ANNUAL MEETING OF THE GERMAN PEDIATRIC SOCIETIES

SEPTEMBER 24, 2011

WORKSHOP:
THE NEUROBIOLOGY OF CHILDHOOD ATTACHMENT TRAUMA

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AFFECT DYSREGULATION

AND DISORDERS OF THE SELF

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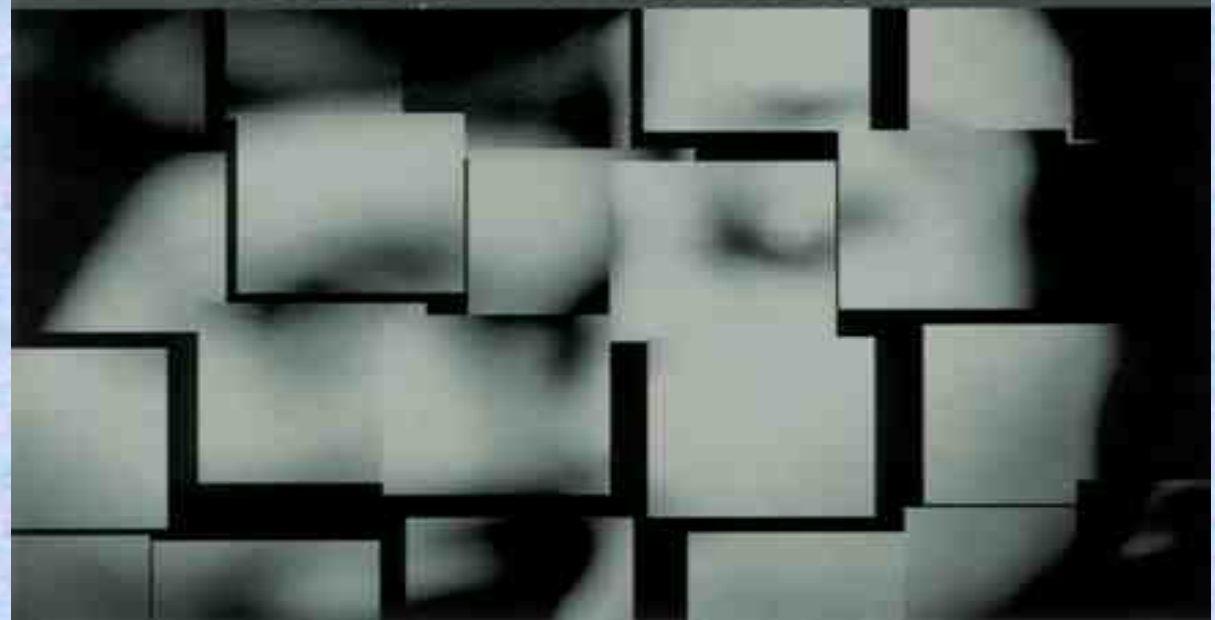


- Bowlby (1969): “In the fields of ethology and psychopathology attachment theory can be used to frame specific hypotheses which relate different family experiences to different forms of psychiatric disorder and also, possibly, to the neurophysiological changes that accompany them.”
- Schore (1991-2011): modern attachment theory provides interpersonal neurobiological models of psychopathogenesis, early forming disorders of self regulation.

- Yesterday's keynote:
- "Positive (formation of emotional attachment) or negative (e.g., maternal separation or loss) emotional experience may carve a permanent trace into a still developing neuronal network of immature synaptic connections, and thereby can extend or limit the functional capacity of the brain during later stages of life." (Helmeke et al., *Cerebral Cortex,* 2001).

- 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): for better or worse, attachment interpersonal neurobiology and it’s impact on the developing right hemisphere can either facilitate resilience to stress or create a predisposition to psychopathology.

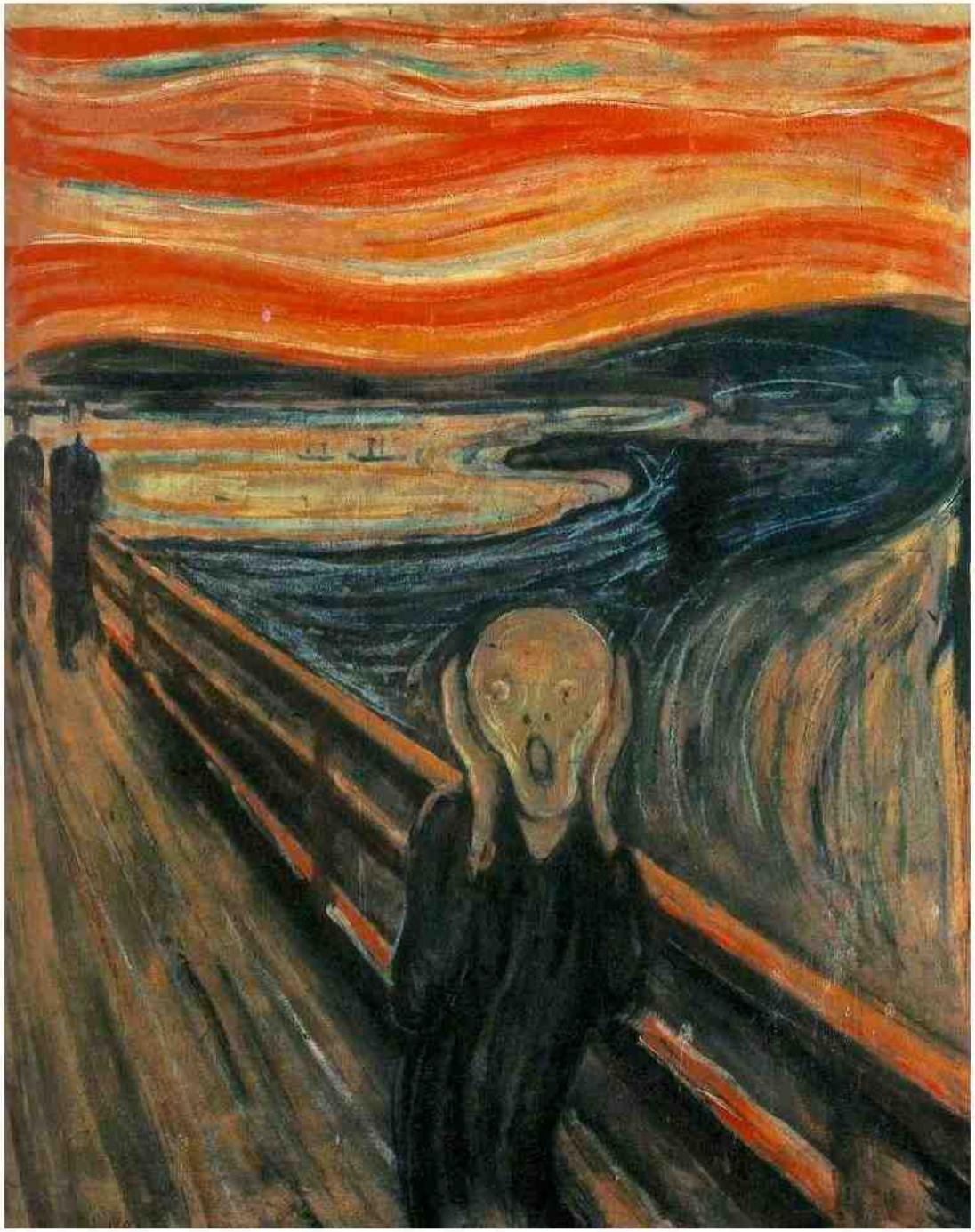
- Henry (1993): “The ability to maintain personally relevant bonds is vital for our evolutionary survival. The infant’s tie to the mother’s voice and odor is recognized even by the newborn, yet this personal relevance and recognition of the familiar can be impaired by anxious insecurity resulting from difficult early experiences or traumatic stress.”

- Kehoe et al. (1996): “An individual’s response to stressful stimuli may be maladaptive producing physiological and behavioral responses that may have detrimental consequences, or may be adaptive, enabling the individual to better cope with stress.
- Events experienced early in life may be particularly important in shaping the individual’s pattern of responsiveness in later stages of life.”

- Colombo et al. (*Brain Research Reviews*, 2006): “In a species with a heavily socially molded brain and mind, such as human, the full expression of an individual special aptitude depends on multiple genetic and environmental factors - which could cancel or potentiate the former…due to sociocultural conditions or their early potential being cancelled following exposure to unwanted health or child rearing hazards during gestation and/or early childhood, or lack of an adequate child-raising environment.”

- LeDoux (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).

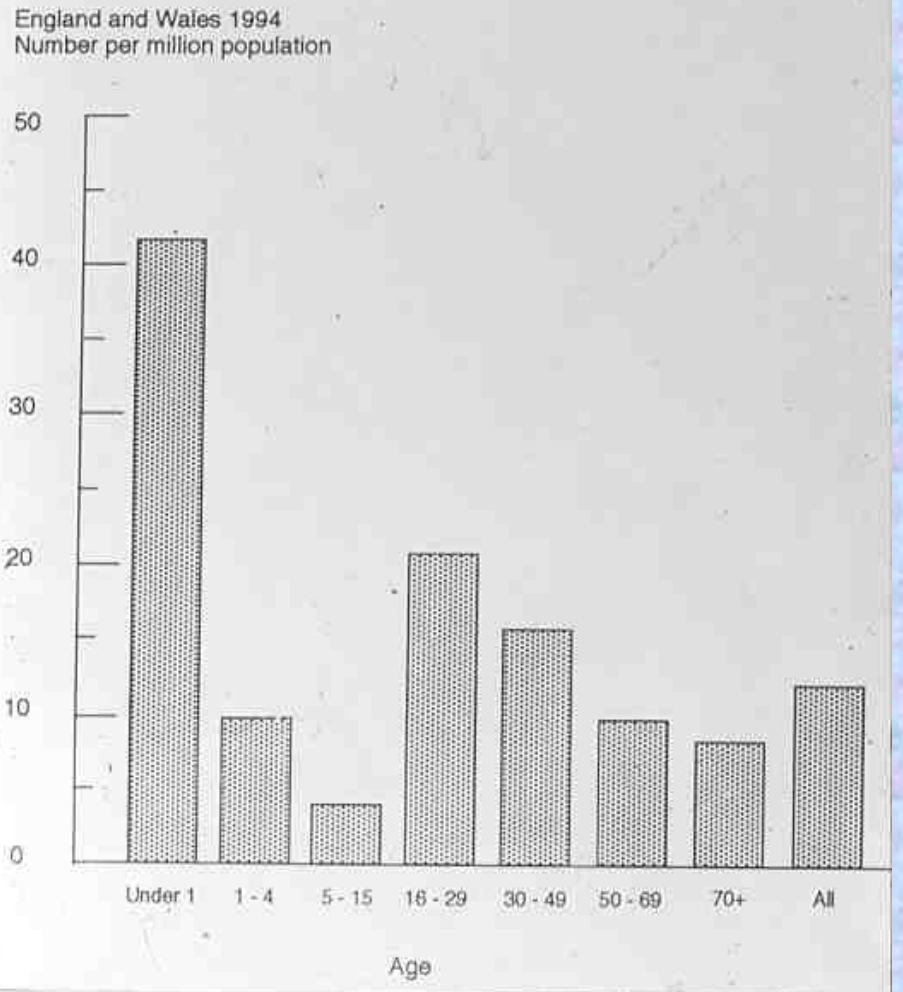
The Dead Mother
by Edvard Munch
(He lost his mother at age 5 and then his older sister at 13)



- Early relational trauma associated with severe attachment stressors
- 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.”

- The most serious maltreatment occurs to infant's under 2 years of age
- Covert video recordings of infants hospitalized for life-threatening events; child abuse inflicted by caregivers on infants as young as 3 months *while they are in the hospital*.

