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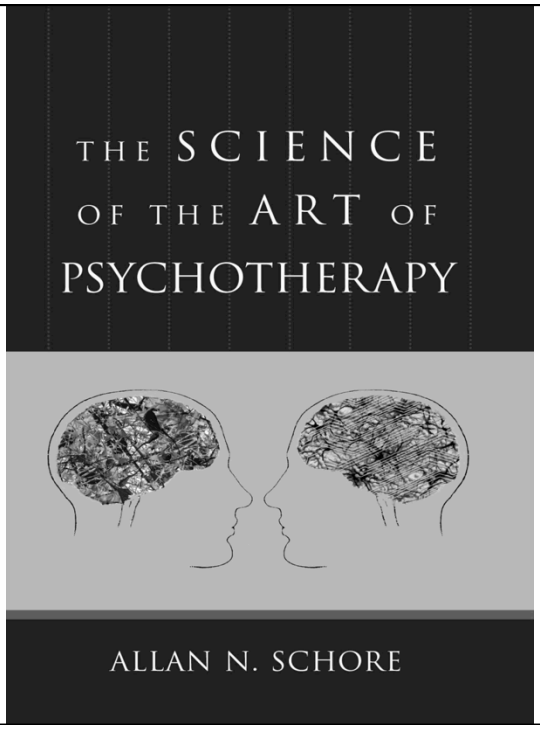
PERSPECTIVES FROM REGULATION THEORY: EARLY BRAIN DEVELOPMENT AND THE INCREASED PREVALENCE OF SEVERE MENTAL DISORDERS IN U.S. YOUTH

ALLAN N. SCHORE
allanschore.com

UCLA DAVID GEFFEN SCHOOL OF MEDICINE

- On daily basis media presents us with images indicating U.S. *culture* is experiencing intense stress.
- This stress over last decade, exacerbated by 9-11, has negatively affected not only political and economic factors but our quality of life, emotional well being of members of the culture, including our children.
- This significant *cultural stressor* also impacting mental health field, both practitioners and patients.
- In *The Science of the Art of Psychotherapy* (Schore, 2012) I utilize perspective of regulation theory to understand interpersonal neurobiological mechanisms that are transmitting cultural stressors into increased levels of psychiatric disorders and physical diseases, especially in our children/infants.



- In this talk, instead of focusing on moment-to-moment dynamics of a single psychotherapy case, I offer a macroscopic broader overview of mental health, at level of culture, over last few decades.
- In introduction to *The Science of the Art of Psychotherapy*, "Toward a new paradigm of psychotherapy" cite recent psychiatric epidemiological study of 10,000 adolescents that documents a "high prevalence" of mental disorders in youth.
- "Approximately one in every four to five youths in the U.S. meets the criteria for a mental disorders with *severe impairment* across their lifetime" (Merikangas et al., *J. Amer. Acad. Child & Adolescent Psychiatry,* 2010)

- Schore (2012): sections on Affect Regulation Therapy (including chapter on therapeutic presence during an enactment) and Clinical Neuropsychoanalysis, and on Developmental Affective Neuroscience and Developmental Neuropsychiatry.
- First chapter, Schore & Schore, "Modern attachment theory: The central role of affect regulation in development and treatment."
- "We argue that individual development arises out of the relationship between the brain, mind, and body of both infant and caregiver held within a *culture* and environment that either supports, inhibits, or even threatens it."

- Schore (2012): Chapter 10, "Bowlby's environment of evolutionary adaptedness: Current decrement in U.S. Culture."
- Briefer form of chapter will soon appear in upcoming volume, *Evolution, Early Experience and Human Development: From Research to Practice and Policy*.
- Co-editors Darcia Narvaez, Jaak Panksepp, Tracy Gleason and I offer a large body of data from a number of disciplines that disturbingly indicate "American culture may be deviating increasingly from traditional social practices that emerged in our ancestral "environment of evolutionary adaptedness."

- This term was devised by John Bowlby, in his first of three now classic volumes, *Attachment*. In this seminal statement of the theory, Bowlby states, "In the case of biological systems, structure takes a form that is determined by the kind of environment in which the system has been in fact operating during its evolution. . . . This environment I propose to term the system's 'environment of adaptedness.'
- Only within its environment of adaptedness can it be expected that a system will work efficiently."

- In chapter 4, "Man's Environment of Evolutionary Adaptedness," he asserts,
- "When we come to consider with what *instinctive* behaviour—or, more properly, with what behavioural systems mediating instinctive behaviour—humans may be endowed, a first task to consider is the nature of the environment within which they are adapted to operate.
- The only relevant criterion by which to consider the natural adaptedness of any particular part of present-day man's behavioural equipment is the degree to which and the way in which it might contribute to population *survival* in man's primeval environment."

