

FORENSIC MENTAL HEALTH ASSOCIATION
OF CALIFORNIA
MONTEREY, CA

MARCH 19, 2014

EARLY RIGHT BRAIN AFFECT REGULATION AND
THE RELATIONAL ORIGINS OF
EMOTIONAL WELL-BEING

ALLAN N. SCHORE

UCLA DAVID GEFEN SCHOOL OF MEDICINE

THE SCIENCE
OF THE ART OF
PSYCHOTHERAPY



ALLAN N. SCHORE

- Editorial of recent issue *Journal of Child Psychology and Psychiatry* “Developmental neuroscience comes of age,” Leckman and March (2011) describe “the phenomenal progress of the past three decades in the developmental neurosciences.”
- “Over the past decade it has...become abundantly clear that...the in utero and immediate postnatal environments and the dyadic relations between child and caregivers within the first years of life can have direct and enduring effects on the child’s brain development and behavior.”

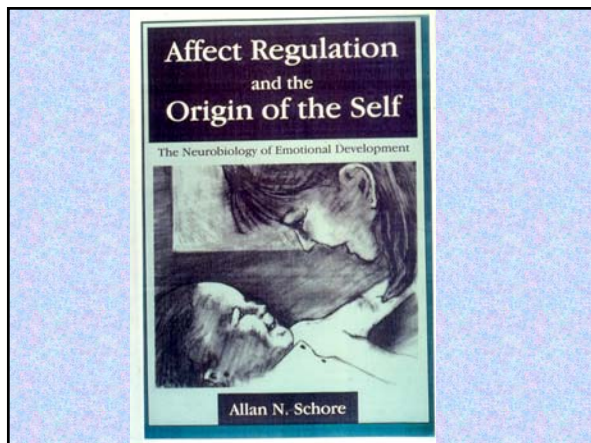
- “Indeed, the enduring impact of early maternal care and the role of epigenetic modifications of the genome during critical periods in early brain development in health and disease is likely to be *one of the most important discoveries in all of science that have major implications for our field.*”
- “A scientific consensus is emerging that the origins of adult disease are often found among developmental disruptions occurring during the early years of life.”
- Research in developmental biology and physiology now strongly supports a model of the “developmental origins of *health and disease*” (Gluckman & Adler, *Science*, 2004).

- Schore (*Affect Regulation and the Origin of the Self: The Neurobiology of Emotional Development*, 1994): developmental origins of emotional well-being. Proposes attachment relationship transmits emotional communications, which in turn shape infant’s early maturing right “emotional” brain.
- (1994-2014) interdisciplinary research supports model of attachment as emotional communications between mother’s right brain and infant’s developing right brain.
- Relational principle of interpersonal neurobiology: “The self-organization of the developing brain occurs in the context of another self, another brain” (Schore, 1996).

- Schore (2012):
- “There is now agreement...that the essential task of the 1st year of human life is the co-creation of a secure attachment bond of *emotional communication* between the infant and his/her primary caregiver.
- The baby communicates its burgeoning positive emotional states (e.g., joy, excitement) and negative emotional states (e.g., fear, anger) to the caregiver so that she can then *regulate* them.
- The attachment relationship shapes the ability of the baby to communicate with not just the mother, but ultimately with other human beings.”

- Schore (2012): “Essentially, interpersonal neurobiology explains how early social-emotional experience indelibly influences later experience—by impacting and altering the developing brain...”
- “In other words, the emotional relational environment provided by the primary caregiver shapes, *for better or worse*, the experience-dependent maturation of the brain systems involved in attachment functions that are accessed throughout the life span.”

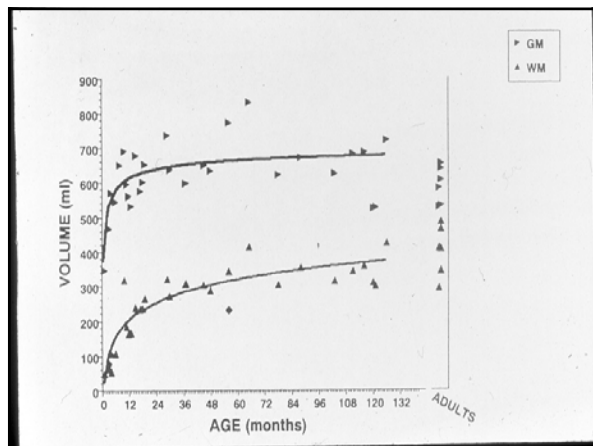
- J. Schore & A. Schore. *Clinical Social Work Journal*, 2008. Modern attachment theory: the central role of affect regulation in development and treatment.
- “We suggest that in line with Bowlby’s fundamental goal of the integration of psychological and biological models of human development, the current clinical and experimental focus on how affective bodily-based processes are nonconsciously interactively regulated... has shifted attachment theory to a regulation theory.”
- Origins of emotional wellbeing: early development of self-regulation is central to emergence of infant social-emotional, mental, and physical health.



- Schore (1994): “The understanding of early development is one of the fundamental objectives of science. The beginnings of living systems set the stage for every aspect of an organism’s internal and external functioning throughout he lifespan.”
- “Events that occur during infancy, especially transactions with the social environment, are indelibly imprinted into the structures that are maturing in the first years of life. The child’s first relationship, the one with the mother, acts as a template, as it permanently molds the individual’s capacities to enter into all later emotional relationships.”

- “These early experiences shape the development of a unique personality, its adaptive capacities as well as its vulnerabilities to and resistances against particular forms of future pathologies. Indeed, they profoundly influence the emergent organization of an integrated system that is both stable and adaptable, and thereby the formation of the self.”

- Leckman and March (2011):
- “A complex, dynamic story is unfolding of evolutionarily conserved genetic programs that guide mammalian brain development and how our *in utero* and our *early postnatal interpersonal worlds* shape and mold the individuals (infants, children, adolescents, adults and caregivers) we are to become.”
- Unfolding of genetic programs that guide brain development occurs in human brain growth spurt from last trimester of pregnancy through second year.



- Knickmeyer et al. (*J. Neurosci.*, 2008):
- "Total brain volume increased 101% in the first year, with a 15% increase in the second. . . . The volume of the subcortical area (including brainstem) increased by 130% in the first year and by 14% in the second year."
- Important to emphasize structural maturation of these brain systems not just genetically encoded. Rather epigenetically regulated mechanism that facilitates "experience-dependent maturation" of early developing right brain.

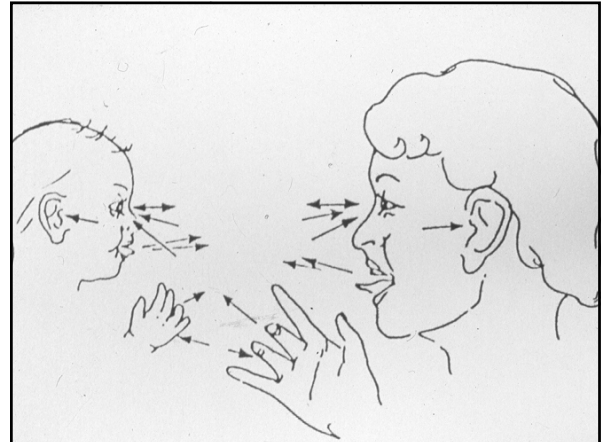
- In this period the right brain develops before the left.
- Trevarthen (1996): "The right hemisphere is more advanced than the left in surface features from about the 25th (gestational) week and this advance persists until the left hemisphere shows a postnatal growth spurt starting in the second year."
- Schleussner et al. (*Early Human Development*, 2004) report "an earlier maturation of certain right than homologous left hemispheric brain areas during fetal brain development."