Figure 1 - Offences currently recorded as homicide by age of victim (Home Office, Chapter 4, 1994)



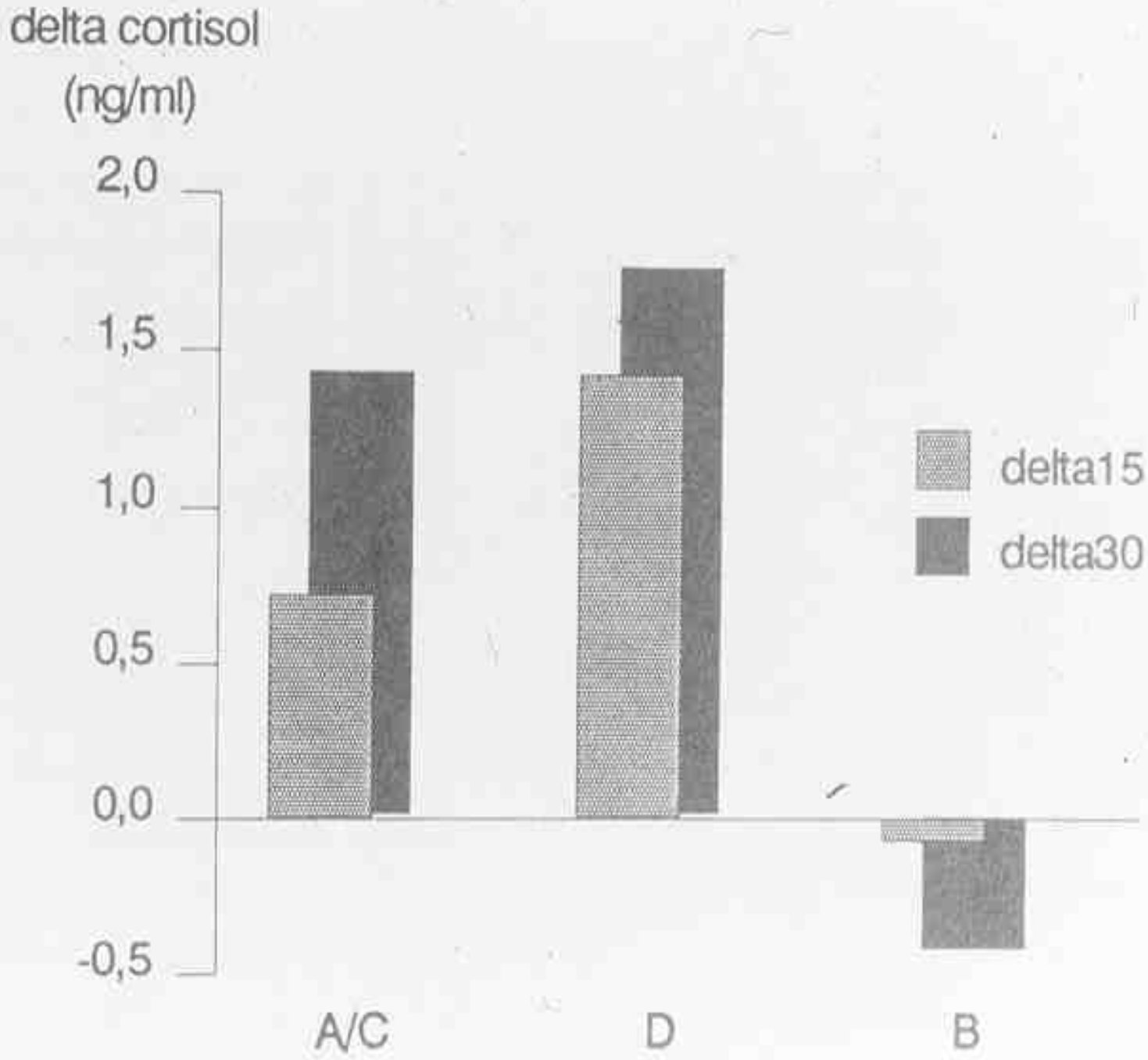
- Krystal (1988): “Psychic trauma in childhood results in an arrest of affective development, whereas trauma in adulthood leads to a regression in affective development.”
- Freud: trauma in early life effects all vulnerable humans because “the ego...is feeble, immature and incapable of resistance.”
- “Trauma“ - from the Greek, a wound, hence in psychiatry, a mental shock

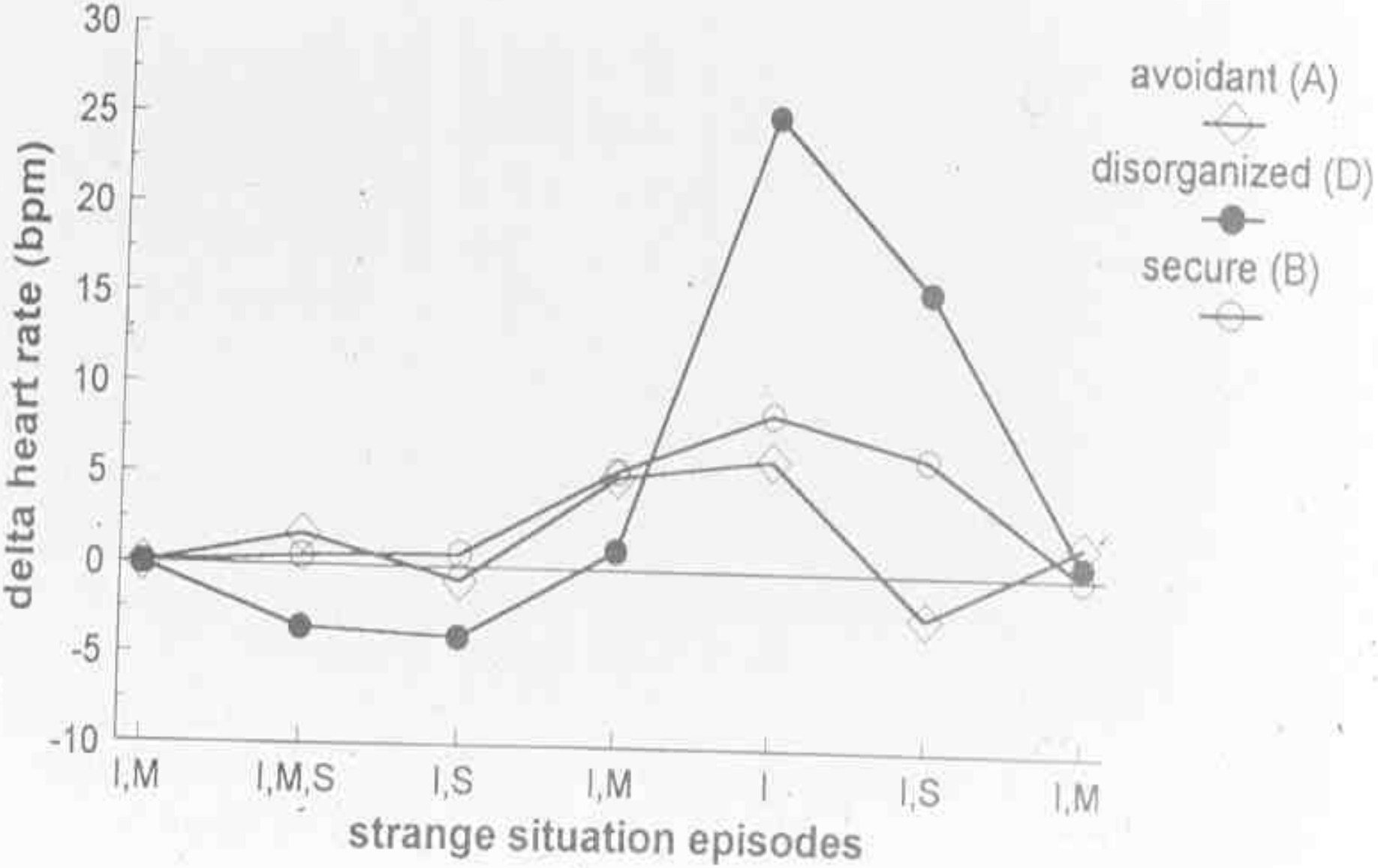
- Developmental traumatology studies: severe trauma of interpersonal origin can override genetic, constitutional, social, or psychological resilience.
- Continued survival of the child is felt to be at risk, because the actuality of the abuse jeopardizes (the) primary object bond and challenges the child's capacity to trust and, therefore, to securely depend.
- Most stressful forms of attachment bond (relational) trauma are abuse and neglect.

- Stress is a critical factor that affects social interactions, especially the mother-child interaction (Suter et al., *Stress*, 2007).
- Overviewing the literature, these researchers report that 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.”

- Newman and Stevenson (*Australian and New Zealand Journal of Psychiatry*, 2007) review of parenting issues for mothers who manifest chronic stress dysregulation (borderline personality disorders) conclude,
- “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.”
- This re-enactment occurs in episodes of relational trauma (abuse and/or neglect). Not a singular event but “ambient”, “cumulative.”

- 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.”
- “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


delta cortisol
(ng/ml)
2,0
1,5
1,0
0,5
0,0
-0,5
A/C
D
B
delta15
delta30


30
25
20
15
10
5
0
-5
-10
delta heart rate (bpm)
I,M
I,M,S
I,S
I,M
I
I,S
I,M
strange situation episodes
avoidant (A)
disorganized (D)
secure (B)

- Relational trauma - *Abuse*
- Attachment trauma impacts developing brain and body, CNS and ANS.
- 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 ANS as well as the precursors of pain?”
- 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, the major excitatory neurotransmitter in the brain

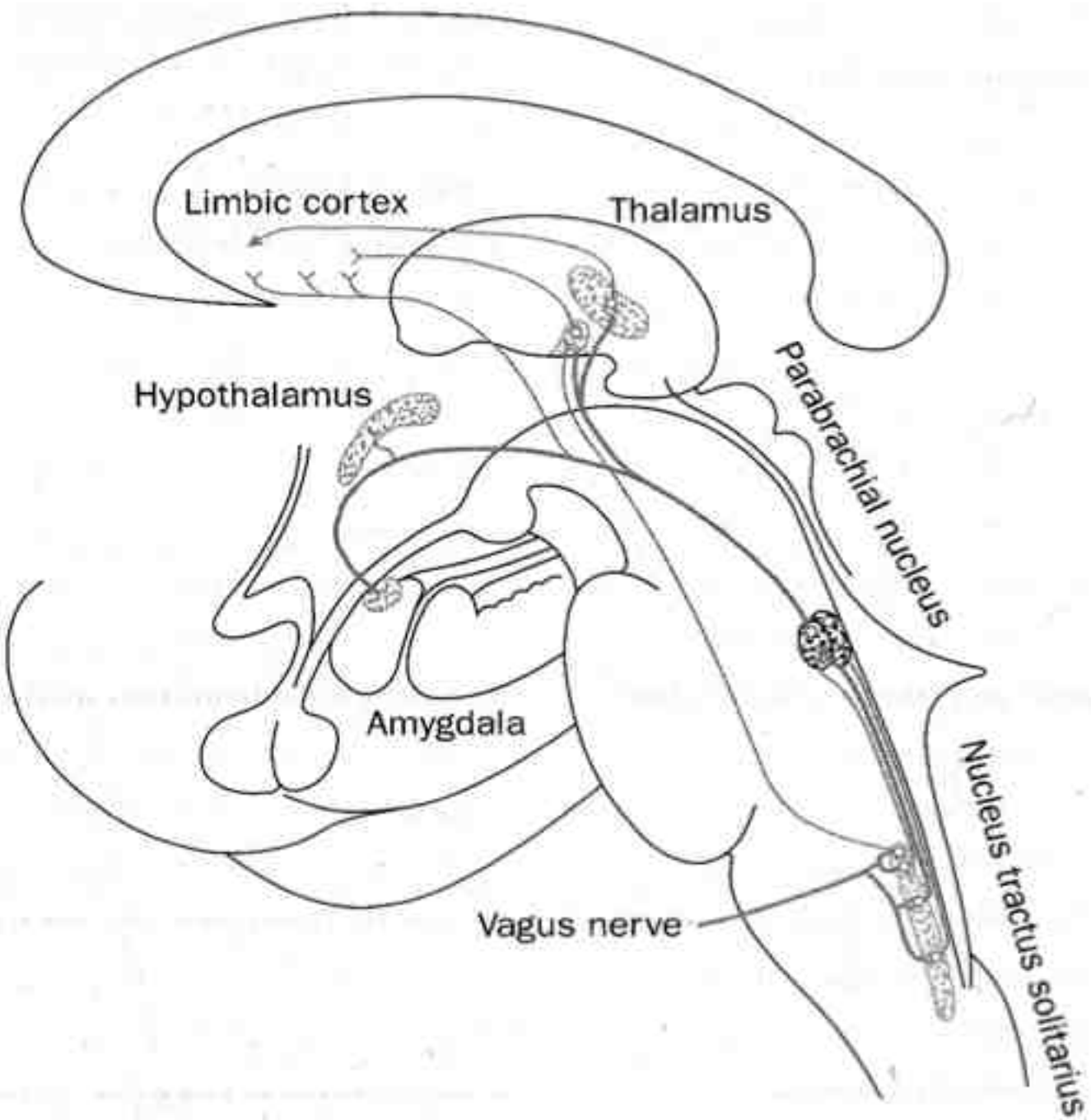
- “Mutually escalating hyperarousal” (Beebe)
- “Each one escalates the ante, as the infant builds to a frantic distress, may scream, and finally throws up. In an escalating overarousal pattern, even after extreme distress signals from the infant, such as ninety-degree head aversion, arching away…or screaming,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