- Although Bowlby struggled with this concept (R. Bowlby, personal communication), he postulated that "man's environment of evolutionary adaptedness" (EEA) is a version of a human's "ordinary expectable environment."
- But this concept is more than just a psychological construct—it also describes events at the biological level. "Not a single feature of a species' morphology, physiology, and behavior can be understood or even discussed intelligently except in relation to that species' environment of evolutionary adaptedness."

- Chapter 11, "The Child's Tie to Its Mother: Attachment Behaviour," Bowlby proposes,
- "The child's tie to his mother is a product of a number of behavioural systems that have proximity to mother as a predictable outcome. . .The behavioural systems themselves are believed to develop within the infant as a result of his interaction with his *environment of evolutionary adaptedness*, and especially of his interaction with the principal figure in that environment, namely the mother."
- "Behavioral systems responsible for maternal behavior in a species will work within certain ranges of social and physical environment and not outside them."

- In modern terms Bowlby's "morphology and physiology" can be identified as neuro-physiological and neurobiological systems of developing brain that are evolving during period of attachment, infancy.
- Early brain maturation shaped by social environment, in forms of parental caregivers and specific cultural environment in which they and infant exist.
- "Culture" not an abstraction; societal CS and UCS implicit forces that impact mother-infant dyad shape early brain and thereby personality development.

- Bowlby (1969) gives some clues as to specifically which developing brain systems influenced by EEA: those involved in "attachment systems mediating *instinctive* behaviour" that contribute to "population *survival* in man's primeval environment."
- Damasio (1994) argues that emotions are "a powerful manifestation of drives and instincts."
- Schore (1991-2012): attachment transactions shape connectivity of specifically early developing right brain, dominant for control of vital functions supporting *survival*, *instinctive* behavior, processing emotions, and *adaptively* coping with stress.

- In foreword of reissue of Bowlby's *Attachment* volume (2000) I discussed his speculation that EEA influences development of a brain system that controls attachment and regulates stress:
- Bowlby (1969) described 'a biological control system' that is centrally involved in instinctive behavior. This control system is structured as a hierarchical mode of organization. Its functions are associated with the organism's 'state of arousal' that results from the critical operations of the reticular system and with 'the appraisal of organismic states and situations of the midbrain nuclei and limbic system.'"

- Bowlby (1969) even offered a speculation about its anatomical location—the prefrontal lobes. This control system, he said, is "*open in some degree to influence by the environment in which development occurs*." More specifically, it evolves in the infant's interaction with an "environment of adaptedness, and especially of his interaction with the principal figure in that environment, namely his mother."
- Bowlby further proposed that the "upgrading of control during individual development from simple to more sophisticated is no doubt in large part a result of the growth of the central nervous system."

- Schore (1991-2012): attachment control systems located in right brain cortical-subcortical axis that is hierarchically organized in the emotion processing limbic system: orbital (ventromedial) prefrontal cortex, anterior cingulate, insular cortex, and amygdala.
- Orbitofrontal-insula, anterior cingulate, and amygdala systems all interconnect with each other and with brain stem bioaminergic neuromodulatory that control arousal, and with neuroendocrine nuclei in the hypothalamus, "head ganglion" of ANS. Each inputs stress-regulating HPA and SAM axes.
- OFC = senior executive of right brain, highest level of control of attachment functions, including the capacity to *adaptively* cope with *environmental* stressors.

- Schore (2000, *Attachment & Human Development*): optimal co-created EEA is isomorphic to a growth-facilitating environment for experience-dependent maturation of a regulatory system in OFC.
- Bowlby's control system evolves in infant's interaction with mother = studies now show dendritic and synaptic maturation of amygdala, anterior cingulate, insula and OFC specifically influenced by *social* environment.
- Schore principle of interpersonal neurobiology: "The self-organization of the developing brain occurs in the context of another self, another brain."
- For rest of life span right, and not left, prefrontal regions are responsible for the adaptive regulation of affective states and stress (see Schore, 2012).

- With this introduction in mind, in following I will utilize perspective of interpersonal neurobiology and regulation theory to demonstrate that the cultural "environment of evolutionary adaptedness" facilitates or inhibits emergence of right-lateralized self-regulatory systems that mediate the capacity to adaptively cope with stress.
- Also describe later sequelae of significant alterations in the EEA 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.