- Lagercrantz & Ringstedt (*Acta Paediatrica*, 2001): prenatal and postnatal periods rate of synaptogenesis estimated at 40,000 new synapses every second.
- Schore (2012): "The idea that everything before birth is genetic and everything after birth is learned is a fallacy. Learning goes on in the fetus, when brain is in a rapid period of maturation from the last trimester of the pregnancy through the 2nd year. This means that in last trimester, biological mother's emotional state influences infant's developing brain, especially the right brain."

- Ratnarajah, . . . Meaney, & Qiu, Structural connectivity asymmetry in the neonatal brain, *NeuroImage*, 2013.
- Report human neonatal brain, at 5 to 17 days, presents "two topologically well-organized hemispheres with distinct and lateralized functions."
- "In early life the right cerebral hemisphere could be better able to process . . . emotion (Schore, 2000; Wada and Davis, 1977). This idea appears consistent with our findings of rightward asymmetry in the . . . limbic structures. . . . These neural substrates function as hubs in the right hemisphere for emotion processes and mother and child interaction."

- Walker-Andrews & Bahrack (*Infancy*, 2001):
- "From birth, an infant is plunged into a world of other human beings in which conversation, gestures, and faces are omnipresent during the infant's waking hours. Moreover, these harbingers of social information are dynamic, multimodal, and reciprocal."
- "It is no wonder that infants' early perceptual preferences include the human face, the human voice, animate motion, and events and *interactions with these important social beings.*"

- Tirassa et al. (2006): The “infant’s subjective perspective of herself as immersed in an all-social world...provides the necessary background against which she can interact with her caregivers, *communicating* with them, trying to make sense of what they do and their attempts to communicate with her, acquiring the first elements of the cultural environment in which she happens to live.”
- Bowlby (1969): attachment communications are “accompanied by the strongest of feelings and emotions, and occur within a context of “facial expression, posture, tone of voice, physiological changes, tempo of movement, and incipient action.”



- Schore (2012): “In order to co-create a secure attachment, the infant seeks *proximity* to the primary caregiver, who must be subjectively perceived as *predictable, consistent, and emotionally available*.”
- Co-creation of dyadic attachment system allows caregiver to regulate child’s affective states via dual processes of interactive regulation:
- 1. Affect synchrony: dyadic regulatory mechanism for establishing and maintaining positive affective states within the attachment bond of emotional communication. In relational play experiences, amplification of positive states in both.

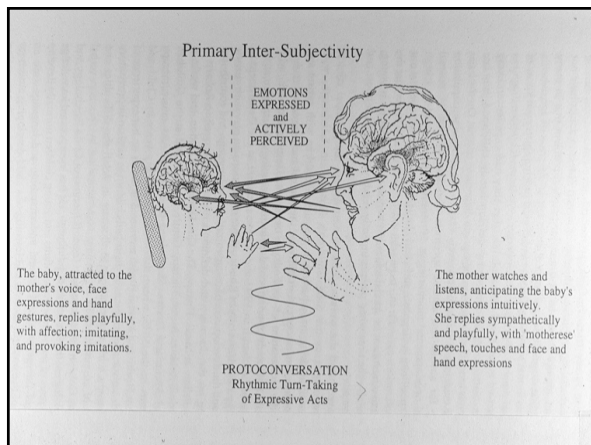
- 2. Interactive repair: dyadic regulatory mechanism for minimizing stressful negative affect states. Dyad recovers from negative affective ruptures of the attachment bond. Low level ruptures are common.
- “Good-enough” caregiver responsible for reparation of dyadic misattunements and ruptures in attachment bond of emotional communication. Child learns how to adaptively tolerate negative affects.
- Baby becomes securely attached to psychobiologically attuned caregiver who minimizes negative affect and maximizes positive affect.

- “It is the emotional availability of the caregiver in intimacy which seems to be the most central growth-promoting feature of the early rearing experience.”
- Development over the first year = an expansion of the affect array; increased tolerance for positive and negative affects.
- Le Doux (2000): “The broader the range of emotions that a child experiences the broader will be the emotional range of the self that develops.”
- Winnicott (1986): “The main thing is a communication between the baby and the mother in terms of the anatomy and physiology of live bodies.”



- Ovtcharoff & Braun (*Neuroscience*, 2001): “The dyadic interaction between the newborn and the mother...serves as a regulator of the developing individual’s internal homeostasis.
- Bradshaw & Schore (*Ethology*, 2007): attachment, interactive regulation of emotion, represents the mutual regulation of biological homeostatic states between and within organisms.
- Pipp & Harmon (*Child Development*, 1987): “Homeostatic regulation between members of a dyad is a stable aspect of all intimate relationships throughout the lifespan.”

- Schore (2012): “Attachment forms through communications that occur essentially between the right brain of the baby and the right brain of the primary caregiver... [F]rom the beginning and indeed for the rest of the life span, these are nonverbal, social-emotional, bodily-based communications.
- Specifically, attachment communication is expressed in (1) visual, face-to-face transactions; (2) auditory expressions of the emotional tone of the voice; and (3) tactile-gestural cues of the body. All of these are performed very rapidly by the right brains of the infant and mother.”

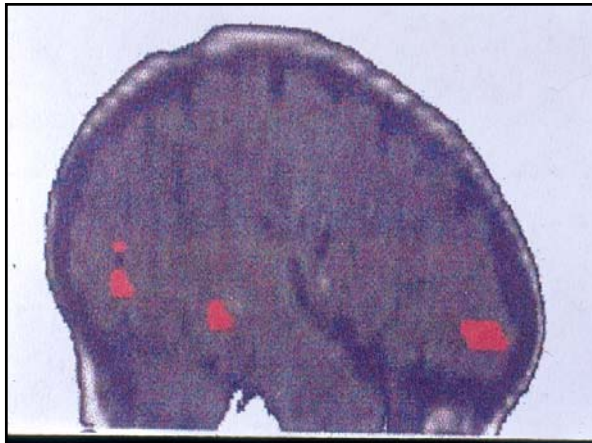


- Schore (*Development and Psychopathology*, 1996): “The infant’s early maturing right hemisphere, which is dominant for the child’s processing of visual emotional information, the infant’s recognition of the mother’s face, and the perception of arousal-inducing maternal facial expressions, is psychobiologically attuned to the output of the mother’s right hemisphere, which is involved in the expression and processing of emotional information and in nonverbal communication.”

- RH visual-facial attachment communications
- Myowa-Yamakoshi et al. (*Cognition*, 2003): “For survival, it may be crucial for infants to perceive gaze early, as it may help to attract the attention of caretakers and increase the opportunities for receiving care.”
- Kohut (*The Analysis of the Self*, 1971): “The most significant relevant basic interactions between mother and child usually lie in the visual area: The child’s bodily display is responded to by the gleam in the mother’s eye”
- “Her self-esteem is heightened as she feels at one with the excited and exhibiting baby.”

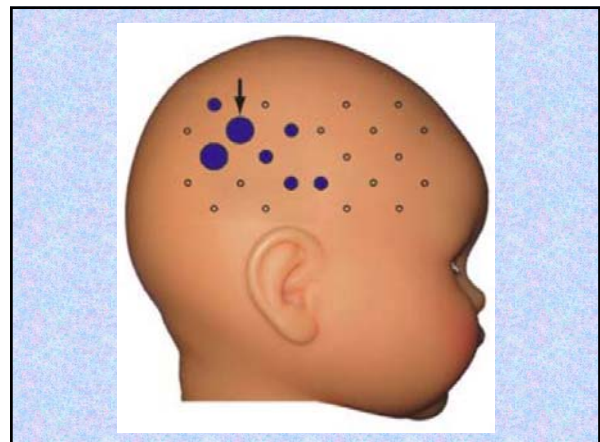


- RH visual-facial attachment communications
- Le Grand et al. (*Nature Neuroscience*, 2003): "Expert face processing requires visual input to the right hemisphere during infancy."
- "Only the right hemisphere is capable of using the early input to develop expertise at face processing."
- Tzourio-Mazoyer et al. (*NeuroImage*, 2002):
- PET study of 2-month-old infant looking at image of a woman's face; activation of infant's right fusiform gyrus of the inferior temporal cortex, the visual area that decodes facial patterns, and the occipital cortex.



