in time, various degrees of adult dissociative psychopathology may result.

Many clinical research articles have been published in the last decade documenting the neurophysiological basis of the developmental link between traumatic early attachment

experiences and later dissociative psychopathology in adulthood (Liotti, 1995, 1999; Main, 1991; Solomon & George, 1999). In addition, Lyons-Ruth, and colleagues (2003) published the results of two longitudinal attachment studies of families at social risk. Of clinical relevance are several findings:

> [D]ata indicate that "disorganized" attachment behaviors in infancy are important precursors of later dissociative symptomatology. Second, this early vulnerability is related to patterns of parent-infant affective communication, particularly quieter behaviors like emotional unavailability or role reversal, and does not appear to reside in the infant alone. Finally, the results suggest that the quality of the attachment relationship may in part account for why some people exposed to later trauma develop dissociative symptoms and others do not. [emphasis in original] (p. 884)

Schore (2002a) links psychoneurobiological elements of traumatic attachments in infancy, dissociative states, and the psychoanalytic concept of "projective identification**."** He and a few others have succeeded in the difficult task of articulating –in a lucid, linear, verbal form –the implicit, non-verbal, procedurally communicative aspects of dissociative states (Alvarez, 1997; Bromberg, 1998, 2006; Chefetz & Bromberg, 2004). These authors bring to our students an awareness of the complexity of clinical experience with patients with a trauma history, while the concepts also powerfully inform our teaching methods and planning.

Implications for teaching psychodynamic technique

When teaching about the impact of trauma on the brain and about traumatic attachments, any lecturer must be aware of the need to keep students (or the audience) in mind as participants in an interactive communicative process. Conscious planning to provide a kind of "integrated-brain scaffolding" for listener-participants when providing learning experiences that are likely to be highly non-verbally triggering—such as video tapes of traumatized infant-parent dyads, or verbatim patient transcripts of descriptions of traumatic experience –is appropriate. We believe this can be accomplished in various ways, but one method we have often found to be successful is — just prior to viewing the video or listening to a graphic verbatim transcript—to set the student listeners/viewers the conscious, cognitive, left-hemisphere-activating task of identifying specific points in the material where, for example, a sequential analysis might explain the

patient's underlying communication. Then, after viewing/hearing the material, we discuss the students' opinions about whatever cognitive task they had been assigned. In such a discussion, we hope to support and enrich the learning experience for each student in an activity that can link left-hemisphere verbal reasoning capacity with right-hemisphere affective receptive-expressive perceptions, activating neural pathways in the corpus collosum of each participant.

When going through this exercise, we consider with the class, the potential experience of working with a traumatized patient. Highlighting the fact that dissociative states are often difficult to determine from the outside (as an observer), and that at times a patient who has been triggered into a dissociative state may continue to talk about things with the therapist in an apparently typical way, we tacitly acknowledge that we may not recognize when our own patients or our students become dissociated. Neurobiologically, when dissociation is extreme (not just a moment of being distracted), the pattern of brain activation is equivalent to a hypnotic trance in terms of brain function – right hemisphere is fully activated while there is dramatically reduced blood flow in the left hemisphere and prefrontal lobes (Gruzelier, 2006). In this state, as in a *hypnotic trance* words and actions may enter the patient's unconscious right hemisphere without being evaluated by left hemisphere reasoning (Conway, 1994). Thus, if there is any suspicion that the patient may be dissociated, it is crucial that his or her therapist not make any statements that could be heard and taken in by the patient as an expression of fact regarding the patient's experience or history. Instead, when the goal is for the patient to become reconnected to the therapist in the here and now, the patient's left hemisphere function is more likely to be *re-awakened* if the therapist quietly asks an *open-ended* question regarding the patient's sensory experience of the therapy environment –to which only the patient could have an answer – "Here in my office it's a bit dark this time of day; would you like me to turn the lights up?" for example. This type of question often results in a responsive triggering of the patient's left hemisphere as he or she reflects on the *facts* of the question and formulates a verbal answer. Here, to paraphrase Pally (1998), it is not an interpretation of what the therapist believes is in the patient's mind but an expression of interest that implicitly acknowledges to the patient that the therapist does *not* know what the patient is experiencing that can allow the therapist to reconnect with the patient in a meaningful manner. It is key to this process that the therapist's question must be authentic. He or she must be truly waiting to learn from the patient what his or her unique response may be (Moore, 2007).

Returning to the teaching process, in order to help students gain a more intuitive understanding of the affective, nonverbal quality of therapist-patient interpersonal dynamics as "co-constructed unconscious experience" (Beebe, 2000; A. N. Schore, 2003, 2007; Tronick, 2001), we give careful attention to clinical examples in the form of process notes, video or audio tapes while teaching the concepts. Applying the theory as well as teaching it, we hope to activate unconscious learning processes in the students, helping them to gain an implicit understanding of the therapist's experience of an "unthought known" (Bollas, 1987c) in working with the patient as well as greater intuitive understanding of the patient's blocks to discussion of the issues at hand.