- *Legacy of Optimal EEA: Adaptive Right Brain Survival Functions.*
- Schore (1991-2012): developmental neuroscience is exploring primacy of right brain structure-function relations over prenatal and postnatal stages of life.
- Leckman and March (*J. Child Psychol. Psychiatry*, 2011) describe "the *phenomenal progress* of the past three decades in the developmental neurosciences."
- "Over the past decade it has also 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*."
- "Early brain development" = accelerated in human brain growth spurt, last trimester to second year.
- Sieratzki & Woll (*Lancet*, 1996): "The role of the right hemisphere is crucial in relation to the most precious needs of mothers and infants."

- Howard & Reggia (*Brain and Cognition*, 2007): "Earlier maturation of the right hemisphere is supported by both anatomical and imaging evidence."
- Kasprian et al. (*Cerebral Cortex,* 2011): at 26 gestational weeks human fetal right superior temporal sulcus appears earlier and is deeper than the left. Conclude, "Our structural data further support the findings of functional neuroimaging studies indicating an earlier maturity of right hemispheric function."
- Lin et al. (*Cerebral Cortex*, 2012): newborns RH 7-10% higher blood flow and oxygen consumption than LH; "the right hemisphere develops earlier."

- 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."
- Subcortical right brain stem systems expressed in first year generate what Bowlby (1969) termed "attachment systems mediating instinctive behaviour."
- Important to emphasize that structural maturation of these brain systems is not just genetically encoded. Rather characterized as an epigenetically regulated mechanism that facilitates "experience-dependent maturation" of early developing right brain.

- Allman et al. (2011): number of von Economo (VEN) neurons in anterior cingulate and frontoinsular cortical areas low at birth, but increase significantly in first 8 months of infancy. These anterior cingulate and frontoinsular neurons perform essential regulatory functions, processing autonomic arousal and communication of social information. *"VEN abundance may be related to environmental influences."*
- VEN are much more abundant in right hemisphere, reflecting fact that *"rightward asymmetry emerges during the first few months of postnatal life."*
- Schore (2011): epigenetic factors impact lateralization of right brain evolutionary attachment systems.

- Miller (*Science*, "The seductive allure of behavioral epigenetics", 2010): "epigenetic mechanisms of gene regulation in the brain…alter the activity of genes without changing their DNA sequence."
- "Epigenetics can explain "how early life experiences can leave an indelible mark on the brain and influence both behavior and physical health in later life."
- "Epigenetics could turn out to be at the heart of some of the most vexing problems in society."
- Miller refers to "the importance of a loving mother."
- Champagne: "What's exciting to me is that the social world, which can be perceived as being this ethereal thing that may not have a biological basis, can affect these mechanisms." [EEA]

- Roth & Sweatt (*J. Child Psychology Psychiatry*, 2011): "Studies continue to show that epigenetic mechanisms, or the chemical markings of the DNA and the surrounding histone proteins that regulate gene activity in the CNS, are modified by experiences, particularly those occurring within the context of caregiving."
- Alluding to attachment mechanisms, these authors refer to "epigenetic programming by variations in maternal care," "epigenetic programming by mother-infant separation," and "epigenetic programming by caregiver maltreatment."

- 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): over 15 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.

- Kringelbach et al. (*PLoS One*, 2008): magneto-encephalographic research reveals that medial orbitofrontal cortex of both females *and* males rapidly and implicitly responds (130 milliseconds) to image of an infant's face. Conclude OFC expresses a specific and rapid signature for not just maternal but also "parental *instinct*."
- One laboratory reports a series of studies demonstrating paternal care affects synaptic development in anterior cingulate, orbitofrontal cortex, and in the somatosensory cortex of the left hemisphere (Pinkernelle, Abraham, Seidel, & Braun, 2009).

- Gordon et al. (2010): “Maternal oxytocin was related to the amount of affectionate parenting behaviors, including “motherese” vocalizations, the expression of positive affect, and affectionate touch, whereas paternal OT correlated with the degree of stimulatory parenting behaviors.”
- Grossmann (2002): though mother’s soothing is essential to child’s attachment security, father’s arousing play is thought to be critical for child’s competent exploration of the physical world.
- Juvenile rough-and-tumble play (Panksepp, 1998), has been shown to be critically impacted by father–child relationship and to depend upon OFC activity.

- Schore (2003): although mother essential to infant’s capacity for fear regulation, in the second year the father critically involved in male and female toddlers’ aggression regulation.
- Infant’s RH ends initial growth spurt in middle/end of second year, as LH begins its own. In later stages RH comes back into less intensive growth spurts, in which its essential functions attain even greater levels of complexity.
- In ensuing developmental periods, these attachment functions are expressed as implicit capacities for a number of essential adaptive emotion-related survival functions involving nonverbal affect communication and interactive stress regulation.