- RH visual-facial attachment communications
- Grossmann et al. (*Social Cognitive and Affective Neuroscience*, 2007): 4-month-old infants presented with images of a female face gazing directly ahead show enhanced gamma electrical activity over right prefrontal areas. "The brain mechanisms underlying eye gaze perception show a high degree of specialization early in ontogeny, recruiting very similar areas in the right hemisphere as in adults."
- Nakato et al. (*Human Brain Mapping*, 2009): near-infrared spectroscopy research reveals that specifically the 5-month-olds' right hemisphere responds to images of adult female faces.

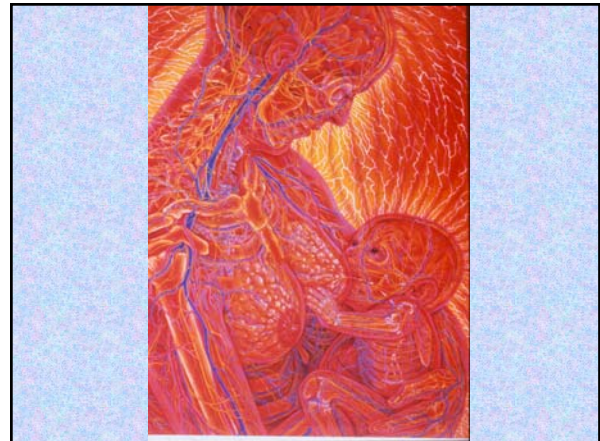
- RH auditory-prosodic attachment communications
- Mento et al. (*Eur. J. Neurosci.*, 2010): EEG study of auditory pitch processing in preterm infants born at 30 gestational weeks: "These findings suggest that the earlier right structural maturation in foetal epochs seems to be paralleled by a right functional development."
- Telkemeyer et al. (*J. Neurosci.*, 2009): NIRS of 2-6 day neonates show "responses to slow acoustic modulations are lateralized to the right hemisphere."
- Homae (*Neurosci. Res.*, 2006): "Prosodic processing in 3-month-old infants is subserved by the right temporoparietal region."



- RH auditory-prosodic attachment communications
- Grossmann et al. (*Neuron*, 2010): “The developmental origins of voice processing in the human brain.”
- NIRS study of emotional prosody. 7-month-old infants respond to emotional voices in a voice-sensitive region of the right superior temporal sulcus. Happy prosody activates the right inferior frontal cortex.
- “The pattern of finding suggests that temporal regions specialize in processing voices very early in development and that, already in infancy, emotions differentially modulate voice processing in the right hemisphere.”

- RH tactile-gestural attachment communications
- Nagy (*Infant Child Develop.*, 2006): study human neonates in their first 3-96 hours of life, and find a “lateralized system for neonatal imitation.”
- “The early advantage of the right hemisphere (Chiron et al., 1997; Schore, 2000; Trevarthen, 2001) in the first few months of life may affect the lateralized appearance of the first imitative gestures.”
- Sieratzki & Woll (*Behav. Brain Sci.*, 2005) on touch and RH: “The emotional impact of touch, the most basic and reciprocal mode of interaction is also more direct and immediate if an infant is held to the left side of the body.”

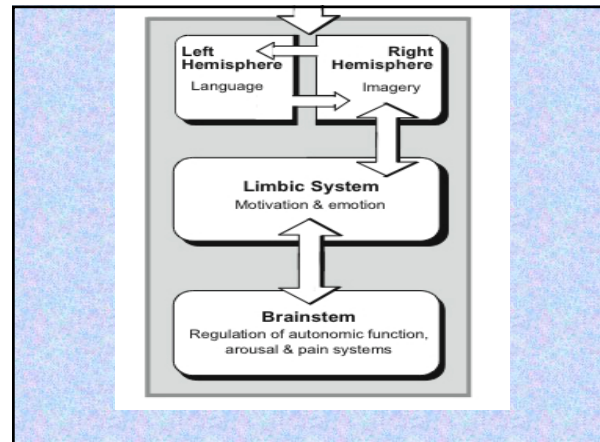
- RH tactile-gestural attachment communications
- Sieratzki and Woll, *Lancet*, 1996, “Why do mothers cradle babies on their left?”
- 80% of right-and left-handed mothers cradle on the left. Males no preference, but when males become fathers, 80% cradle left.
- “In the left cradling position, maternal affective signals are given to the infants free left ear and processed by the right hemisphere, the hemisphere which is more advanced at this stage of development, and destined for the reception and processing of prosody.”



- RH tactile-gestural attachment communications
- “Along the right hemisphere affect-communication vector, left-sided cradling facilitates the flow of auditory and visual communication between mother and infant and channels somato-affective feedback and infant sound to the mother’s right hemisphere, which in turn tunes the melody of the mother’s voice - the lullaby will not sound the same, and will not feel the same with the baby on the other side.”
- “The role of the right hemisphere is crucial in relation to the most precious needs of mothers and infants.”

- Bourne & Todd (*Developmental Science*, 2004): Right-handed mothers who are RH dominant for perception of facial emotion cradle left.
- “A number of functions located within the right hemisphere work together to aid monitoring of a baby. As well as emotion and face processing the right hemisphere is also specialized in auditory perception, the perception of intonation, attention, and tactile information.”
- Advantage of “optimal transmission of affective information to the right hemisphere.”

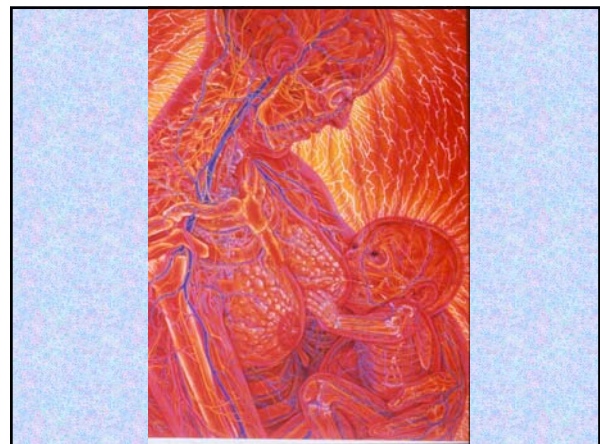
- Schore (1994): right brain-to-right brain attachment experiences impact experience-dependent maturation of infant's developing right brain.
- Chiron et al. (*Brain*, 1997): "The right brain hemisphere is dominant in human infants."
- Allman et al. (*Trends in Cognitive Sciences*, 2005): "The strong and consistent predominance for the right hemisphere emerges postnatally."
- Howard & Reggia (*Brain and Cognition*, 2007): "Earlier maturation of the right hemisphere is supported by both anatomical and imaging evidence."



- Schore (1996): maternal-infant bodily-based attachment transactions imprint developing right brain, which is more so than the left, deeply connected into emotion processing limbic system.
- Helmeke et al., 2001: "The functional maturation of limbic circuits is significantly influenced by early socio-emotional experience"
- Limbic system derives subjective information in terms of emotional feelings that guide behavior; allows the brain to adapt to rapidly changing environment and organize new learning.

- Dapretto et al. (2006): "Typically developing children can rely upon a right hemisphere-mirroring neural mechanism - interfacing with the limbic system via the insula - whereby the meaning of imitated (or observed) emotion is directly felt and hence understood."
- Devinsky (2000): RH dominant for an "emotional" "corporeal self"
- McGilchrist (2009): "The right hemisphere, is...more closely in touch with emotion and the body (therefore with the neurologically 'inferior' and more ancient regions of the central nervous system)..."