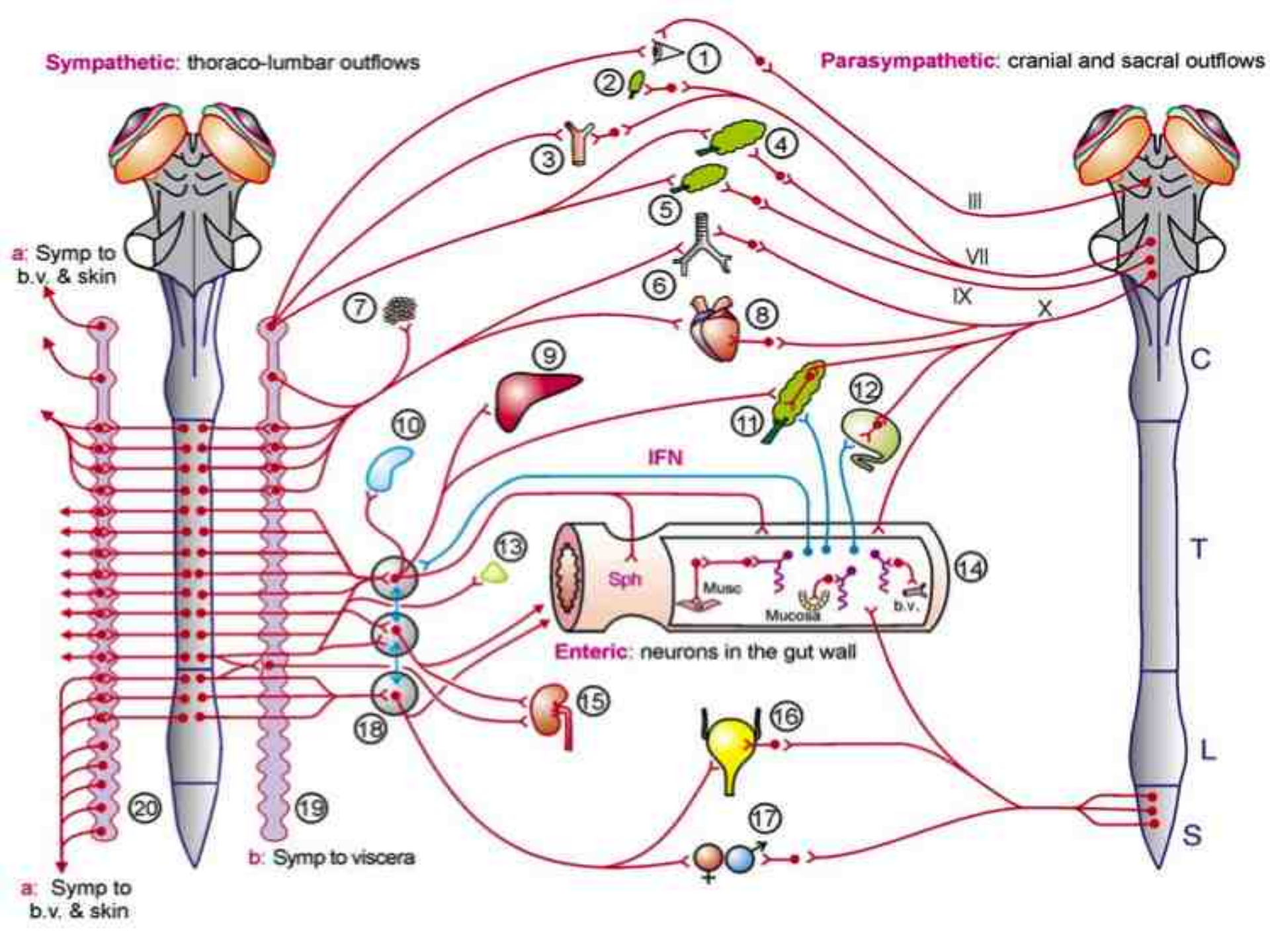
- Porges: switch from sympathetic hyperarousal to parasympathetic hypoarousal / dissociation: “the sudden and rapid transition from an unsuccessful strategy of struggling requiring massive sympathetic activation to the metabolically conservative immobilized state mimicking death.”
- Bromberg (2006): 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.
- In passive state pain numbing and blunting endogenous opiates are elevated. Enkephalins, instantly trigger pain-reducing analgesia and immobility and inhibition of cries for help.
- Dissociation = “detachment from an unbearable situation”, “the escape when there is no escape”, “a last resort defensive strategy.”

- Schore, A. N. (2009). Attachment trauma and the developing right brain: Origins of pathological dissociation. In P. F. Dell, & J. A. O'Neil (Eds.), *Dissociation and the dissociative disorders: DMS-V and beyond.*
- Dissociation = metabolic down-regulation and shutdown: "to conserve energies...to foster survival by the risky posture of feigning death, to allow healing of wounds and restitution of depleted resources by immobility."
- Vagal tone, regulated by brainstem dorsal vagal medulla involved in parasympathetic functions, lowers blood pressure and heart rate.

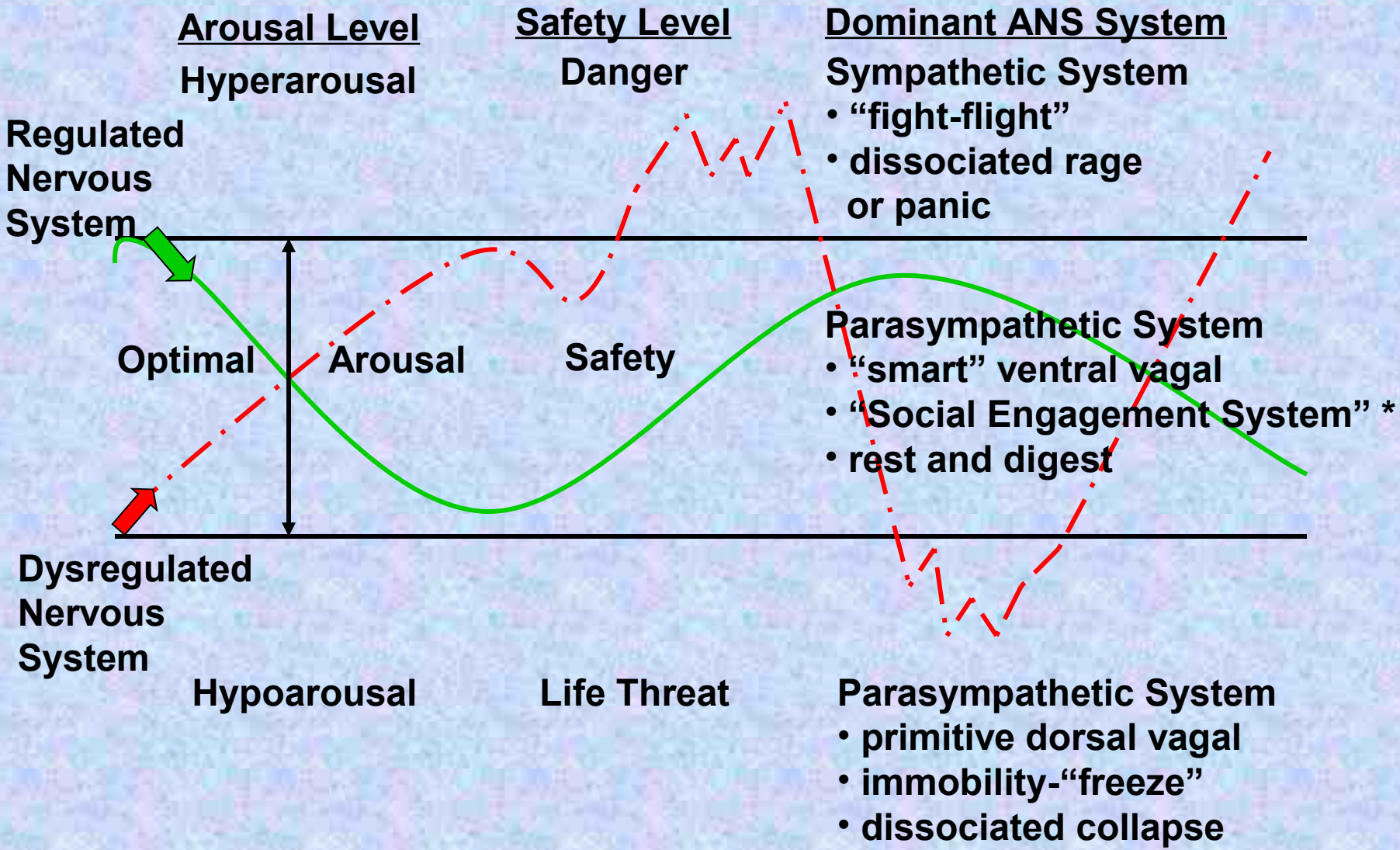

Limbic cortex
Thalamus
Hypothalamus
Parabrachial nucleus
Amygdala
Nucleus tractus solitarius
Vagus nerve


Sympathetic: thoraco-lumbar outflows
Parasympathetic: cranial and sacral outflows
a: Symp to b.v. & skin
III
VII
IX
X
C
T
L
S
IFN
Sph
Musc
Mucosa
b.v.
Enteric: neurons in the gut wall
b: Symp to viscera
a: Symp to b.v. & skin

- Regulation theory models how developing systems organize primitive defense mechanisms such as dissociation to protect against interactive forces which induce intensely stressful states.
- The stressed child, with only primitive abilities to cope with the overwhelming arousal induced by relational trauma and at the limit of his or her fragile regulatory capacities, experiences intense affect dysregulation, projects a distressing emotional communication, and then instantly dissociates.

- Sudden discontinuous, counter-regulatory switch from an active state of emotion-expressing autonomic sympathetic hyperarousal into an enduring passive state of emotion-dampening parasympathetic hyperinhibition underlies the rapid onset of dissociation.

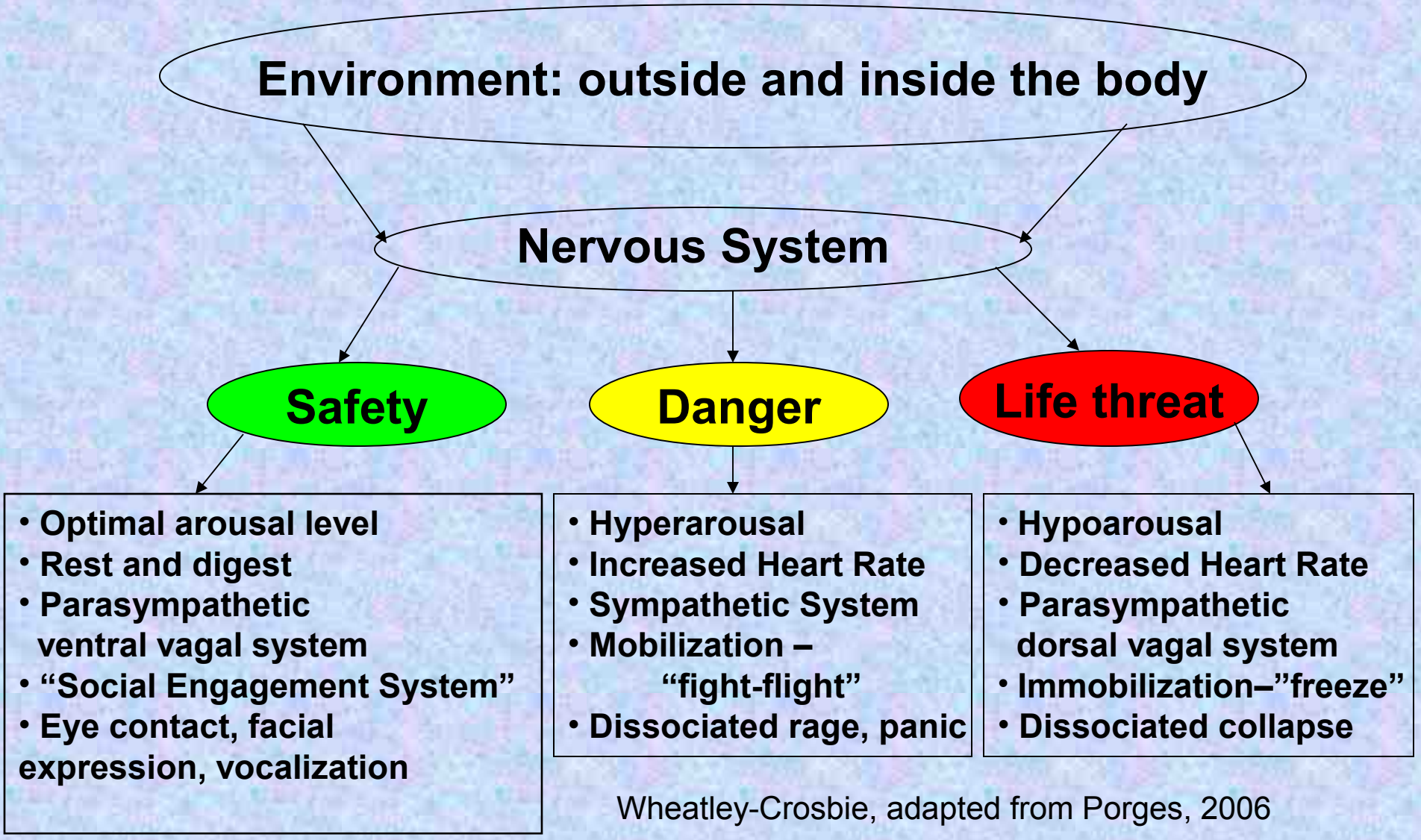
Autonomic Nervous System Arousal



Wheatley-Crosbie, adapted from Levine, *Porges, & Ogden

Porges' View of the ANS

The metaphor of safety



Wheatley-Crosbie, adapted from Porges, 2006

- Robertson and Bowlby (1952) describe a 3 stage emotional reaction in young children, protest, despair, and detachment in response to prolonged separation.
- Barach (1991): Bowlby's detachment "is actually a type of dissociation…although Bowlby uses the term detachment in describing how children respond to abandonment, he is really describing a dissociative process"
- Liotti (1992) links trancelike states of disorganized strange situation with minidissociative episodes.