The Importance of Developing Integrated Brain processing in the Psychotherapeutic Experience

While right brain processes are extremely important, there is mounting evidence that the integration of neural circuits is extremely important in the amelioration of psychiatric symptoms (Cozolino, 2002). For example, pre- and post-treatment fMRI data on patients who have successfully been treated for post-traumatic symptoms, using Eye Movement Desensitization and Reprocessing (EMDR) therapy, are compelling. EMDR processing uses bilateral stimulation of the brain while asking the patient to hold in mind visual memories, emotions, cognitive self-attributes, and bodily sensations associated with a traumatic event (Stickgold, 2002). Pre-treatment data show activation in the right-limbic portion of the brain while post-treatment data show activation in both the right and left hemispheres as well as in the frontal and pre-frontal lobes (Levin, Lazrove, & van der Kolk, 1999). Wrzos (2007) suggests that EMDR techniques involving the therapist alternately tapping each of her patient's hands may also enhance a neurobiological, nonconscious, "brain to brain" communication between therapist and patient, as each member of the therapeutic dyad is experiencing the bi-lateral stimulation of brain hemispheres.

Inefficient or dysfunctional neural circuits leading to problems integrating information between right and left hemispheres or between cortical and subcortical structures have been linked to pathological states. Teicher's (2002) study utilizing brain scans of sexually abused subjects and nonsexually abused controls demonstrated a significantly smaller corpus callosum (fibers that connect the right and left hemispheres of the brain) in those subjects with a traumatic abuse history. Concomitantly, there is some evidence that in traumatic states, Broca's area (in the

left hemisphere) may be inactive while structures in the right hemisphere are highly activated (Rauch, van der Kolk, & Fisler, 1996). These findings have implications regarding the role of the left hemisphere in modulating overwhelming affective experience. Looking within brain hemispheres rather than at connections between left and right hemispheres, dysfunctional communication between cortical and subcortial structures may be implicated in PTSD (Freeman & Kimbrell, 2001), attachment disorders (A. N. Schore, 2002a), and psychosomatic disorders (Maunder & Hunter, 2001; Thayer & Brosschot, 2005).

Implications for teaching psychodynamic technique

In the coming years, it is likely we will learn a great deal from neuroimaging about how to facilitate neural integration in psychotherapy. At present, Cozolino (2002) has a number of suggestions that are solidly grounded in neurobiology. He proposes that neural growth and integration in psychotherapy may be enhanced by:

> 1) The establishment of a safe and trusting relationship.
>
> 2) Gaining new information and experiences across the domains of cognition, emotion, sensation, and behavior,
>
> 3) The simultaneous or alternating activation of neural networks that are inadequately integrated or dissociated.
>
> 4) Moderate levels of stress or emotional arousal alternating with periods of calm and safety.
>
> 5) The integration of conceptual knowledge with emotional and bodily experience through narratives that are co-constructed with the therapist (pg 27).

The authors have found that if the therapist carefully holds in mind cognitve, narrative, planning, and affective processes as the patient is relating information, the therapist may, in a sensitive, timely manner, bring in aspects of the communication that have been omitted by the patient. Thus, affect is inquired about when cognition is dominating; cognition is inquired about when affect threatens to overwhelm. Prefrontal processes are called on to plan for the future as well as to give a context for previous behavior and interactions.

Providing accurate neuroscientific reading materials—written for a lay audience—to patients, as well as being willing to discuss in treatment the content of some of the new neurobiological concepts, can provide a powerful link to left hemispheric cognitive processes

when, in later stages of therapy, the patient and therapist may find themselves stuck in a mire of projected and enacted procedural memories.

We have found that offering patients and their families some education about the huge impact of interpersonal experience on individual brain development—and thus, personality development—tends to reduce feelings of self-blame and shame over difficulty in making desired changes. Also, when the concept of inter-generational transmission of experience through attachment relationships is comprehended, very often blame of, and rage toward, attachment figures is gradually replaced by an ability to see parents in a more compassionate light. Not surprisingly, when first encountering the course material, students' personal as well as professional reactions often include those described above.

A conscious sense of relief can emerge when an individual in psychotherapy first comprehends that in terms of evolution of the species, it is highly adaptive for an infant to be born with a brain neurologically primed with instantly functional, innate survival mechanisms (Damasio, 1994), programmed to continue functioning throughout the lifespan—influencing and interacting with the many additional coping skills and reason-based survival capacities that develop—particularly in the neocortex and left hemisphere—as the brain develops over time. In fact, brain development depends upon, and is ultimately shaped by each individual's actual, interpersonal and environmental experiences as they interact with the genetic potential, in each person's life (Sander, 2002). Realizing that this combination of developmental forces even exists, allows a patient to consider past experiences in new ways; the knowledge that this process of development and change continues across the lifespan can inspire hope for the future.

The awareness that every human brain develops in this complex, genetic- and experience-specific manner, carries within it the realization that therapist and patient are equally a product of these evolutionary dynamics. The therapist's implicit acknowledgment that one always plays an unconscious role in the therapeutic dynamics, coupled with the patient's awareness that all relationships are co-constructed to some degree, brings here and now psychotherapeutic processes into focus. Avenues are thus opened for joint consideration of procedural enactments and possibly explicit discussion, when therapeutic timing is appropriate. This requires much introspection and reflection on the therapist's part –often in consultation – regarding implicit experiences that constitute counter-transference reactions.