- These "ancient regions" are in both the central and autonomic nervous systems (CNS and ANS). RH deeply connected into sympathetic energy-expending and parasympathetic energy-conserving components of ANS that generate somatic aspects of emotions.
- Schore (1994): ANS develops pre- and postnatally, and is imprinted by attachment relationship. Crescendos and decrescendos of mother's affective arousal state in resonance with similar crescendos and decrescendos of the infant's internal arousal states.

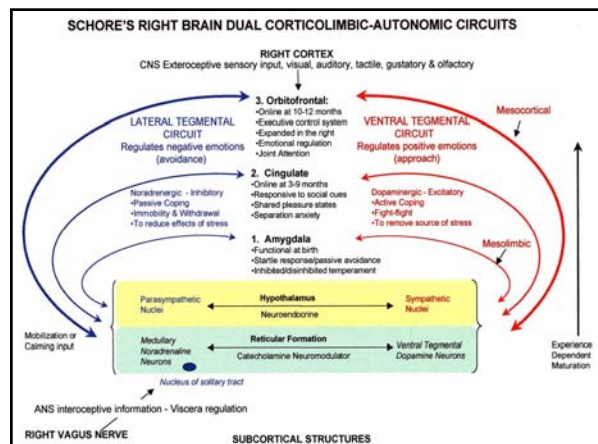
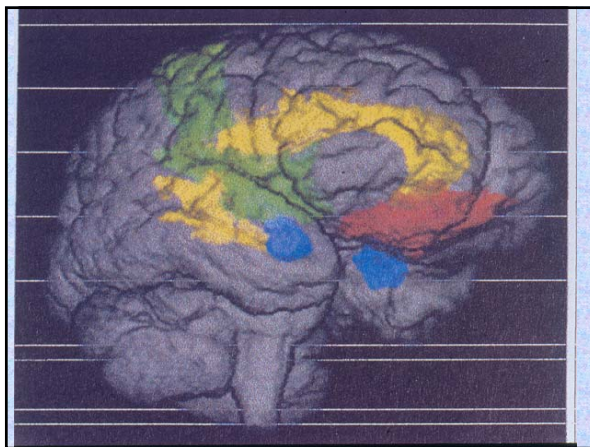


- Basch (1976): “the language of mother and infant consist of signals produced by the autonomic, involuntary nervous system in both parties.”
- Porges (2009): “Consistent with the views that the right hemisphere appears to play a greater role in affect, especially the adaptive expression of negative affect, the right hemisphere also appears to have a greater role in regulation of cardiac function presumably via shifts in vagal regulation.”
- Gunnar (2000): maternal care within attachment relationship shapes the infant’s hypothalamic-pituitary-adrenocortical (HPA) axis.

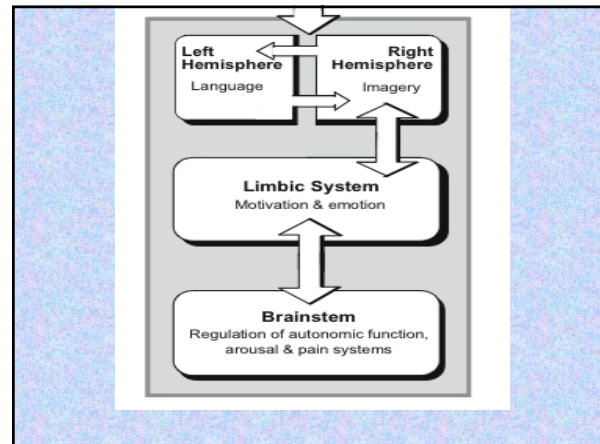
- Wittling et al. (1997): RH regulates HPA axis and mediates human stress response; RH central to control of vital functions supporting survival and enabling organism to cope with stresses and challenges.
- Schore (1994): attachment interactions impact experience-dependent maturation of prefrontal cortical circuits of early developing RH, locus of highest levels of affect processing and stress regulation in the brain.
- Sullivan & Dufresne (*Brain Research*, 2006): Optimal stress regulation is dependent on “right hemispheric specialization in regulating stress - and emotion-related processes.”

- Attachment facilitates right brain survival functions:
- Brancucci et al. (2009): “the neural substrates of the perception of voices, faces, gestures, smells, and pheromones, as evidenced by modern neuroimaging techniques, are characterized by a general right-hemispheric functional asymmetry.”
- Schutz (2005): “The right hemisphere operates a distributed network for rapid responding to danger and other urgent problems. It preferentially processes *environmental challenge, stress and pain* and manages self-protective responses such as avoidance and escape.”

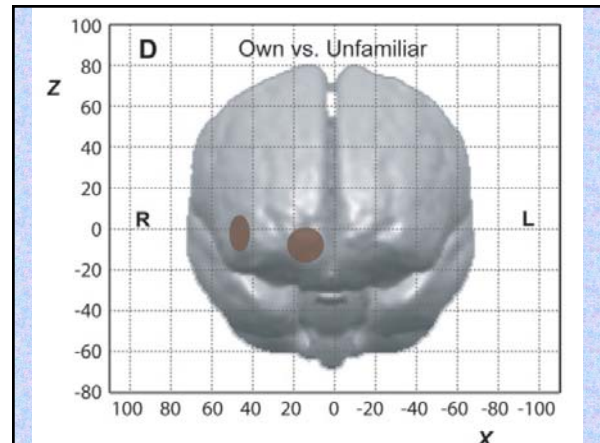
- Schore (1996): “The self-organization of the developing brain occurs in the context of another self, another brain.”
- Watt (2003): “Attachment experiences form the ground out of which we emerge, and certainly the groundwork for much of cortical development and prefrontal system development.”
- [and subcortical development]
- Schore (2003): over course of first year attachment transactions shape the development of right lateralized limbic system: amygdala, insular cortex, cingulate (medial frontal) cortex, and orbitofrontal cortex.



- Right OFC acts hierarchical apex of limbic system and ANS. Control system of attachment; executive regulator of right brain, “emotional,” “social” brain.
- Schore (1994): lower subcortical levels of right brain (the deep unconscious) contain all major motivational systems (including attachment, fear, sexuality, aggression, disgust, etc.) and generate somatic autonomic expressions and arousal intensities of all emotional states.
- When optimally functioning, higher OFC system of RH generate a conscious emotional state that expresses the affective output of these motivational systems.



- Minagawa-Kawai et al. Prefrontal activation associated with social attachment: Facial-emotion recognition in mothers and infants, *Cerebral Cortex*, 2009:
- NIRS of 12 month infants looking at video of their smiling mother, and mothers' looking at video of infant while playing. Mothers watched movie alone, rated their emotional mood from 0-6 (“6 = most loving”).
- “We captured neural responses from the prefrontal area that were specific to looking at their own-mother's smiling expression in 12-month-old infants and vice versa in the mothers.”
- Mothers looking at their infant show activation in right OFC; infants looking at mother also right OFC.



- “These results suggest the OFC’s role in regulating and encoding the affect in attachment system and also show that infants share similar neuronal functions with mothers, associated with their bonds at 1 year of age.”
- “Our results are in agreement with those of Schore (1999, 2000) who addressed the importance of the right hemisphere in the attachment system.”
- Right lateral OFC functions “develops within the social world between caretakers and infants as one form of attachment.”