- Hesse and Main: the 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.”

- Lateralization of type D dissociation in Strange Situation: Hesse and Main (2006) describe at reunion, one “toddler approached her mother, slapped her full in the face with her left hand, and then, with a dazed expression, and still standing in place, used her right hand to pull the left hand and arm down.”

- 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.
- "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." (Hesse & Main)
- During the trauma, the infant is presented with an aggressive expression on the mother's face that induces a stressful fear response in the infant's right brain.

- Tronick (“Why is connection with others so critical?, *Emotional Development*, 2004):
- Study of coping with stressful fear states: 6 month infant takes hold of mother’s hair. When she pulls away he does not let go. In pain, mother responds with bare-toothed angry facial-expression and angry vocalization.
- In response to threat display of mother’s facial anger expression infant brings up his hands and arms up to his face in a defensive maneuver. Infant with sober wary face, looks away from behind his hands.


10- 11 00:07:35:94

- De Haan, Belsky, et al. (*J. Child Psychology and Psychiatry*, 2004): very fearful 7-month-old infants showed larger ERP to fearful expressions over RH.
- Baker & Kim (*Behavioral Neuroscience*, 2004): "Amygdalar lateralization in fear conditioning: evidence for greater involvement of the right amygdala.
- Fischer et al. (*Emotion*, 2002): right-sided human prefrontal brain activation during activation of conditioned fear (relational trauma of abuse/neglect)
- Sullivan & Gratton, (*Psychoneuroendocrinology*, 2002): right prefrontal cortex is "most directly linked to stress-regulatory systems"

- But in traumatic episodes, maternal expression of fear-terror is also displayed. Mother withdraws from infant as though infant were the source of alarm. Dissociated, trancelike, and fearful behavior is observed in parents of type “D” infants.
- In heightened affective moments infant matching rhythmic structures of these states; synchronization of firing patterns of right corticolimbic brain regions.
- Primary mechanism for the real time intergenerational transmission of trauma

- Abrams, Rifkin, & Hesse (*Development and Psychopathology*, 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.”
- Marysko et al. (*Psychopathology*, 2008, History of childhood abuse is accompanied by increased dissociation in young mothers five months postnatally): maternal history of abuse significantly increases maternal dissociative experiences.

- Relational trauma - *Neglect*
- Neglect and depression: Winnicott
- “The mother’s central internal object is dead at the critical time in her child’s early infancy,”
- The infant is exposed to “an antilife factor derived from the mother’s depression.”
- Dissociation from the psychosomatic core of the self is experienced as “psychic death”
- Kestenberg (1985) refers to dead spots the infant’s subjective experience

- 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."

- Fraiberg: “The mother had been grudgingly parented by relatives after her mother’s postpartum attempted suicide and had been sexually abused by her father and cousin. During a testing session, her baby begins to cry. It is a hoarse, eerie cry…On tape, we see the baby in the mother’s arms *screaming hopelessly; she does not turn to her mother for comfort.* The mother looks distant, self-absorbed. She makes an absent gesture to comfort the baby, then gives up. She looks away.”

"The screaming continues for five dreadful minutes. In the background we hear Mrs. Adelson's voice, gently encouraging the mother. "What do you do to comfort Mary when she cries like this? (The mother) murmurs something inaudible…As we watched this tape later…we said to each other incredulously, 'It's as if this mother doesn't hear her baby's cries.'" (Fraiberg)

- 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*


A
B
C
D

- 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

- Buss et al. (*Behavioral Neuroscience*, 2003). Right frontal brain activity, cortisol, and withdrawal behavior in 6-month-old infants.
- “Withdrawal behaviour is also a feature of most attachment disorders, particularly disorganized attachment.”
- “Withdrawal behaviour is also a key symptom of infant depression (Spitz, 1946).” [anaclitic depression]
- 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.”

- 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.”

- Kohut (1984): “If the mother’s empathic ability has remained infantile, that is, if she tends to respond with panic to the baby’s anxiety, then a deleterious chain will be set into motion. She may chronically *wall herself off* from the baby, thus depriving him of the beneficial effect of merging with her as she returns from experiencing mild anxiety to calmness.”

- “Alternatively, she may continue to respond with panic, in which case two negative consequences may ensue: the mother may lay the groundwork in the child for a lifelong propensity toward the uncurbed spreading of anxiety or other emotions, or by forcing the child to *wall himself off* from such an overly intense and thus traumatizing [experience, she] may foster in the child an impoverished psychic organization, the psychic organization of a person who will later be unable to be empathic himself, to experience human experiences, in essence, to be fully human.”

- Bugental, Martorell, & Barraza, “The hormonal costs of subtle forms of infant maltreatment” (*Hormones and Behavior*, 2003): focus on impact of maternal withdrawal, a form of “psychological or emotional maltreatment” on 17-month-old toddlers
- “At the most general level, early maltreatment is associated with disruptions in the functioning of the HPA axis - both in terms of basal activity and stress reactivity.”
- Differentiate 2 forms of subtle maltreatment: maternal harshness [abuse-intrusiveness-hyperarousal] and maternal unavailability [neglect-disengagement-dissociative hypoarousal]

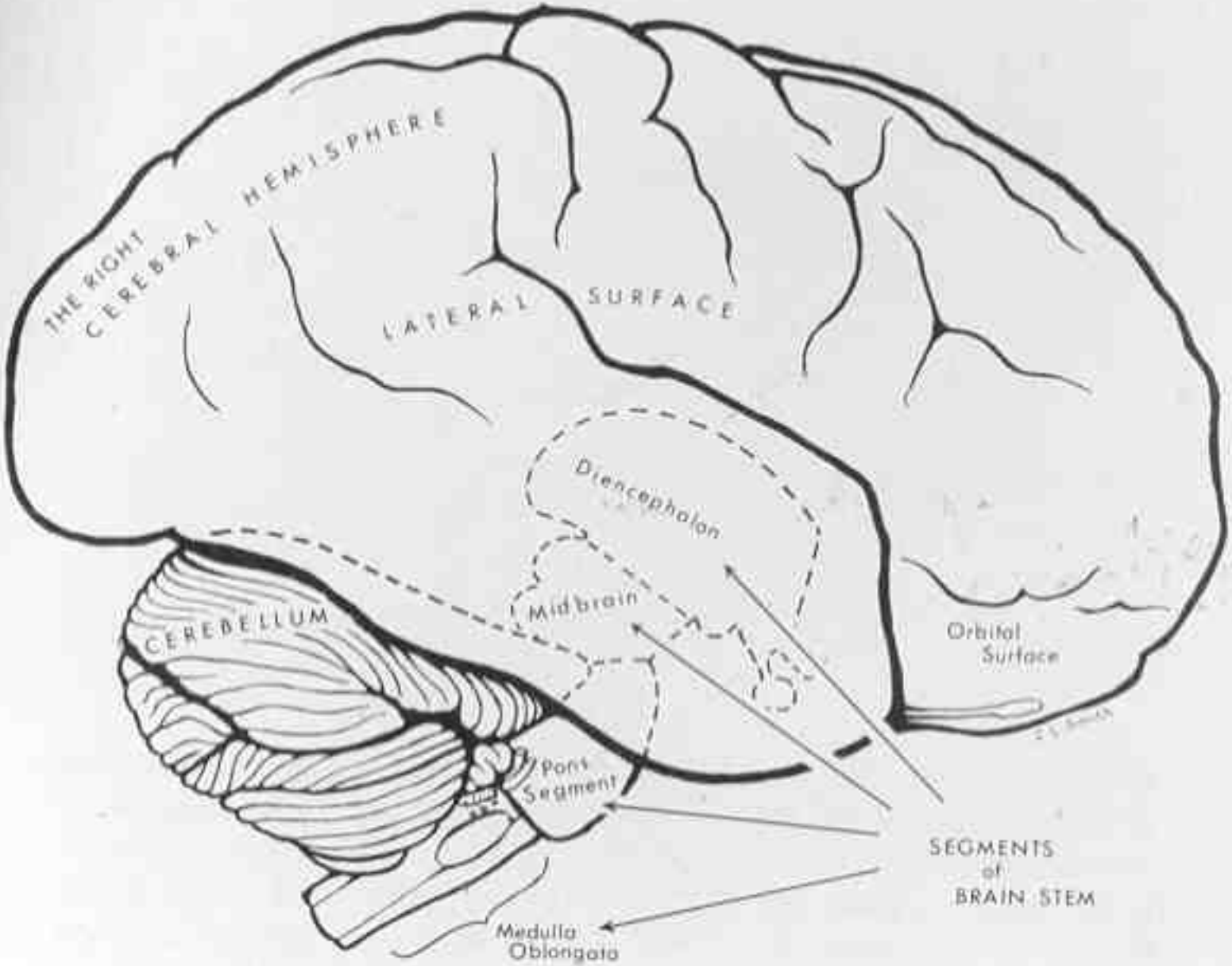
- “Infants’ hormonal responses were shown…to be reactive to subtle forms of parental maltreatment.” Elevated cortisol = “an adaptive way of coping with unbuffered stress.”
- “Higher baseline levels of cortisol were shown by children whose mothers showed a high level of emotional unavailability - either as an intentional tactic or as a side effect of her own depressed state.”
- Effects stronger for maternal depression.

- 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

- Glaser et al. (*J. Psychosomatic Research*, 2006):
- “Childhood trauma may have long-lasting and enduring effects on adult psychological functioning, as exposed individuals continually react more strongly to small stressors occurring in the natural flow of everyday life.”
- “Emotional stress reactivity is most pronounced for subjects who experienced trauma early in life…The effects of trauma are more detrimental when trauma occurs at a younger age.”