Maximizing Potential for Student Learning Through Modeling of the Principles

Wylie and Simon, in their excellent Psychotherapy Networker article, "Discoveries from the Black Box: How the neuroscience revolution can change your practice," (2002), address this issue and express the thought behind some of our conscious teaching strategies, in a quotation from Daniel Siegel:

> "The more areas of the brain that are engaged in an experience or interaction (especially those linked to emotion), the more neurotransmitters like serotonin and norepinephrine are produced, the more likely the brain is to be more 'plastic.' Neuro-modularity creates a state in which the connectivity of neurons is more likely to happen. Making something personally relevant for a student allows them to engage more parts of their brains than just the areas used to "memorize" things that are repeatedly read or said." Siegel, as quoted in (Wylie & Simon, 2002)

However, if students apply the material to their own life events, the chance of being affectively flooded may preclude the integration of new material as frontal lobes become less engaged in the service of lower-right brain functioning. Many times students voluntarily share with us important facts about their particular family history, and we realize that some topics and some times of year are likely to be triggering enough that they will be unable to take in material presented simply didactically. Thus, as we organize the lecture content and clinical vignettes to be discussed, in addition to linking concepts to clinical material brought by both of us as well as our students, we make available some recorded lecture material, encouraging students to use the tapes or CD's if they have missed a class, or simply want to think about the material again while integrating it into their working knowledge of psychotherapy process. In his 1985 text, Developmental Theory and Clinical Process, Pine insightfully calls this practice of returning to disturbing material when affective regulation is under better control, and there is more capacity for an integrated brain response, "striking while the iron is cold." (Pine, 1985, p. 153)

Becoming aware of the crucial impact of interpersonal experience on specific aspects of brain development—for example, of the ways intersubjective relationship dynamics serve to co-regulate affect states—is clearly an important concept on which to build a more nuanced understanding of the therapist-patient relationship. These dynamics can have an impact on one's ability to think and respond to others, and are an essential—if most frequently a non-conscious—

aspect of every human interaction. With this in mind, the authors organize the teaching process in such a way that they attempt to remain at least partially aware their own interactive behavior, as co-lecturers for the course. As we teach together, we cannot help but implicitly demonstrate the kind of interactive regulatory and learning dynamics that form the content of the course. Very occasionally—and only when the material is relevant to course content—we may stop for a moment during our prepared presentation, to think out-loud with each other, to try to articulate what we feel might have been the procedural, non-conscious process triggered in whatever was our own immediately previous interaction. (e.g. one being aware of the time remaining in the class, and interrupting to hurry the other speaker along, but initially without explanation.) When these interactions are spontaneous and authentic, it is our belief that we are serving multiple functions in the learning process.

The realities of being an intern can impact the therapeutic relationship between the student-therapists and their patients. These include a looming thesis or examination, pressure to produce results in a patient before year end, feelings of loss triggered by holiday breaks or the upcoming ending of the internship, a need to impress supervisors, and competition with peers. The demands of these situations are often unconsciously introduced into interns' co-constructed, intersubjective space with their patients. We bring as many of these potential dynamics as possible into explicit discussion in the classroom, stressing the crucial differences in brain processing capacity between highly anxious and reflective states of mind. We emphasize the student's therapeutic role in co-constructing the affective regulatory process as part of treatment, e.g. reminding the students of ways to "down-regulate" in the therapy room, practicing established "mindfulness" techniques (A. N. Schore, 2007; J. R. Schore & Schore, 2007; Siegel, 2007).

As noted earlier, the course continually evolves as a result of new research findings. By introducing neurobiological data and attempting to integrate this knowledge into psychodynamic psychotherapy we hope to demonstrate the process of carefully evaluating new research and incorporating findings from valid, reliable studies into every-day practice.

Our attempts to bring unconscious processes into awareness for the students, and link the course materials to their developing ability to recognize and work with stresses in their psychotherapeutic training, are not always successful, of course. But we hope that combined with our planning which tries to take the students' context into account, our openness to brief,

spontaneous, authentic "moments of meeting" (Stern et al., 1998) with our students, will provide meaningful learning that is personally relevant for each of them. Students are invited to consider –when they have the opportunity to reflect, perhaps with their therapist or a supervisor they trust—what their own potential roles may be as participants in the co-construction of the communicative process in seminar discussions, as well as with their patients. We recognize that our goals for the course are lofty, and we ourselves frequently fall short of this ideal– at times utterly failing. In such instances, we are encouraged by Tronick's many studies of *normal* patterns of disruption and reparation in all relationships (Tronick, 1998, 2001; Tronick & Cohen, 1989), believing that if we recognize where we have failed at some point, we can address the issue with our student(s) at the next opportunity, in an authentic effort to make reparation and perhaps create a productive learning experience.

It is our hope that utilizing more than the traditional mode of verbal, didactic teaching—along with the careful consideration of new ideas –will foster the development of a method of learning that can continue for an entire professional career.

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