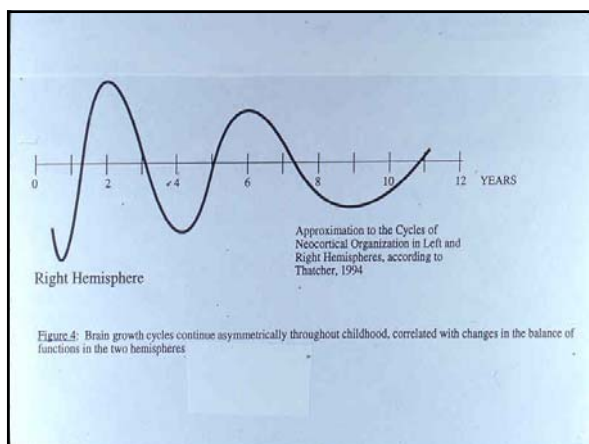
- Semrud-Clikeman & Hind (*Psychol. Bull.*, 1990): “The emotional experience of the infant develops through the sounds, images, and pictures that constitute much of an infant’s early learning experience, and are disproportionately stored or processed in the right hemisphere during the formative stages of brain ontogeny.”
- Early developing right brain encodes, in implicit-procedural memory, internal working model of attachment, strategies of affect regulation that nonconsciously guide individual through various affectively charged interpersonal contexts.

- Attachment = dual processes of right brain implicit bodily-based self-regulation:
- *Interactive regulation*, ability to resiliently regulate emotional states through interactions with others in interconnected contexts (intersubjectivity). Strategy of “open and direct communication of intentions and feelings together with negotiation and compromise.”
- *Autoregulation*, regulation of internal psychobiological states in autonomous contexts, without others.
- Secure attachment = adaptively shift between 2 modes, depending upon context.
- Tension between 2 regulatory strategies responsible for conflict between interconnectedness and autonomy

- What about early paternal caregiver?
- Bowlby (1969) proposed that child forms an attachment with a supportive mother and “a little later, father,” indicating that transmission of attachment patterns between mother and infant precedes subsequent transmission between father and child.
- Schore (1994): 20 years ago I provided extant developmental data suggesting that subsequent to the child’s formation of an attachment to the mother in first year, the child forms another, to father, in second year.
- Also contended that both impact brain development, mother earlier, father later.

- Subsequent to child’s formation of an attachment to mother in 1st year, forms another, to father in second.
- Herzog (2001): “The biorhythmicity of man with infant and woman with infant” affords the infant to have “interactive, state-sharing, and state-attuning experiences with two different kinds of caregivers.”
- Braun’s laboratory in Germany published series of studies demonstrating that paternal care affects synapse formation of the developing brain.
- Schore (2003): father later critically involved in male and female toddler’s aggression regulation [vs. earlier mother and fear regulation]

- Toronto (*Psychoanal. Psychol.*, 2001) describes critical nature of the nonverbal experiences of early stage of human development:
- “The period when individuals experience life totally, globally, outside the bounds that language places on them is important not only to the understanding of deficits, developmental arrests, and pathology, it is also a vital and abundant source of creativity, artistry, religion, intuition, and love.”
- RH ends its initial growth spurt in middle/end of second year. Later less intensive growth spurts; adaptive functions accessed over lifespan.



- Rotenberg (*Behavioral and Brain Sciences*, 2004): “The main functions of the right hemisphere...(the ability to grasp the reality as a whole; the emotional attachment to the mother (Schore, 2003); the regulation of withdrawal behavior in the appropriate conditions (Davidson, 1992); the integration of affect, behavior and autonomic activity (Schore, 2003) are the basic functions of survival (Saugstad, 1998) and for this reason are the first to appear.”

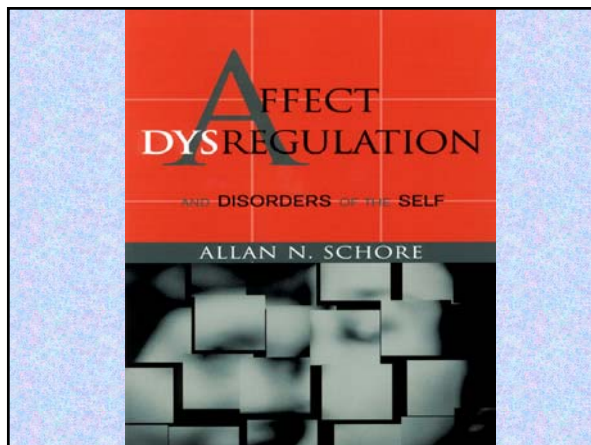
- Attachment impacted right brain adaptive functions:
- Communication/processing of facial expressions, prosody, gestures.
- Regulation of central and autonomic arousal.
- Storage of implicit/procedural emotional memory.
- Processing novelty, threat, and unexpected stimuli.
- Regulation of stress response and cortisol release.
- Control of vital functions supporting survival; enabling organism to cope actively and passively with stress.
- Reception, expression, and communication of negative affects and pain.
- If early attachment trauma, these functions impaired.

**FORENSIC MENTAL HEALTH ASSOCIATION
OF CALIFORNIA
MONTEREY, CA
MARCH 19, 2014**

**RELATIONAL TRAUMA, RIGHT BRAIN AFFECT
DYSREGULATION, AND THE RELATIONAL ORIGINS
OF A PREDISPOSITION TO VIOLENCE**

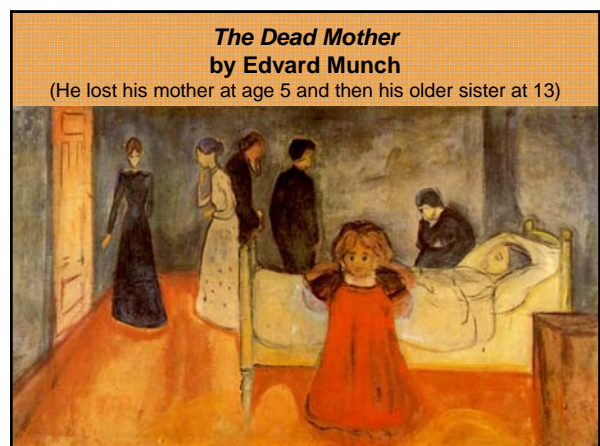
ALLAN N. SCHORE

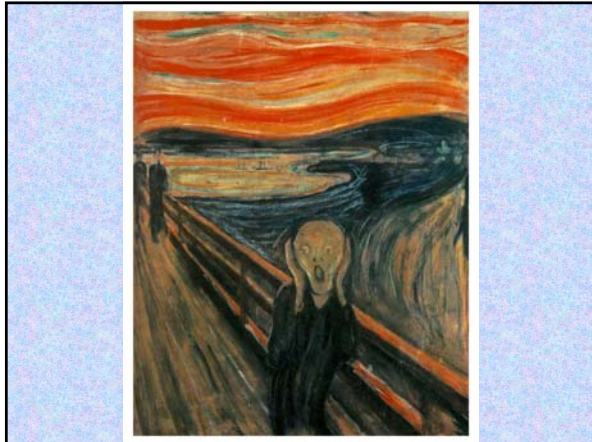
UCLA DAVID GEFEN SCHOOL OF MEDICINE



- Adaptive functions of efficient lateralized right brain evolve only in optimal growth-promoting relational environment. On the other hand:
- Henry (1993): “The vital task of establishing a personally relevant universe and the solace derived from it depend on right hemispheric functioning. If this function is indeed lost in the insecurely attached, much has been lost.”
- Schore (1994): mother-infant attachment impacts the developing right hemisphere for better or worse, and can either facilitate resilience to stress or create a predisposition to affect dysregulation and thereby psychopathology.

- Le Doux (2000): “If a significant proportion of the early emotional experiences one has are due to activation of the fear system rather than the positive systems, then the characteristic personality that begins to build up from the parallel learning processes coordinated by the emotional state is one characterized by *negativity and hopelessness* rather than affection and optimism.”
- “Sickness, insanity and death were the dark angels standing guard at my cradle and they have followed me throughout my life” (Edward Munch).