- Optimal EEA facilitates adaptive 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.”
- MacNeilage et al. (2009): “The left hemisphere of the vertebrate brain was originally specialized for the control of well-established patterns of behavior under ordinary and familiar circumstances. In contrast, the right hemisphere (is) the primary seat of emotional arousal, was at first specialized for detecting and responding to unexpected stimuli in the environment.”

- 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.”
- Perez-Cruz et al. (2009): “minor challenges” stimulate the left hemisphere whereas “severe stress” activates the right medial prefrontal cortex.
- Uddin (2006): describe “a special role of the right hemisphere in self-related cognition, own body perception, self-awareness and autobiographical memories.”

- *Later Sequelae of Significant Alterations in the EEA*
- Consonant with Bowlby's speculations, these adaptive functions of efficient lateralized right brain epigenetically evolve only in optimal early relational environment (EEA).
- Epigenetic programming influenced by 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.

- Severe alterations of EEA lead to *early appearing yet enduring* inefficient capacities for coping with interpersonal stressors, and a predisposition to later psychiatric disorders.
- Large number of studies demonstrate critical import of early brain development, and that alterations of brain development associated with less than optimal early maternal care, especially chronic "relational trauma" such as abuse and 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."

- Wei et al. (2010): “The organized stepwise progression of neurodevelopment allows changes that interfere with a specific earlier step earlier in life to modify functional output later in life.”
- 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-traumautic stress disorder, borderline personality disorder, schizophrenia, and major depression.”
- Each year an estimated 3.7 million children are evaluated for childhood maltreatment (U.S. Department of Health and Human Services, 2009).

- Very recent research now studying effects of not just maltreatment (abuse/neglect) but even lower levels of relational stress on brain development.
- Champagne (in press): “The emergence of developmental trajectories which lead to individual differences can be linked to early life experiences . . . the quality of the environment experienced during perinatal development is shaped primarily by the interactions between mothers and offspring . . . *even natural variations in the quality or quantity of maternal care can have a long-term impact on offspring brain and behavior*.”

- Cultural variations in parenting generate not only disorganized but organized secures and insecures.
- Barrett & Fleming (*J. Child Psychol. Psychiatry*, 2011): "*All mothers are not created equal*."
- "The interaction between a mother and her infant can be like a dance. There are routines, standards and missteps, there is give and take, there is unparalleled intimacy, there are often vast differences in skill level and motivation, there is learning…This dance can be beautiful, it can be tender, it can be awkward, it can be difficult. And sometimes it just does not occur."
- Variations in EEA differentially impact brain development, for better or worse.

- Recall Bowlby: maternal behavioral systems "will work within certain ranges of social and physical environment and not outside them."
- Suter et al. (*Stress*, 2007): stress is a critical factor that affects social interactions, especially mother-child interaction. These researchers report during stressful life episodes mothers were less sensitive, more irritable, critical and punitive, and showed less warmth and flexibility in interactions with their children.
- Overall, stress seems to be a factor that has the power to disrupt parenting practices seriously and results in a lower quality of the mother-child interaction.
- Applies to cultural stressors of EEA.

- In light of research on impact of *fathers* and lack of early paternal care on brain development…
- New York Times, February 18, 2012, "Unwed mothers now a majority before age 30."
- "The recent rise in single motherhood has set off few alarms, unlike in past eras."
- Academic literature indicates children born to married couples, on average "experience better education, social, cognitive and behavioral outcomes."
- "Researchers have consistently found that children born outside marriage face elevated risks of falling into poverty, failing in school or suffering emotional and behavioral problems."

- Optimal EEA may include opportunities for developing brain to be exposed to maternal *and* paternal brains.
- Although most research focuses upon detrimental effects of deficits of maternal care, a small but growing number of studies show that lack of paternal care in infancy is significantly associated with "delayed and partly suppressed development of orbitofrontal circuits" (Helmeke et al., 2009).
- Current agreement that early attachment stress is associated with alterations in orbital frontolimbic cortex of emotion processing right brain, and that individuals who experience early adversity are at a heightened risk for a wide range of psychopathologies.