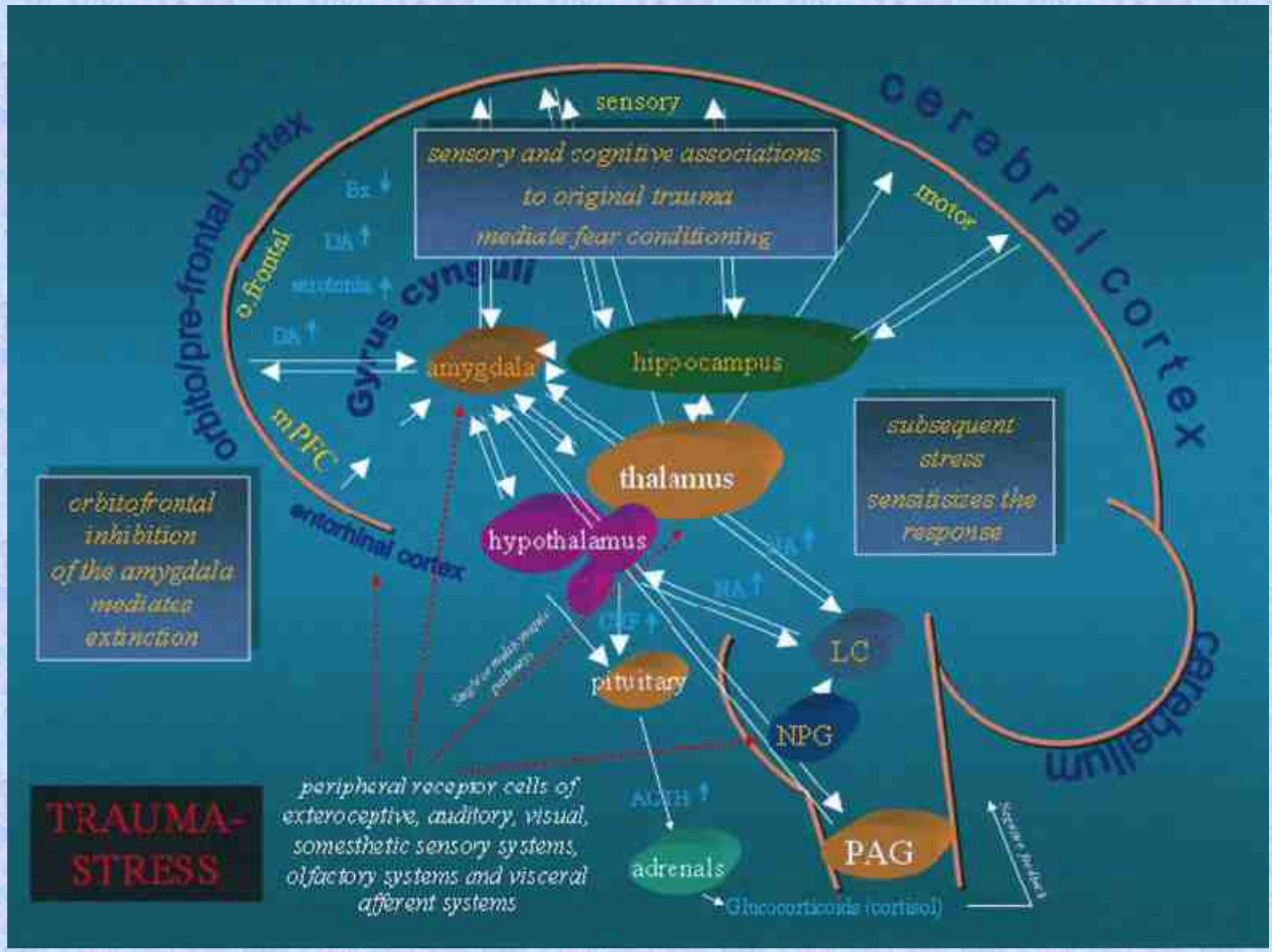
- Watt (2003): “If children grow up with dominant experiences of separation, distress, fear and rage, then they will go down a bad pathogenic developmental pathway, and it’s not just a bad psychological pathway but a bad neurological pathway.”
- De Bellis: “The overwhelming stress of maltreatment in childhood is associated with adverse influences on brain development.”

- Kalsched (2005): during early trauma, “the raw impact of unformulated, unsymbolized experience hits the child’s psyche like a bolt of lightning hits the electrical panel of a house. Without a human transformer for this high-voltage archetypal affect, all the circuits can be blown.”
- Relational trauma-induced stressful hypoarousal dysregulates higher right brain cortical circuits. Shift to hypoarousal and metabolic shutdown to control high arousal apoptotic damage.


THE RIGHT CEREBRAL HEMISPHERE
LATERAL SURFACE
Diencephalon
Midbrain
CEREBELLUM
Orbital Surface
Pons Segment
SEGMENTS of BRAIN STEM
Medulla Oblongata

- Gadea et al., *Psychoneuroendocrinology*, (2005): processing load of RH and intensity of negative affect:
- “Mild to moderate negative experiences (such as induced negative affect or even a clinical anxious state) might result in right hemisphere processing activation (and an attentional bias to the left ear), but an intense experience (such as…pure major depression) might interfere with right hemisphere processing, with eventual damage if some critical point is reached.”

- De Bellis *(*2002): “In the developing brain, elevated levels of catecholamines and cortisol may lead to adverse brain development through the mechanisms of accelerated loss (or metabolism) of neurons; delays in myelination, abnormalities in developmentally appropriate pruning and by inhibiting neurogenesis.
- Consequently, a stress-related adverse brain development mechanism may also contribute to maturation failures in the frontal and prefrontal cortex.”


cerebral cortex
orbito/pre-frontal cortex
sensory
sensory and cognitive associations
to original trauma
mediate fear conditioning
motor
Gyrus cyngull
amygdala
hippocampus
thalamus
hypothalamus
mPFC
entorhinal cortex
orbitofrontal
inhibition
of the amygdala
mediates
extinction
subsequent
stress
sensitizes the
response
pituitary
LC
NPG
PAG
adrenals
Glucocorticoids (cortisol)
TRAUMA-
STRESS
peripheral receptor cells of
exteroceptive, auditory, visual,
somesthetic sensory systems,
olfactory systems and visceral
afferent systems
cerebellum

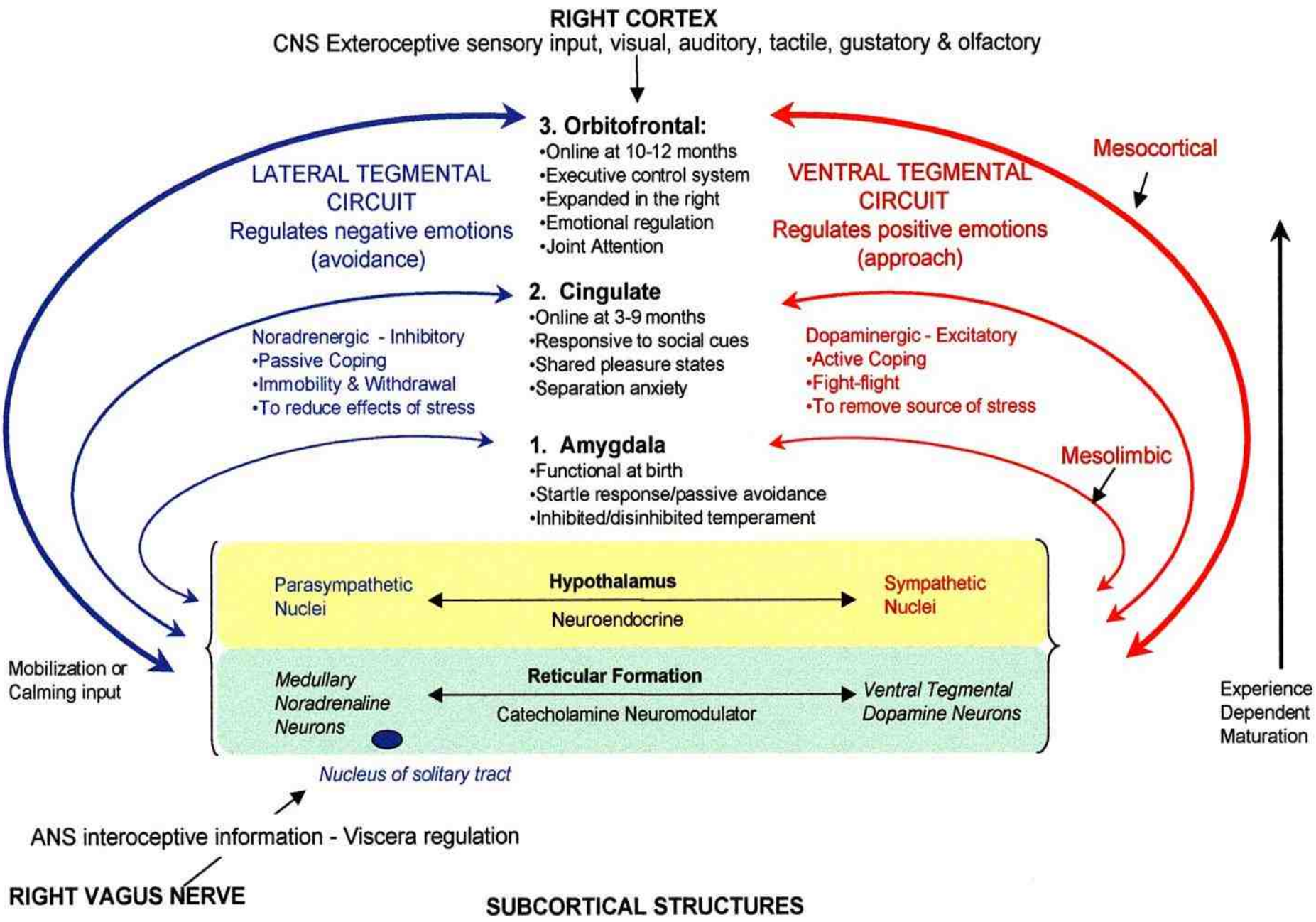
- “Early childhood abuse may alter the course of *limbic system maturation*, producing neurobiological alterations, and these alterations may provide the biological substrate for a panoply of psychiatric consequences, including affective instability, limited stress tolerance, *dissociative disturbances* and memory impairment” (Ito et al., *Journal of Neuropsychiatry*, 1993).

- “Psychological” factors "prune" or "sculpt" neural networks in the postnatal brain
- Trauma-induced excessive pruning of hierarchical right cortical-subcortical circuits in etiology of vulnerability to later disorders of affect regulation, severe self pathologies
- Adamec et al. (*Prog Neuro-Psychopharmacol. Biol. Psych*., 2003) show “neuroplasticity in right hemispheric limbic circuitry in mediating long-lasting changes in negative affect following brief but severe stress.”

- Schore (*Infant Mental Health J*, The effects of early relational trauma on right brain development, affect regulation, and infant mental health 2001):
- Early traumatic environments interfere with organization of right brain cortical-subcortical limbic circuits and compromise such functions as attachment, capacity to play, empathy, and affect regulation.
- Van der Kolk and Fisler (1994): “Loss of the ability to regulate the intensity of feelings is the most far-reaching effect of early relational trauma.”

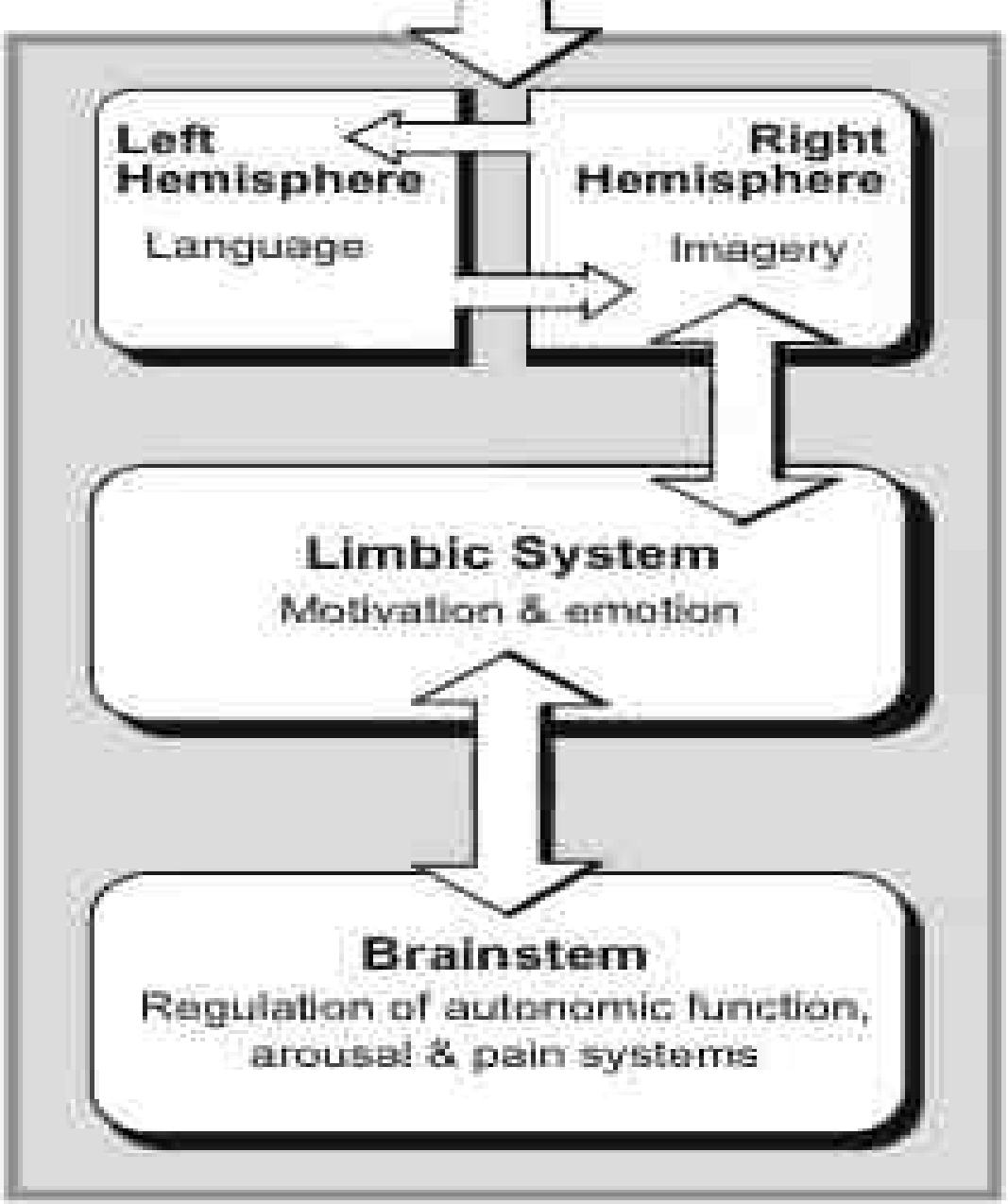
- “Preverbal children even in the first year of life, can establish and maintain some form of internal representation of a traumatic event over significant periods of time” (Gaensbauer, 2002)
- Schore (1994-2011): relational attachment trauma and experiences of disorganized attachment and dissociation leave behind a permanent physiological reactivity in limbic areas of the right brain, thereby inhibiting its capacity to regulate negative affect and cope with future stressors.