- Eigen (*Damaged Bonds*, 2001):
- “The personality has undergone a terrible fright probably repeatedly, probably suddenly. It is likely fright that permeated the atmosphere the individual was born into or was a significant dimension or thread or grain in upbringing. The individual was born into a frightened and frightening world.”
- Developmental traumatology studies: severe trauma of interpersonal origin can override genetic, constitutional, social, or psychological resilience.

- Continued survival of the child is felt to be at risk, because the actuality of the abuse jeopardizes (the) primary object bond and challenges the child’s capacity to trust and, therefore, to securely depend.
- Schore (*Infant Mental Health J.*, 2003): intense and enduring stress created in high risk contexts of *relational trauma*. Not attachment regulation but dysregulation; little play or interactive repair. This trauma derives from stressors not in the the physical but social environment.

- Suter et al. (*Stress*, 2007): stress significantly affects social interactions, especially mother-child interaction. These researchers observe during stressful life episodes mothers were less sensitive, more irritable, critical and punitive, showed less warmth and flexibility in interactions with their children.
- Stress is a factor that has power to disrupt parenting practices seriously and results in a lower quality of mother-child interaction.
- Schore (*IMHJ*, 2003): chronic early relational stress expressed in abuse and or neglect.

- Newman and Stevenson (*Aust. N. Z. J. Psychiatry*, 2007): parenting of mothers who manifest chronic stress dysregulation (borderline personality disorders):
- “Clearly, this group of women are very fragile and experience high levels of inner turmoil. This distress, often a product of their own experiences of early abuse and attachment disruption in abusive relationships, can be re-enacted with their own infants.”
- Re-enactment occurs in episodes of relational trauma. Attachment trauma not singular event but “ambient” and “cumulative.” Because mother doesn’t provide interactive repair, negative state lasts a long time.

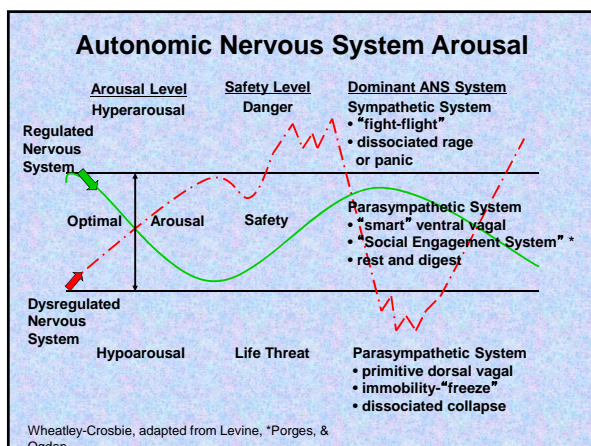
- Schore (2001): relational trauma = attachment trauma
- Lyons-Ruth & Spielman (2004): “An emphasis on fearful arousal and the relational modulation of that arousal lies at the heart of attachment theory.”
- Highest levels of stress in “Type D”, insecure-disorganized / disoriented attachment pattern found in 80% of maltreated infants
- These infants are unable to generate a coherent behavioral (active) coping strategy to deal with this emotional challenge of a reunion with mother
- Highest cortisol levels and heart rates in strange situation

- Relational trauma - *Abuse*
- Krystal (1988): "What can be the psychic state of a child overwhelmed with the primitive affect precursors...that involve a massive response mobilizing the entire autonomic nervous system as well as the precursors of pain? How can we imagine the child's timeless horror?...It is literally a fate worse than death, an unspeakable horror that is expected to mount and get worse and go on and on."
- The infant's psychobiological ANS response to trauma is comprised of two separate response patterns, hyperarousal and dissociation.

- *Hyperarousal*: Initial stage of threat, startle-alarm reaction. Energy-expending sympathetic component of the ANS is suddenly and significantly activated, resulting in increased heart rate, blood pressure, and respiration.
- Distress expressed in crying, then screaming.
- Hypermetabolic brain state via high levels of corticotropin releasing factor, catecholamines (dopamine, noradrenaline, adrenaline), and glutamate, major excitatory neurotransmitter in the brain.

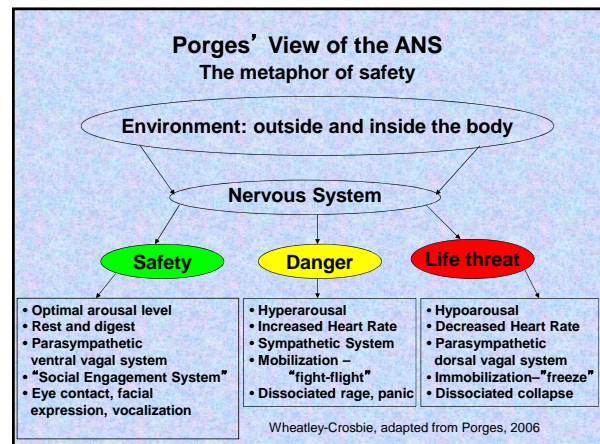
- Beebe: "Mutually escalating hyperarousal"
- "Each one escalates the ante, as the infant builds to a frantic distress, may scream, and finally throws up. In an escalating overarousal pattern, even after extreme distress signals from the infant, such as ninety-degree head aversion, arching away...or screaming, the mother keeps going."

- Porges (1997): switch from hyperarousal to hypoarousal / dissociation: "the sudden and rapid transition from an unsuccessful strategy of struggling requiring massive sympathetic activation to the metabolically conservative immobilized state mimicking death."
- Bromberg (2006): trauma associated with autonomic hyperarousal, "a chaotic and terrifying flooding of affect that can threaten to overwhelm sanity and imperil psychological survival. The mind's normal capacity for dissociation is typically enlisted as a primary defense."



- *Dissociation/hypoarousal*:
- Child disengages from stimuli in external world, freezes, and stares off into space as though out of contact with self, environment, and parent.
- Strange Situation: "One infant hunched her upper body and shoulders at hearing her mother's call, then broke into extravagant laugh-like screeches with an excited forward movement. Her braying laughter became a cry and distress-face without a new intake of breath as the infant hunched forward. Then suddenly she became silent, blank and dazed (dissociated)."

- *Dissociation/hypoarousal:*
- Parasympathetic conservation-withdrawal, immobility, reduced heart rate, involuntary autonomic disengagement and ultimately hypoarousal and metabolic collapse of the psychobiological bodily-self.
- “To foster survival by the risky posture of feigning death.” Passive defense to threat.
- Dissociation = “detachment from an unbearable situation”, “the escape when there is no escape”, “a last resort defensive strategy.”
- Dissociative defense: vagal tone, regulated by the dorsal vagal medulla, increases dramatically, lowering blood pressure and heart rate.



- Hesse and Main (1999): disorganization and disorientation of type “D” attachment phenotypically resembles dissociative states.
- Strange Situation: One infant “became for a moment excessively still, staring into space as though completely out of contact with self, environment and parent.”
- Another showed “a dazed facial appearance ...accompanied by a stilling of all body movement, and sometimes a *freezing* of limbs which had been in motion.”
- Another “fell face-down on the floor in a depressed posture to separation, stilling all body movements.”

- Mother’s face is the most potent visual stimulus in the child’s world
- Direct gaze can mediate not only loving but powerful aggressive messages. During the trauma, the infant is presented with an aggressive expression on the mother’s face.
- Hesse & Main (2006): “In non-play contexts, stiff-legged ‘stalking’ of infant on all fours in a hunting posture; exposure of canine tooth accompanied by hissing; deep growls directed at infant.”

- In traumatic episodes, maternal expression of fear-terror is also displayed. Mother withdraws from infant as though the infant were the source of the alarm
- Dissociated, trancelike, and fearful behavior is observed in parents of type “D” infants.
- Hesse & Main (2006) observe when mother enters into dissociative state fear-alarm triggered in infant. Caregiver’s entrance into dissociative state expressed as, “parent suddenly completely ‘freezes’ with eyes unmoving, half-lidded, despite nearby movement; parent addresses infant in an ‘altered’ tone with simultaneous voicing and devoicing.”