- Bowlby (1969): “Only within its environment of adaptedness can it be expected that a system will work efficiently.”
- Schore (1994): deficits of OFC attachment control system lie at core of a number of psychiatric disorders.
- Over last decade altered morphological and functional development of the orbitofrontal cortex, the control system of attachment has been documented in a wide variety of early forming neurodevelopmental disorders:
- Schizophrenia; autism; affective psychosis; bipolar disorder; borderline personality disorder; psychopathic personality disorder, aggression, and violence; alcohol and drug addiction; PTSD; dissociative identity disorder; panic disorder; and depression.

- Bowlby’s concept of the EEA describes the psychobiological space that a particular culture, at any point of its history, creates to scaffold the emotional attachment bonding between mothers and infants, the evolutionary mechanism of attachment.
- This relational space operates at implicit levels, and it can be either expansive and facilitating or constrictive and inhibiting. In terms of modern attachment theory, a stressful decrement in the EEA in a particular culture would be expressed as a decrease in secure and an increase in insecure attachment typologies.

- Such a disturbing trend now exists.
- Bakermans-Kranenburg & van IJzendoorn (2009): analysis of 10,000 Adult Attachment Interviews of North American *non-clinical* mothers over last two decades reports only 58% secure attachments, with 23% insecure-dismissive, 19% insecure-preoccupied. In addition 18% unresolved loss or other traumas.
- Conclude, "nonclinical populations might be less 'healthy' than one would expect." [EEA decrement]
- Regulation theory interprets a reduction in secure and expansion of insecure attachments as reflecting non-optimal alterations in right brain maturation and limbic-autonomic functioning and reduced efficiency in implicit stress and affect regulation.

- Atztil et al. (*Neuropsychopharmacology*, 2011):
- "Early disruptions and *slight deviations* from normative functioning may result in non optimal patterns of maternal care that may bear negative consequences for the infant's future mental health.
- Indeed, recent studies have shown that up to 29% of mothers and infants suffer from some sort of disruptions to early bonding, due to marked increases in cases of maternal post-partum depression and anxiety, as well as in premature birth.
- Such conditions pose risk for infant's adaptation and well-being and may lead to a variety of epigenetic, behavioral, and mental processes that would compromise the infant's *future well-being, health, and adaptation*."

- Gluckman et al. *N. Eng. J. Medicine,* 2008, "Effect of in utero and early-life conditions on adult health and disease."
- Karr-Morse and Wiley (2012), *Scared Sick: The Role of Childhood Trauma in Adult Disease*.
- "Chronic fear experienced in infancy and early childhood lies at the root of numerous diseases as well as emotional and behavioral pathologies in adults."
- Lanius et al.,*The Impact of Early Life Trauma on Health and Disease: The Hidden Epidemic*.
- *"Hidden epidemic"* = negative alterations in EEA.

- *Thoughts on the Current Decrement of the EEA in U.S. Culture*
- Schore (1994): "The conclusions of this volume echo and amplify a recent 'worrisome' concern about the experimentally demonstrated increased risk of insecure attachments if day care, as typically provided in present American society, begins in the 1st year and is extensive in duration."
- "In a series of studies Belsky is finding that extensive nonmaternal (and nonparental) care in this 1st year is a risk factor in the increased development of insecure patterns of attachment, and that insecure-avoidant infants with such care express more negative affect and engage in less object play in reunion episodes with the mother."

- “Even infants in middle- and upper-middle-class families that use in-home baby-sitters for more than 20 hours per week display higher rates of avoidance on reunion with the mother and are more likely to be classified as showing an insecure attachment.”
- Increase of insecure avoidant = rise of narcissistic personalities in U.S.?
- Dmitrieva, Steinberg, and Belsky (2007): “Evidence indicates clearly that care initiated early in life and experienced for many hours, especially in child-care centers, is associated with somewhat elevated levels of externalizing behavior problems (e.g., aggression and disobedience), and that these effects are not simply a function of low-quality care.”

- Sajaniemi et al. (2011): “The number of physical and psychological stressors in the lives of children has multiplied in recent years as the number of children with various kinds of behavioural and developmental difficulties has increased.”
- Besides other stressful childhood events such as family turmoil, disruptions or adverse social circumstances, day care may also be challenging for some children.”
- “The link between elevated cortisol levels and day care has been shown in several studies including ours.”

- These findings should be considered alarming since developmental difficulties may be, at least partly, the consequence of chronically-induced stress which is known to have detrimental effects on brain activity, emotional well-being and development."
- Citing studies showing low-quality day care has a detrimental influence on children's cortisol levels, authors assert that "stressful environment" of day care is "known to have jeopardized children's development."
- But this study is day care at 5 years. What about day care in the first year, during the brain growth spurt and critical periods of vulnerability?