SCHORE'S RIGHT BRAIN DUAL CORTICOLIMBIC-AUTONOMIC CIRCUITS



- Schore (*Australian & N. Zeal. J. Psychiatry*, 2002, Dysregulation of the right brain: a fundamental mechanism of traumatic attachment and the psychopathogenesis of posttraumatic stress disorder): disorganized attachment associated with later pathological dissociation and PTSD.
- MacDonald et al. (*Development & Psychopathology*, 2008, Longitudinal association between infant disorganized attachment and childhood posttraumatic stress symptoms): disorganized attachment predicted PTSD symptoms in later childhood. These children "may unconsciously use dissociative behaviors to escape from stressful experiences."

- Another detrimental enduring effect of attachment trauma: relational trauma in the second year, would induce a severe pruning of the right hemisphere callosal axons that are growing towards their counterparts in the left.
- This would produce an inter-hemispheric organization in which facial expressions, bodily states, and affective information implicitly processed in the right brain would be inefficiently transmitted to the left hemisphere for explicit, semantic processing.

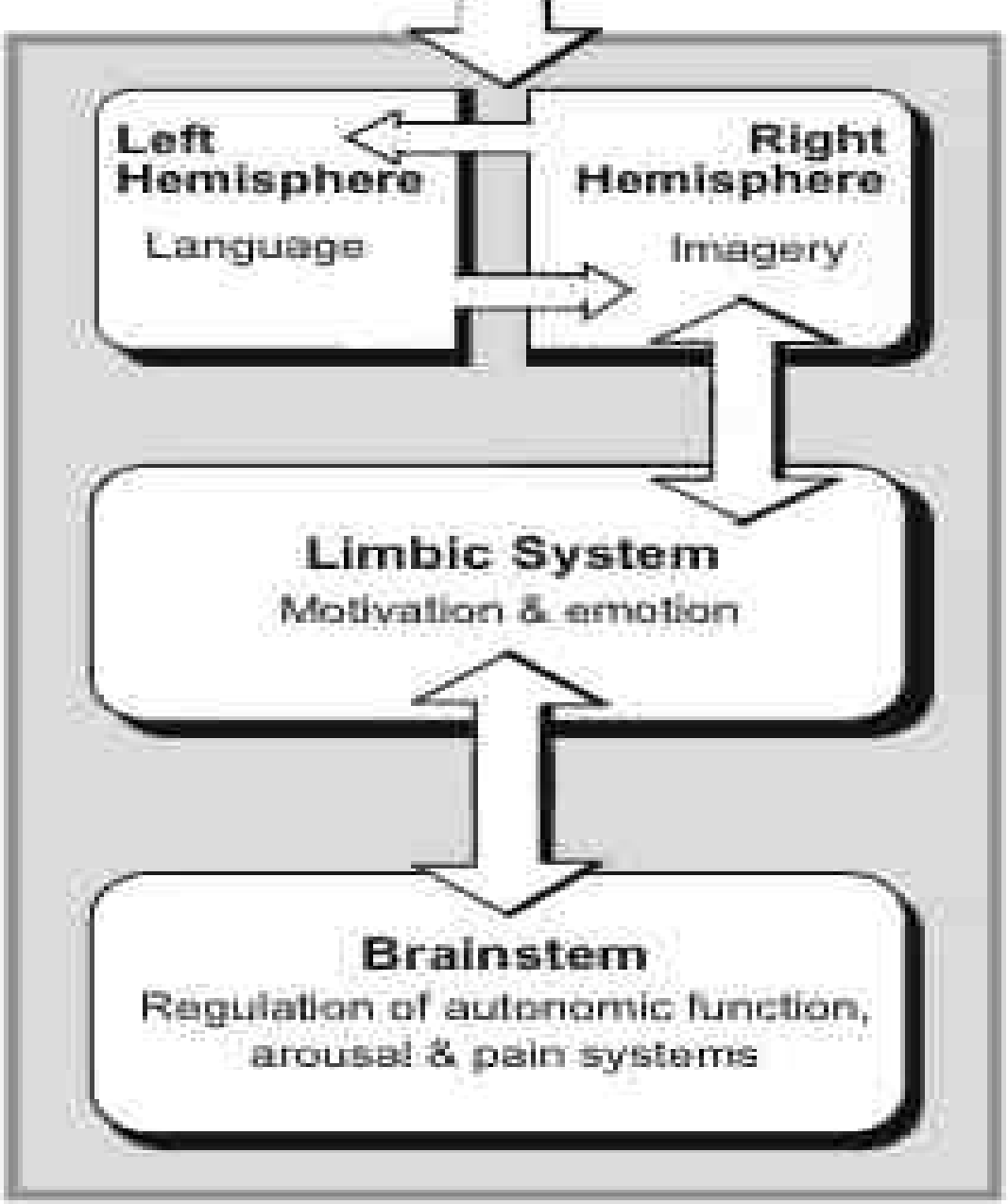

Left
Hemisphere
Language
Right
Hemisphere
Imagery
Limbic System
Motivation & emotion
Brainstem
Regulation of autonomic function,
arousal & pain systems

- Alexithymia-“no words for feelings” (from the Greek “a” for lack, “lexis” for word, and “thymos” for emotion).
- Relative impairment in the functioning of the right hemisphere and in the ability to transfer information between hemispheres.
- Alexithymia common in psychosomatic disorders

- 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.”

- Sroufe: “The vulnerable self will be more likely to adopt dissociation as a coping mechanism because it does not have either the belief in worthiness gained from a loving and responsive early relationship or the normal level of defenses and integration that such a belief affords.”
- Kluft: dissociation, a defense in which an overwhelmed individual cannot escape nor take meaningful action or successful flight, and so escapes instead by altering internal organization, i.e., by inward flight.

- In classical writings on dissociation, Janet proposed “when certain individuals experience ‘vehement emotions,’ their minds may become incapable of matching their frightening experiences with existing cognitive schemes.
- As a result the memories of the experience cannot be integrated into personal awareness; instead, they are split off [dissociated] from consciousness…extreme emotional arousal results in failure to integrate traumatic memories.” (van der Kolk et al., 1996).
- These memories are stored in the RH, dominant for autobiographical memory (Markowitsch).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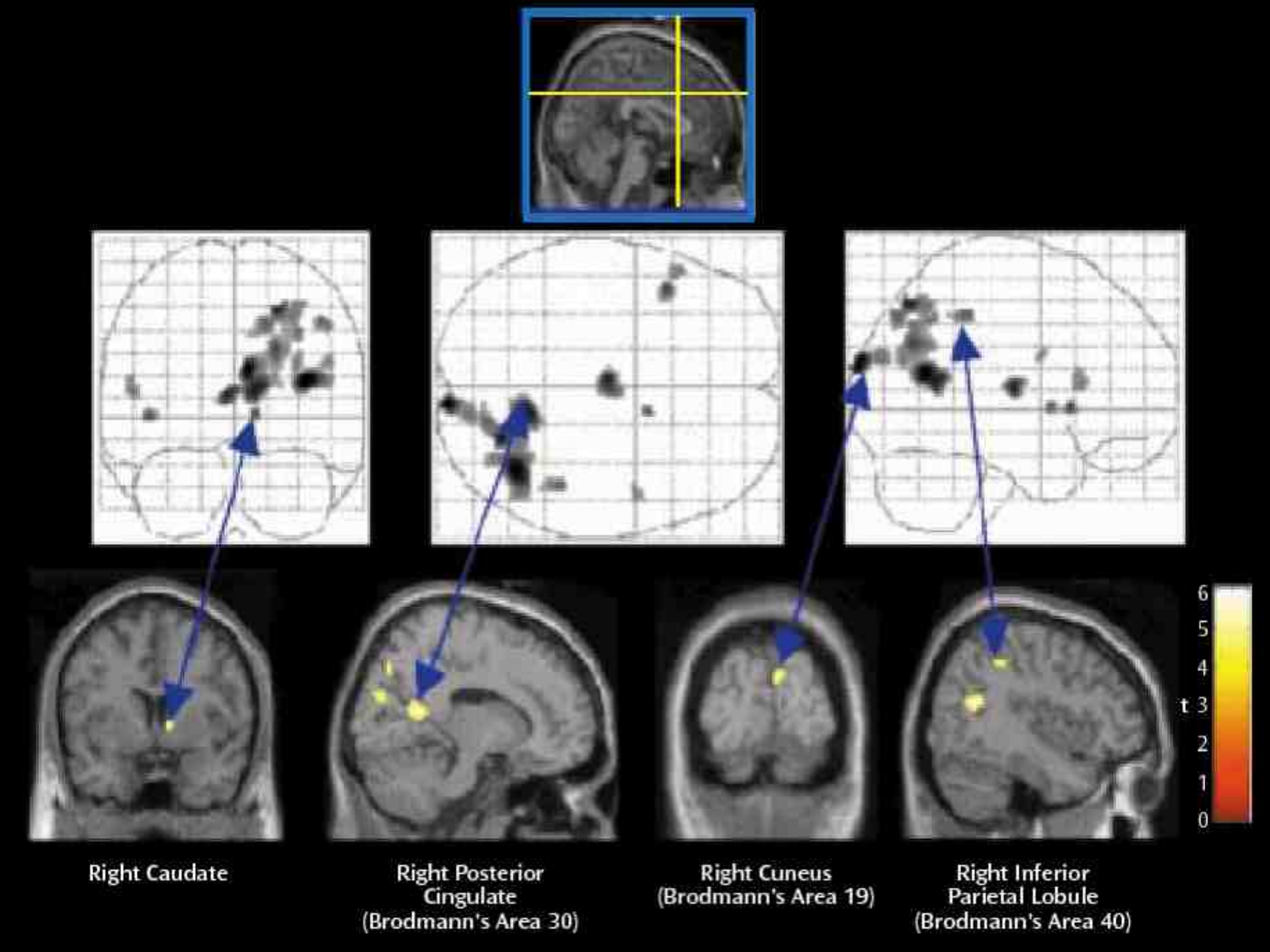
Hemisphere
Imagery
Limbic System
Motivation & emotion
Brainstem
Regulation of autonomic function,
arousal & pain systems