- “Here the parent appears to have become completely unresponsive to, or aware of, the external surround, including the physical and verbal behavior of their infant...We observed one mother who remained seated in an immobilized and uncomfortable position with her hand in the air, blankly staring into space for 50 sec.”
- Abrams, Rifkin, & Hesse (2006) describe dissociative behavior in a parent of a disorganized infant, who “froze all movements with a fixed gaze for 45s while the infant very actively attempted to attract the parent’s attention.

- Relational trauma - *Neglect*
- Widom et al. (*Arch. Gen. Psychiatry*, 2007):
“Given that neglect represents almost two thirds of the reported and substantiated cases of child maltreatment in the United States, more attention needs to be paid to these children...Onset of depression began in childhood for many of these children.”
- “Neglected children are at increased risk for depression...These results underscore the need to detect and treat the long term psychological sequelae of childhood neglect.”

- Tronick still-face, experimental paradigm of traumatic abuse, specifically, neglect (regulatory loss = episodes of abandonment)
- Relational stressor = lack of vocalization and suspension of facial expression and gesture while mother maintains eye contact.
- Figure - infant shows *bodily collapse*, loses postural control, gaze averts, sad facial expression, self-comforts with hands in mouth, *withdrawal*.



- Infant confusion and fearfulness in break in connection; “this is threatening.” State of consciousness dissipates (dissociation).
- Chronic breaks of connections lead to an “extremely pathological state” equated with Spitz hospitalism and Roumanian orphans.
- Defensive strategy of massive disengagement reflects a state of very early-forming yet already chronic pathological dissociation associated with loss of ventral vagal and dominance of dorsal vagal parasympathetic states.
- No interactive repair out of state = no strategy for coming out of dissociative withdrawal



- Montirosso, Cozzi, Tronick, & Borgatti, *Infant Behavior and Development*, 2012
- Thirty full-term 6–12 month-old infants were videotaped during the Face-to-Face Still-Face paradigm.
- During the Still-Face, self-directed regulatory gestures were predominantly performed with the left side of the body during the stressful condition.
- Left-sided infant other-directed gestures and left-sided maternal gestures were associated with each other.
- These results are suggestive of a brain asymmetry, but an asymmetry related to emotional engagement and stress regulation

- “[I]n light of the essential role of the right hemisphere in the human stress response (Schore, 2005) it seems plausible that infants cope with the emotional distress caused by an unresponsive mother and other forms of stress using self-regulatory behaviors associated with a greater activation of the right hemisphere.”
- “This possibility is consistent with the Schore’s (2005) hypotheses of hemispheric right-sided activation of emotions and their regulation during infant–mother interactions and his argument that the left side of the brain is less developed than the right side making it less likely to generate differential gestural effects.”

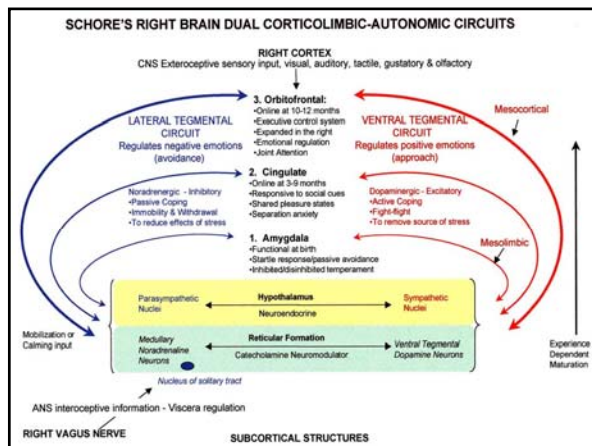
- Milne et al. (*Infant Behavior and Development*, 2009): Citing my right brain model, they conclude, “A withdrawal response in infancy is problematic behavior...not because it leads to later withdrawal per se, but because of the compounding effects on development of not being present in the interpersonal space - the space upon which much of infant development depends.”
- Withdrawal behaviour is also a key symptom of infant depression (Spitz, 1946).

- Guedeney et al. (*European Psychiatry*, 2008): “Sustained withdrawal behavior may be viewed as a chronic diminution of the attachment system, which is gradually generalized into a diminished engagement and lowered reactivity to the environment as a whole.”
- “Withdrawal behaviour is also a feature of most attachment disorders, particularly disorganized attachment.”
- Withdrawn social behavior at 2 months akin to learned helplessness.

- Dissociation is always associated with maternal preoedipal right brain attachment dynamics (repression-oedipal)
- Draijer & Langeland (*Amer. J. Psychiatry*, 1999): severe early maternal dysfunction is associated with level of dissociation in psychiatric patients
- Roelofs et al. (*Amer. J. Psychiatry*, 2002): physical abuse and parental dysfunction by the mother - not the father - is associated with somatoform dissociative experience

- In heightened affective moments of relational trauma infant matching rhythmic structures of mother’s dysregulated states; synchronization of right corticolimbic brain regions in critical period of growth
- Primary mechanism for real time intergenerational transmission of trauma *and* dissociative defense.
- Watt (2003): “If children grow up with dominant experiences of separation, distress, fear and rage, then they will go down a bad pathogenic developmental pathway, and it’s not just a bad psychological pathway but a bad neurological pathway.”

- Adamec (2003): “neuroplasticity in right hemispheric limbic circuitry in mediating long-lasting changes in negative affect following brief but severe stress.”
- Schore (2003): “psychological” factors “prune” or “sculpt” limbic neural networks in postnatal brain
- Severe attachment trauma may leave behind a permanent physiological reactivity in limbic areas of the right brain, thereby inhibiting its capacity to cope with future stressors.
- Early relational trauma interferes with critical period organization of right brain. Trauma-induced excessive pruning of right cortical-subcortical circuits in etiology of later disorders of aggression dysregulation.

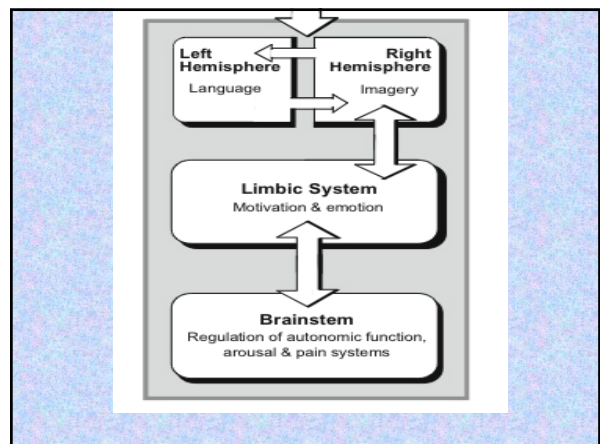


- Gaensbauer (2002): “Preverbal children even in the first year of life, can establish and maintain some form of internal representation of a traumatic event over significant periods of time.”
- Ito et al. (1993). “Early childhood abuse may alter the course of limbic system maturation, producing neurobiological alterations, and these alterations may provide the biological substrate for a panoply of psychiatric consequences, including affective instability, limited stress tolerance, dissociative disturbances and memory impairment.”
- Characterological use of pathological dissociation:

- Mollon (1996): “If childhood trauma or abuse is repeated, and if the abuser is a caregiver, so that the child has *nowhere to run and no one to turn to*, then internal escape is resorted to – the child learns to dissociate more easily and in a more organized way.”
- Allen & Coyne (1995): “Although initially they may have used dissociation to cope with traumatic events, they subsequently dissociate to defend against a broad range of daily stressors, including their own posttraumatic symptoms, pervasively undermining the continuity of their experience.”