- Two out of three American children under 5 years old now receive some form of nonparental child care; in most cases, this care begins during first year of life.
- Significant changes over last 20 years: 1960s, 17% of women returned to work by 12 months after delivery, compared with 60% in early 1990s (52% by 6 months).
- In 1990s, of mothers who returned to work within 12 months, more than half did so by 3 months, and 75% by 6 months.
- In 2004, 52.9% of mothers with children under 1 year old were in the workforce.

- Despite recommendation of at least 18 weeks of maternity leave by International Labor Organization (2000), U.S. lags seriously behind other industrialized countries in which maternal and paternal leave routinely extend into late months of infant's first year.
- Due to this shortsighted policy, 6 weeks after delivery is the particular time that most mothers in US reenter the job market and put their infants into day care (much of which is substandard).
- During this identical perinatal period, cerebral and corticolimbic areas of infant's brain are just beginning to myelinate and to initiate functions such as more complex tactile, visual and auditory sensoriaffective processing, which are critical to attachment.

- Recall volume of subcortical areas increases significantly after birth (130% in the first year).
- Although subcortical amygdala begins its growth spurt in prenatal period, it continues its experience-dependent maturation in this perinatal period, thereby becoming involved in postnatal attachment functions.
- Markowitsch (*Cortex,* 2011): "the amygdala may be sensitive to context, including cultural influences."
- Schore (2003): amygdala, especially central and medial nuclei, insula, and paraventricular nucleus of hypothalamus associated with sympathetic branch of ANS, in a critical period of maturation that onsets in last trimester of pregnancy and continues through first 8 weeks of human life.

- At 8 weeks anterior cingulate cortex begins its experience-dependent maturation. This control system that regulates amygdala and HPA enters into a critical period that requires body-to-body and face-to-face psychobiological transactions.
- In a suboptimal relational context of day care infant lacks one-to-one interactive regulation. Developing anterior cingulate may not acquire robustness needed to down-regulate right amygdala, major fear center of brain. This may precede a weak connection to the OFC, highest emotional regulation center in brain.
- No research has been done on effects of early entry (6 weeks) into day care on brain development, especially on subcortical brain development.

- Developmental neurobiological, neuropsychological studies and neuroimaging studies (NIRS) of infants before, during, and after early day care now essential.
- However, basic research on impact of "early life stress" on infant's brain now available. This research studies effects of daily brief maternal separation on early brain development (analog of day care).
- Wei et al. (*Hormones and Human Behavior*), 2010): early life stress in perinatal period in form of "brief daily separations" induces high and prolonged levels of stress and glucocorticoids in infant's developing brain.
- Most surprisingly, "this early life stress was associated with anxiety-like behavior in adulthood, *despite increased maternal care after the separations*."

- Brief daily separations from the mother reduced amount of RNA and DNA in developing subcortical hippocampus. Conclude, "*exposure to stress during the postnatal period overrides the ability of high levels of postnatal maternal care* to program anxiety-like behavior by inhibiting the normal growth spurt that characterizes this period."
- These data consonant with my model of stress-induced excessive parcellation of developing brain circuits, wherein dysregulated levels of relational stress induce oxidative damage to DNA during regional growth spurts, thereby increasing "apoptotic" "programmed cell death" in rapidly developing areas of infant's brain.

- Infant entry into early day care and maternal return to the workforce also interferes with 6-month policy of breastfeeding advocated American Academy of Pediatrics. Maternal milk rich source of unsaturated fatty acids, essential to early brain development.
- Oddy et al. (2010): shorter duration of breastfeeding (less than 6 months) may be a predictor of adverse mental health outcomes throughout developmental trajectory of childhood and early adolescence.
- Calnen (2007): "It is biologically necessary that mothers be with their infants, especially during the first few months postpartum. This is not likely to become a reality until working families are granted a sufficiently long, and paid, maternity leave as a matter of national policy"

- Developmental neuroscience indicates that right brain is epigenetically shaped, for better or worse, in not only perinatal and postnatal, but also prenatal periods.
- Paul MacLean (1996): "For the mother the experience during pregnancy of the formless life within, could become after birth a sense of exteriorization and extension of the self that physiologically derives to a large extent from the right hemisphere."
- Thomson, *J. Prenatal and Perinatal Psychology and Health*, 2004, "The impact of trauma on the embryo and fetus: An application of the diathesis-stress and neurovulnerability-neurotoxicity model.
- Research shows emotional stress communicated from mother to fetus, impacting fetal brain.