- Continuity of lateralization of traumatic memories, hyperarousal, and dissociation:
- Lanius et al. (2004): PTSD patients who experience traumatic memories with heart rate increases show a pattern of right brain connectivity of activation of the right posterior cingulate, right caudate, right occipital and right parietal lobe.
- This right lateralized pattern “may account for the nonverbal nature of traumatic memory in PTSD subjects…Subjects who had experienced early trauma displayed…right dominance during memory recall.”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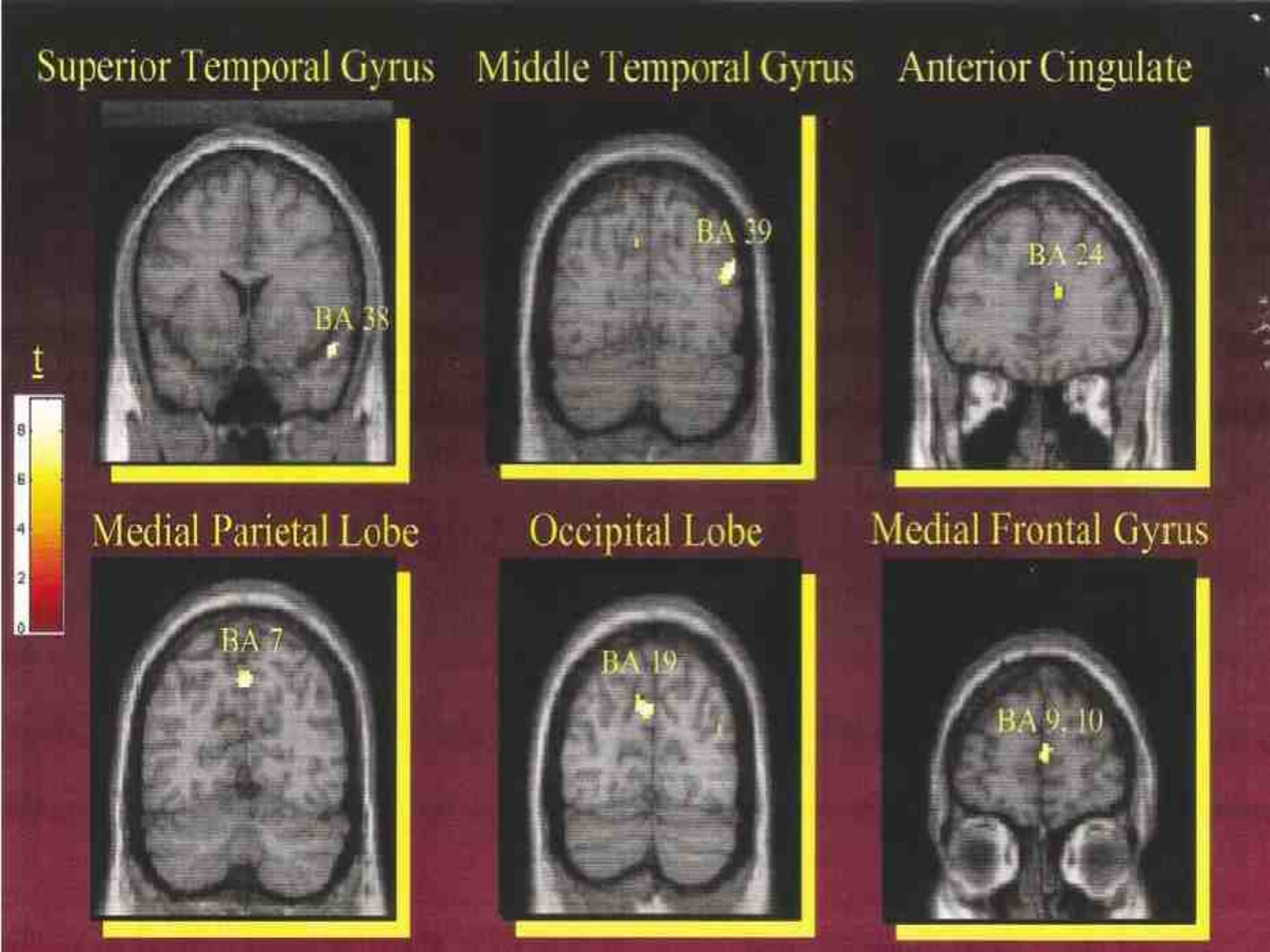
Right Caudate
Right Posterior Cingulate (Brodmann's Area 30)
Right Cuneus (Brodmann's Area 19)
Right Inferior Parietal Lobule (Brodmann's Area 40)

- Lanius et al (2002): PTSD patients in a dissociative state, when exposed to their traumatic script, no increase in heart rate
- Show greater activation in right superior and middle temporal gyri, right inferior frontal, right parietal, right anterior cingulate.
- Corticolimbic pattern of dissociated PTSD patients is lateralized to RH, and different than those who relive traumatic experience.


Superior Temporal Gyrus
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Medial Parietal Lobe
Occipital Lobe
Medial Frontal Gyrus
BA 7
BA 19
BA 9, 10

- Patients here dissociate “in order to ‘escape from’ the overwhelming emotions associated with the traumatic memory.”
- Activation in right prefrontal and temporal cortices, posterior cingulate, and insula
- “The present functional connectivity findings show primarily left-hemispheric frontal activation in the control subjects as compared to predominantly right-hemispheric frontal and insula activation in the dissociated PTSD subject.”

- Lanius (2005, fMRI study of dissociation):
- “I was out of my body”, “I was completely zoned out and could not recall the memory”.
- “The present functional connectivity findings show primarily left-hemispheric frontal activation in the control subjects as compared to *predominantly right-hemispheric frontal and insula activation in the dissociated PTSD subject.”*
- Patients here dissociate “in order to ‘escape from’ the overwhelming emotions associated with the traumatic memory.”
- Dissociation “interpreted as representing a non-verbal response to the memory.”

- Patients with pathological dissociation are cut off from their body
- “Somatoform dissociation”: suppression of autonomic physiological responses, especially when recalling traumatic memories (reduced felt experience)
- Williams et al. (2003); Koopman et al. (2004): dissociation associated with a reduction of heart rate (metabolic shut down).
- Scaer: “Perhaps the least appreciated manifestations of dissociation in trauma are in the area of perceptual alterations and somatic symptoms.”

- Distortion of proprioceptive awareness of trauma patient's body most common dissociative phenomena.
- Nijenhuis (2000): somatoform dissociation associated with early onset traumatization, often involving physical abuse and threat to life by another person.
- Lack of integration of sensorimotor experiences, reactions, and functions of the individual and his/her self-representation.

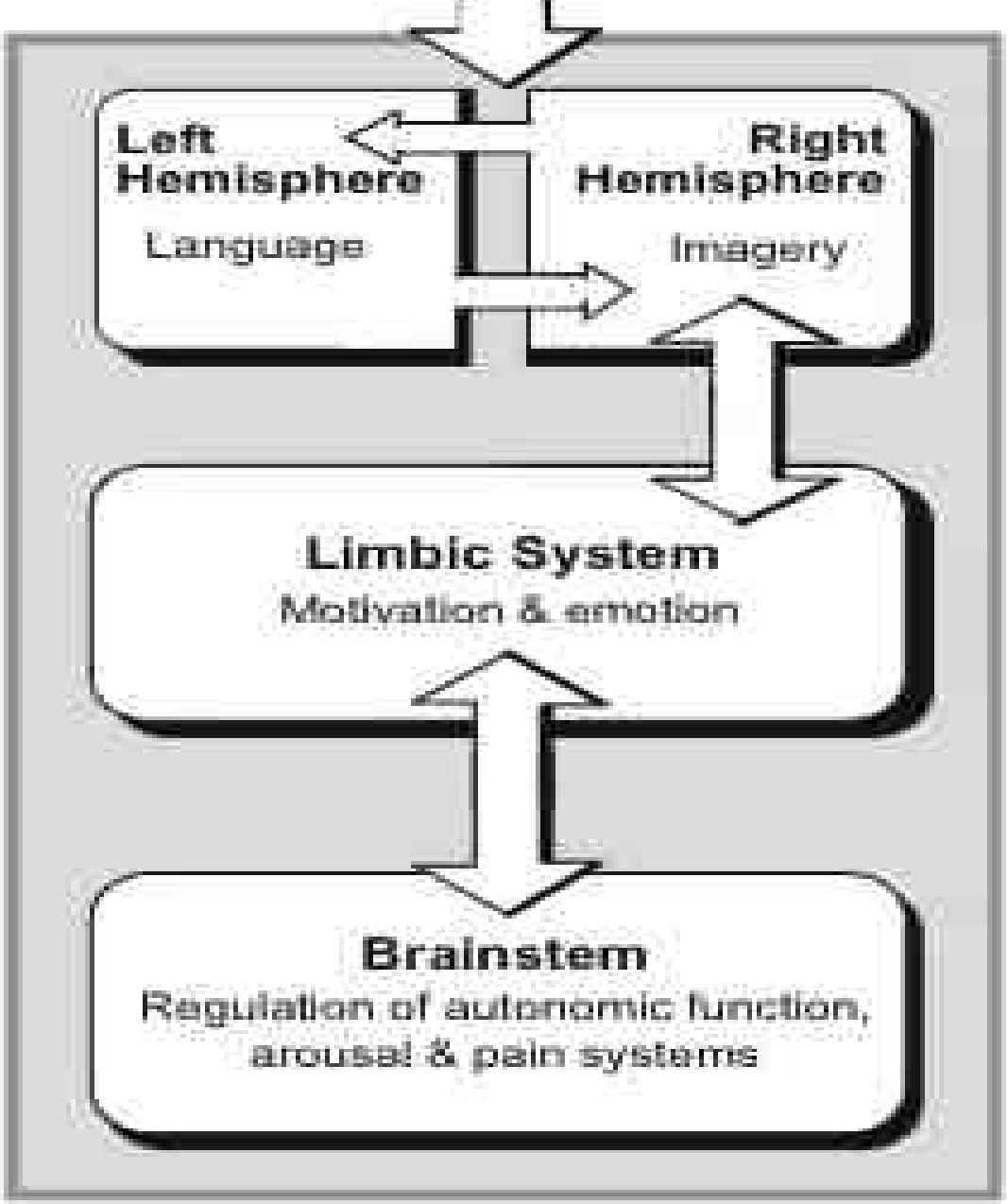
- Personalities with pathological dissociation are also cut off from others
- “Patients report that they are ‘tuned out,’ and they are not aware of anything to which they are ‘tuned in.’”
- “Some patients indicate that they go beyond feeling ‘spacey’ to being utterly ‘blank’ or ‘gone,’ as if they are in ‘the blackness’ or ‘a void.’ At the extreme, they sit and stare, almost as if in a catatonic or comatose state. When patients are in such states, others find it extremely difficult to engage their attention and to help the resume a normal state of consciousness.”

- 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 notice 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, the “escape when there is no escape” is an operation of the right brain, which specializes in withdrawal, avoidance, and involuntary disengagement.
- Bernard & Bandler (*J. Comp. Neurol.,* 1998): active vs. passive coping strategies
- Active emotional coping strategies (confrontation, fight, flight, freezing) are characterized by “engagement with the environment.”
- Sympathoexcitation, hyper-reactivity, tachycardia and high metabolic demands. Useful when threat or stress is escapable or terminable [flight, fight].

- Passive emotional coping strategies (quiescence, immobility, hyporeactivity) are characterized by “disengagement or withdrawal from the external environment” and parasympathetic bradycardia.
- More adaptive for coping with stress that is inescapable or interminable and for facilitating recovery and healing. Observed following traumatic injury or repeated defeats in social encounters (i.e., inescapable stress or pain).
- Passive coping of RH involuntary dissociative disengagement vs. active coping of LH behavioral voluntary avoidance.

- Dissociation: inability of right brain cortical-subcortical system to recognize and coprocess (integrate) external stimuli (exteroceptive information coming from environment) and internal stimuli (interoceptive information from body, the corporeal self).
- This interoceptive information includes sympathetic hyperarousal associated with pain.
- Graff-Guerrero et al. (*Cog. Brain Res.*, 2005): transcranial magnetic stimulation study shows “a right hemisphere preference in pain processing.”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- RH dominant for negative affect and pain processing. RH strategy of dissociation acts as ultimate defense for blocking conscious awareness of emotional pain.
- Spitzer et al. (*J. Neuropsychiatry Clin. Neurosci*., 2004): “Dissociation may involve a... *lack of integration in the right hemisphere*. This corresponds with the idea that the right hemisphere has a distinct role in establishing, maintaining, and processing personally relevant aspects of an individual’s world”

- Enriquez and Bernabeu (*Consciousness and Cognition,* 2008): “dissociation is associated with dysfunctional changes in the right hemisphere which impair its characteristic dominance over emotional processing.”
- As an example these authors document that although high dissociators retain an ability for processing left hemispheric verbal stimuli, they show deficits in right hemispheric perception of the emotional tone of voice (prosody).

- Helton, Dorahy, and Russell (*Consciousness and Cognition,* 2011):
- High dissociators have difficulty in specifically coordinating activity within the RH.
- Such deficits become evident when this hemisphere is “loaded with the combined effects of a sustained attention task and negative emotional stimuli…Thus, the integration of experiences, which rely heavily on right hemispheric activation (e.g., negative emotion, sense of self with reference to the experience) may be compromised in high dissociators.”

- Winnicott: the complete dissociation from the deeper psychosomatic core of the self is experienced as “psychic death.” In such a “catastrophe” one loses contact with the psychobiological core of the self, the generator of meaning.
- 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.”

- Personalities who experience chronic relational trauma, of either abuse and/or neglect, are high risk for somatoform, that is psychosomatic disorders
- 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.
- "Dissociation represents an effective short-term strategy that is detrimental to long-term functioning" (Bremner & Brett, 1997).

- Naga, Devinsky, & Barr (*Cognitive and Behavioral Neurology*, 2005):
- RH dysfunction facilitates the development of somatoform disorders
- Studies show a left side body predominance of somatoform, hypochondriacal, or conversion symptoms. Emotional trauma and abuse are risk factors for conversion disorders.
- “In patients with primary somatoform disorder, right temporal systems involved in regulating emotions and body image may be impaired. This dysfunction may result from environmental stressors and genetic factors.”