- Personalities with pathological dissociation are also cut off from others
- Leavitt (*J. Clinical Psychology*, 2001): individuals who extensively dissociate “may become socially dysfunctional by virtue of the fact that large chunks of personal situations and social experiences fail to be noticed and therefore can not be used to orient to or meaningfully interact with broad aspects of experience that are essential to normal social intercourse.”
- Schore (*Ann. New York Academy of Sciences*, 2009): these personalities unconsciously passively disengage and shut down affects in intimate contexts

- Dissociation: detachment from unbearable situation, last resort defensive strategy.
- Bottom-line survival defense against arousal dysregulation of overwhelming affective states. Intense negative affects associated with emotional pain blocked from consciousness.
- Inability of right brain cortical-subcortical system to recognize and co-process (integrate) external stimuli (exteroceptive information coming from environment) and internal stimuli (interoceptive information from body, the corporeal self).



- Kalsched (2005) describes operations of defensive dissociative processes used by the child during traumatic experience by which “Affect in the body is severed from its corresponding images in the mind and thereby an unbearably painful meaning is obliterated.”
- Endpoint of chronically experiencing catastrophic states of relational trauma in early life is a progressive impairment of the ability to adjust, take defensive action, or act on one’s own behalf, and a *blocking of the capacity to register affect and pain*, all critical to survival.

- Clinical research shows pathological dissociation, a primitive defense against overwhelming affects associated with early abuse/neglect, a key feature in:
- Reactive attachment disorder of infants
- Pediatric maltreatment disorder
- Dissociative identity disorder
- Somatoform disorders
- Eating disorders
- Substance abuse and alcoholism
- Psychotic disorders
- Posttraumatic stress disorder
- Borderline personality

- *Escalation of Psychiatric Disorders in U.S. children*
- Schore (2012): on daily basis media presents images indicating U.S. culture is experiencing intense stress.
- This stress over last decade, exacerbated by 9-11, negatively affected not only political and economic factors but quality of life, emotional well being of members of culture, including our children.
- Describe significant alterations in current U.S. culture, review a large body of data indicating a disturbing escalation of psychiatric disorders in U.S. children, and offer some thoughts about early intervention and prevention.

- Adaptive functions of efficient lateralized right brain evolve only in optimal relational environment.
- Variations in maternal care impart either a resilience or a risk for psychopathology. Developmental neuroscience now concludes all children not “resilient” but “malleable,” for better or worse (Leckman & March, 2011).
- If primary caregiver chronically dysregulates child’s arousal and affective states during early critical periods, this inhibits experience-dependent maturation of right brain and alters its trajectory in later stages.

- Each year an estimated 3.7 million children are evaluated for childhood maltreatment. (2009).
- Roth & Sweatt (2011): “There is wide acceptance of the developmental principle that severe alterations of the social environment such as the maltreatment of abuse and neglect imprint a brain developmental trajectory that is later susceptible to post-traumatic stress disorder, borderline personality disorder, schizophrenia, and major depression.”
- All associated with history of right brain attachment trauma; maternal-infant dysregulation abuse / neglect.

- Leckman & March (2011): “A scientific consensus is emerging that the origins of adult disease are often found among developmental and biological disruptions occurring during the early years of life.”
- Shonkoff, Boyce, & McEwen (*Science*, 2009): “toxic” childhood trauma “disrupts brain architecture, affects other organ systems, and leads to stress-management systems that establish relatively lower thresholds for responsiveness that persist throughout life, thereby increasing the risk of stress-related disease and cognitive impairment well into the adult years.”

- Insel and Fenton (*Arch. Gen. Psychiatry*, 2005): "Most mental illnesses . . . begin far earlier in life than was previously believed."
- In 2001 28.3% of adolescents reported episodes of serious depression in previous year.
- In 2002 at least 1 of every 4 adolescents in U.S. found to be at risk of not achieving productive adulthood.
- *Hardwired to Connect* (2003), report produced by the Commission on Children at Risk (of which I was a member) cites sociological psychiatric research that documents 21% of U.S. children ages 9 to 17 have a diagnosable mental or addictive disorder.

- "The implications of this research are clear and profound: The declining mental health of many U.S. children is a pressing issue that plays a substantial role in many of today's emerging physical problems. Psychosomatic and psychosocial disorders have pronounced and long-lasting effects on both children's lives and society."
- Kessler et al. (*Arch. Gen. Psychiatry*, 2005): National Comorbidity Survey Replication study reported that about half of all Americans will meet criteria for a DSM-IV disorder in their life, with first onset usually in childhood or adolescence.

- Narvaez et al. (2013): a decade ago, one of four teenagers in the US was at risk for a poor life outcome and in recent analyses such trends have not improved.
- National prevalence of young children (under 5) with psychosocial problems has been increasing to between 10% and 21%.
- Rates of young children who display aggressive behavior, delinquency, or hyperactivity are on the increase, at times estimated to be as high as 25%.
- Dropout rate of adolescents who fail to complete high school is now 16%. Authors conclude early trauma experiences may account for this "staggering" rate.

- *Implications for Early Intervention and Prevention*
- Developmental neuroscience emphasizes important need for clinical assessment and early intervention, especially for high risk chronically misattuned mother-infant dyads.
- Knickmeyer et al. (*J. Neuroscience*, 2008): "The large increase in total brain volume in the first year of life suggests that this is a critical period in which disruption of developmental processes, as the result of innate genetic abnormalities or as a consequence of environmental insults, may have long-lasting or permanent effects on brain structure and function."

- "Although the first year of life may be a period of developmental vulnerability, it may also be a period in which therapeutic interventions would have the greatest positive affect."
- Atzil et al. (2011): "Understanding the motivational basis of healthy and at-risk parenting may open new theoretical vistas and clinical opportunities and may lead to the construction of more specific interventions that can target disruptions to maternal-infant bonding at an earlier stage and in a more accurate manner."
- Early intervention in infancy, period of not only vulnerability but also maximal brain plasticity, will have important practical effects at later points of life span.

- Early assessment of infant-mother right brains
- Schore (2012, chapter 11), "Using regulation theory to guide assessments of mother-infant attachment relationships:" assessments must evaluate right brains of both members of an attachment *relationship*.
- Evolving right lateralized *visual-facial, auditory-prosodic, and tactile-gestural communications* of "the human social brain" can be assessed over the pre- and postnatal stages of infancy to appraise the ongoing status of emotional and social development.
- Assess lateralization of brain, degree to which "rightward asymmetry emerges during the first few months of postnatal life" (Allman et al., 2011).

- UNICEF report, "Child Well-Being in Rich Countries, 2013: (US 26/29)
- "It is perhaps no longer necessary to argue the case for the importance of the early years. Advances in both neuroscience and social science have repeatedly confirmed that it is at this time that genetic potential interacts in infinitely complex ways with early experience to construct the neural pathways and connections that quickly become both the foundations and the scaffolding for all later development."
- "It is therefore at this time that the child's wellbeing, health and development are most in need of society's concern and protection."

- Infant Mental Field needs to intensify focus on optimal right brain development, expand early prevention.
- US policy on amount of maternal and paternal leave needs to rise to level of other industrialized societies.
- Training of day care workers, infant mental health and child therapists need to be upgraded/expanded.
- Legal profession needs interpersonal neurobiological model of attachment to make informed decisions, especially about infants and their families.
- Schore (2012, chapter 12, "Family law and the neuroscience of attachment: An interview in *Family Court Review*." Plenary address, Association of Family and Conciliation Courts, Chicago, June 2012.



- Schore, 2001, Introduction to a special issue of *Infant Mental Health Journal*, "Contributions from the Decade of the Brain to Infant Mental Health":
- "The earliest stages of humanhood are critical because they contain within them the representation of our possible futures—they model the potential developmental extension of our individual and collective social identities. . . . When and where shall we place our current resources so as to optimize the future of human societies? . . . How much should we value the very beginnings of human life, in tangible social program dollars?"
- Can we afford to put this off for another decade?