- Schore (1994): original embryological concept of critical periods connoted bounded times in development when a rapidly growing tissue is most vulnerable to alterations by external factors.
- Now consensus about existence of critical periods when developing brain has heightened sensitivity to environmental experiences.
- Neuroscience authors now describing critical "role of early life experiences in modifying gene expressions via epigenetic mechanisms," and "the complex influence of environmental factors on gene expression, which may be *time-dependent (taking place during certain windows of vulnerability*)" (Markowitsch, 2011).

- Schore (2012): last two decades American culture has been providing a growth-inhibiting EEA for mother–infant attachment bond formation during "*windows of vulnerability*" of first 2 years of life.
- These severe cultural alterations generating developmental risks, including increased numbers of insecure attachments and negative impacts on cognitive and especially social-emotional abilities.
- Decrement in EEA is expressed in more than psychological impairments, but in less than optimal epigenetic influences on biological maturation of early developing "emotional" right brain.
- Schore (1991-2012): early dysregulation of right brain = psychopathogenesis of psychiatric disorders.

- *Data Indicating Escalation of Psychiatric Disorders in U.S. children*
- 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.

- Commission of 33 children's doctors, research scientists, and mental health professionals concluded:
- "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.

- Earlier cited an upcoming volume in which my co-editors, Darcia Narvaez, Jaak Panksepp, Tracy Gleason and I report that 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.

- American Academy of Child & Adolescent Psychiatry now describing a "crisis" in children's mental health needs: one in every five children has a diagnosable psychiatric disorder, and one in every ten suffers from mental illness severe enough to impair everyday living.
- Shonkoff, Boyce, & McEwen (*Science,* 2009): childhood trauma is "toxic" because ''it 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.''

- Clinical research now documents dramatic increases in childhood psychopathology, specifically, bipolar disorder, Attention Deficit Hyperactivity Disorder, and autism. Each of these conditions show right brain deficits (see Schore, 2010).
- Also data on childhood obesity epidemic. Very recent research views insecure attachment as a risk factor for obesity in children (Anderson & Whitaker, 2011).
- Echoing these trends, in 2010 SAMHSA reported 1.9 million youths (8% of population 12-17) who had major depressive episode during the past year. 2.9 million youths 12 to 17 (12%) received treatment for problems with emotions or behavior in a mental health setting.

- *New York Times* op-ed Aug. 22, 2011, The kids are not all right (Joel Bakan):
- "There is reason to believe that childhood itself is now in crisis."
- "The 20th century also witnessed another momentous shift, one that would ultimately threaten the welfare of children: the rise of the for-profit corporation."
- "Deregulation, privatization, weak enforcement of existing regulations have eroded our ability, as a society, to protect children."
- "We medicate increasing numbers of children with potentially harmful psychotropic drugs, a trend fueled in part by questionable and under-regulated pharmaceutical industry practices."

- *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. (*Neuropsychopharmacology*, 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 within EEA, period of not only vulnerability but also maximal brain plasticity, will have important practical effects at later points of life span.

- Environment of Evolutionary Adapatedness and assessments of infant mental health:
- Schore (*Infant Mental Health J.*, 2001): “*Adaptive* infant mental health can be fundamentally defined as the earliest expression of efficient and resilient strategies for coping with novelty and stress, and *maladaptive* infant mental health as a deficit in these same coping mechanisms.”
- Schwartz et al. (*Molecular Psychiatry*, 2011): report a phenotype of early infancy identified at 4 months predicts individual differences in reactivity of the right amygdala to faces *almost two decades later in adults!*
- Infant mental health precursor of adult mental health.

- Focus of assessment of EEA and relational trauma
- Lanius et al. (2011), Schore Synopsis of Section, The Impact of Early Life Trauma: Psychobiological Sequelae in Children:
- "Recent models of early life trauma are altering their focus from deficits in later maturing conscious, verbal, explicit and voluntary behavior, to impairments of early maturing nonconscious, nonverbal, implicit and automatic adaptive social emotional functions.
- Developmental neuroscience is now moving from studies of later maturing left brain conscious verbal cognitive processes into the early preverbal development of adaptive emotion processing right brain systems in pre- and postnatal periods."

- Schore & Newton, 2012, chapter 11, "Using regulation theory to guide assessments of mother-infant attachment relationships:" assessments of infant mental health in first year 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).

- Mento et al. (*European J. Neuroscience,* 2010): "The right hemisphere would sustain the functions necessary for the *survival* of the species, such as visuospatial or emotional processes. Consequently the earlier and faster development of the neural substrates underlying these functions is needed to prevent possible impairment during infancy and childhood"
- Shonkoff et al.(*Science,* 2009, "Protecting brains, not simply stimulating minds"): "Advances in neuroscience suggest that interventions that enhance mental health, executive function skills, and self-regulation capacities of vulnerable mothers, beginning as early as pregnancy, suggest promising strategies to protect the developing brains of their children."

- 2007 UNICEF study of child well-being in 21 rich countries shows US 21st in health and safety and 20th in quality of family and peer relationships.
- "All families in Organization for Economic Co-operation and Development countries today are aware that childhood is being re-shaped by forces whose mainspring is not necessarily the best interests of the child….At the same time, a wide public… is becoming ever more aware that *many of the corrosive social problems affecting the quality of life have their genesis in the changing ecology of childhood."*
- "Many therefore feel that it is time to attempt to re-gain a degree of understanding, control and direction over what is happening to our children in their most vital, vulnerable years."

- Here in U.S., how are we reacting to this crisis at the core of our culture, and to the discoveries in human development? And if we're not responding, why not?
- In clinical models we speak of individuals having intrapsychic defenses against uncertainty, stress, and painful negative information.
- But defenses such as denial, repression, and even dissociation are collectively used by the culture to avoid more directly the stressors that lie at is core.
- Jacob Bronowski (1972): "Think of the investment that evolution has made in the child's brain…For most of history, civilizations have *crudely ignored* that enormous potential. In fact the longest childhood has been that of civilization, learning to understand that."

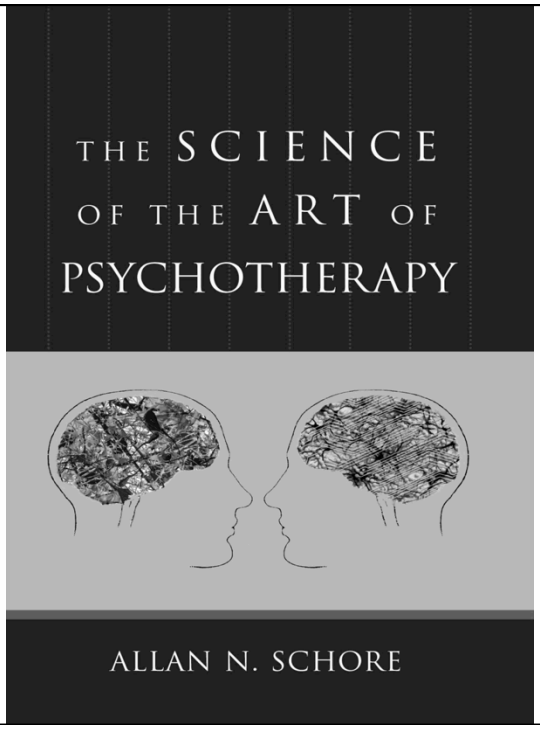
- Mental health field needs to intensify its focus on infant mental health and optimal right brain development, and expand programs of early prevention.
- US policy on amount of maternal and paternal leave needs to rise to level of other industrialized societies.
- Training of day care workers, infant 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, 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.

- Twenty years ago neuroscientist Don Tucker postulated, "the baby brain must begin participating effectively in the process of social information transmission that offers entry into the *culture*."
- Long period of nurturance and social interaction provided human children allows "the life experience of other individuals to serve as epigenetic determinants of brain differentiation and intelligence."
- Social interaction that promotes brain differentiation is mechanism for teaching "the epigenetic patterns of culture;" successful social development requires a high degree of skill in negotiating emotional communication, "much of which is nonverbal," in "specialized neural networks in humans, within the right hemisphere."

- Tucker and Moller (2007): "The right hemisphere's specialization for emotional communication through nonverbal channels seems to suggest a domain of the mind that is close to the motivationally charged psychoanalytic unconscious."
- Suggest the culture shapes not only the conscious mind of the left brain, but more importantly the unconscious mind of the right brain.
- Leckman & March (2010): "Our in utero and our early postnatal interpersonal worlds shape and mold the individual (infants, children, adolescents, and adults and caregivers) we are to become."
- Early prevention optimizes right brain development.

- McGilchrist (2009): “The right hemisphere…has the most sophisticated and extensive, and quite possibly most lately evolved, representation in the prefrontal cortex, the most highly evolved part of the brain.”
- “The right hemisphere…yields a world of individual, changing, evolving, interconnected, implicit, incarnate, living beings within the context of the lived world, but in the nature of things never fully graspable, always imperfectly known - and to this world it exists in a relationship of care.”
- McGilchrist: RH = “the most highly evolved part of the brain.” Describes how current U.S. *culture* heavily lateralized to the left hemisphere.

- 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?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