- Clinical research shows pathological dissociation, a primitive defense against overwhelming affects, a key feature in:
- Pediatric maltreatment disorder
- Dissociative identity disorder
- Posttraumatic stress disorder
- Psychotic disorders
- Reactive attachment disorder of infants
- Eating disorders
- Substance abuse and alcoholism
- Somatoform disorders
- Borderline personality (self-mutilation of body)

- Taylor et al. (1996): affect dysregulation is a fundamental mechanism of all psychiatric disorders.
- Posner & Rothbart (1998): “The development of systems of self-regulation…may be open to change in adult life, providing a basis for what is attempted in therapy.”
- Nemeroff et al. (*Proc. Natl. Acad. Sci. USA,* 2003): large multicenter study reports that psychological therapy is superior to pharmacotherapy in patients with a history of early childhood trauma.

- Amini et al. (*Psychiatry*, 1996): psychotherapy is “an attachment relationship capable of regulating neurophysiology and altering underlying neural structure.”
- Andreasen (*Brave New Brain*, 2001): psychodynamic therapy “may be viewed as a long-term rebuilding and restructuring of the memories and emotional responses that have been embedded in the limbic system.”
- Etkin, Pittenger, Polan, & Kandel (*J. Neuropsychiatry Clin. Neurosci*., 2005): “There is no longer any doubt that psychotherapy can result in detectable changes in the brain.”

- Early pediatric intervention and prevention:
- Knickmeyer (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.”

- Bakersman-Kraneburg et al. (*Infant Mental Health J*., 2005):
- “New intervention studies should address the important question whether infant attachment disorganization can be prevented effectively through interventions explicitly aimed at decreasing parental non -involved [neglect] or intrusive [abuse] behavior, and/or parental frightened, frightening, or dissociative behaviors.”
- Early intervention is applicable to pediatrics, as well as to family law and the legal profession (Schore & McIntosh, *Family Court Review*, 2011).

Case example of early intervention

Clinical Application of Regulation Theory:
Early Attachment Interventions

Allan N. Schore and Ruth P. Newton

Chapter in

Attachment-Based Clinical Social Work
With Children and Adolescents
(in press)

- Schore (1994) relational trauma and psychopathogenesis of borderline personality disorder:
- BPD retrospective studies show high incidence of abuse in early development. Zanarini (1997): 91% BPD report childhood abuse, 92% neglect.
- Golier et al. (2003):“Abuse is a nearly ubiquitous experience in the early lives of these patients.”
- Linehan (1995): “Most of the problems exhibited by borderline individuals are either the direct or indirect consequence of emotion dysregulation or attempts to modulate intense emotional reactions.”

- Westen & Cohen (1993): a disturbance in the continuity of the self is a central deficit in the identity disturbance of BPD.
- Deficits in right brain implicit self = in affect regulation
- DSM IV most recent revision - “transient, stress-related severe dissociative symptoms and paranoid ideation.”
- Core dimensions of psychopathology: pervasive pattern of instability in self-image, interpersonal relationships, impulse control, and emotion regulation.
- Emotional vulnerability defined as marked sensitivity to emotional stimuli, unusually strong affective reactions, and abnormally slow return to baseline.

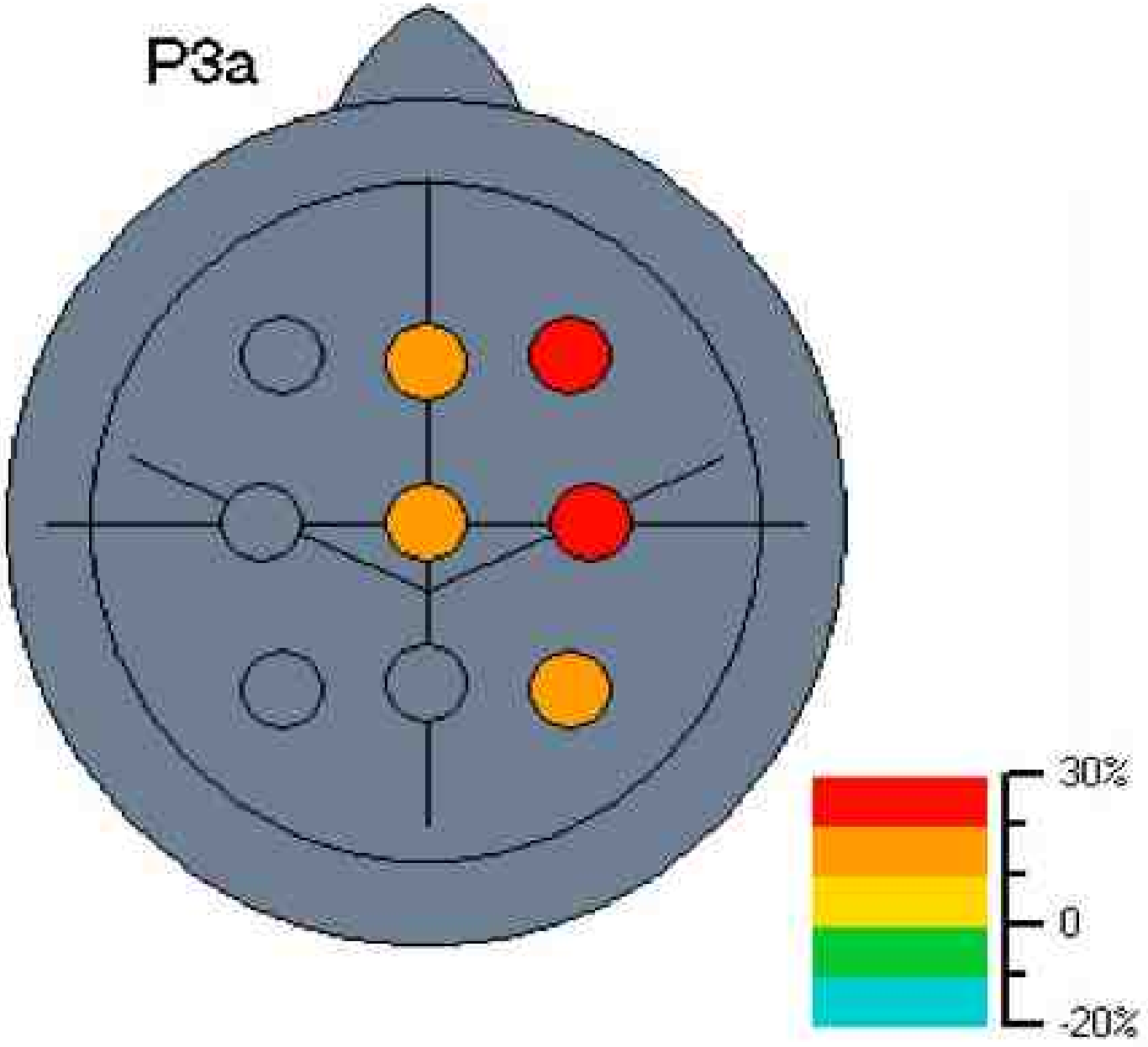
- Current attachment literature: “Borderline personality was linked to experience of trauma and lack of resolution” (Fonagy et al.,1996).
- Disorganized-disoriented (Type D) insecure attachment found in abused / neglected infants and children and adults diagnosed as BPD.
- This attachment pattern predicts later chronic disturbances in affect regulation, stress management, hostile-aggressive behavior, and dissociative defenses (BPD symptoms).
- Recent models emphasize relational attachment trauma (abuse/neglect) in infancy, rather than sexual trauma in later childhood.

- Contemporary child psychiatry literature describes “Borderline syndrome” of latency age children referred to as “multiple complex developmental disorder” (Ad-Dab’Bagh & Greenfield, 2001)
- Pathogenesis - an interaction of diatheses (constitutional predisposition identified by neurobiological markers) *and* stressors (childhood trauma and parental psychopathology)
- *Neurobiological abnormalities are the result of environmental stressors, specifically, effects of neonatal stress on brain development*
- ADHD, bipolar diagnoses, but where is childhood personality disorder?

- Dinn et al. (*Prog. Neuropsychopharmacology and Biological Psychiatry*, 2004):
- BPD patients show striking deficits in nonverbal executive function and nonverbal memory, but unimpaired in verbal fluency and verbal working memory (implicit-explicit).
- Refer to RH role in processing affective stimuli (facial expression, affective intonation). "Dysfunction of right hemisphere frontotemporal regions may be associated with borderline personality disorder."

- Meares, Schore, & Melkonian, *Australian and New Zealand Journal of Psychiatry*, 2011, Is borderline personality disorder a particularly right hemispheric disorder? A study of P3a using single trial analysis).
- Event-related potential (ERP) study of BPD, a disorder of affect regulation, shows impairment of RH limbic-prefrontal connections
- “The etiology of a disturbed maturation of neurocircuitry include disturbances of attachment (Schore, 1994, 2005) and also the effect of traumatic impairments which disrupt maturational processes.”

- “This finding is consistent with the concept that disturbances of BPD reflect an impairment and dysregulation of the right brain (Schore, 1994).”
- The right brain abnormalities of inhibitory circuitry indicate a disturbance underlying of complaints of pain and other bodily distress made by the typical borderline patient.


P3a
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- Schore (1994): “The developmental psychopathology of personality disorders.”
- “The dyadic dysjunctions between the caregiver and borderline child-to-be are already apparent in the first six months…Due to the primary caregiver’s severely limited capacity to act as a psychobiological regulator of the infant’s maturing nervous system, the attachment system poorly forms.”

- “This represents a deprivation of conditions that are necessary for the experience-dependent maturation of a corticolimbic system that can regulate subcortical activity. This developmental structural defect becomes permanent by the middle of the second year and is responsible for the later socioaffective impairments of borderline personality disorders.”

- Crandall, Patrick, & Hobson, 'Still-face' interactions between mothers with borderline personality disorder and their 2-month-old infants (*Brit. J. Psychiatry*, 2003).
- During SF mothers with BPD more intrusively insensitive towards their infants. Infants of mothers with BPD show more looks away and more *dazed looks*, indicating "a different strategy of dealing with interpersonal stress."
- After SF these infants "were depressed in affect and continued to show more dazed looks," and "less satisfying re-engagement with the mother.

- Gaze aversion and dazed looks are similar to “states of infant‘freezing’observed in disorganized infant attachment patterns” [early borderline dissociation].
- Conclusions - “The diagnosis of BPD is associated with a particular pattern of mother-infant interaction.”
- “Even as early as 2 months of age, there are signs that the infants of such mothers manifest atypical social-emotional responses to interpersonal stress… These infant characteristics probably reflect the impact of maternal relatedness, and…represent early signs of potentially *dysfunctional self-regulation*”

- Lanius-Schore-study, London Health Sciences Center, University of Western Ontario, Canada.
- Neural correlates of mother-infant attachment relationships in mothers with borderline personality disorders and healthy controls.
- fMRI study of neurobiology of attachment + home videos + Strange Situation + AAI
- Study normal vs borderline mother's viewing of videos and implicit perception of their infant's attachment cues; patterns of limbic activation, ANS activity, and affect regulation strategies associated with secure and insecure patterns.

- De Bellis (*Psychoneuroendocrinology*, 2002):
- “Early childhood traumatic experiences, such as childhood maltreatment, are associated with an enhanced risk of adolescent and adult alcohol and substance abuse disorders.”
- “Maltreated children and adolescents manifest dysregulation of major biological stress response systems including adverse influences on brain development…[This] may put a child at risk for adolescent or young adult onset alcohol or substance use disorders.”

- Hill et al. (*Biol. Psychiatry*, 2001): offspring of alcoholic families at high risk for alcoholism show smaller right amygdala volumes
- Schoenbaum and Shaham (*Biol. Psychiatry*, 2008): "The role of the orbitofrontal cortex in drug addiction: review of preclinical studies."
- Goldstein et al. (*Psychiatry Research Neuroimaging*, 2005): "Anger and depression in cocaine addiction: association with the orbitofrontal cortex."
- Stalnaker et al. (*Ann. NY Acad. Sci*., 2007): compulsive or inflexible cocaine addiction behavior is associated with orbitofrontal-amygdalar dysfunction

- Johnson et al. (*Neuropsychologia,* 2008) neuropsychological study of adolescent binge drinkers.
- OFC of adolescent binge drinkers involved in "poor affective decision-making."
- "Affective and emotional systems play a critical role in such learning processes."
- This deficit "would predispose individuals to poorly controlled substance use, as they become more likely to be lured by immediate reward, or more oblivious to the negative future consequences of their choice."

- Adolescents high-risk for alcoholism show impairments on OFC affective control.
- This alteration of "orbitofrontal/ventromedial-amygdala circuitry-related emotions and decision making may predate alcohol use and may reflect risk factors for, rather than the consequence of, alcohol abuse."

- Bradshaw, G.A., Schore, A.N., Poole, J.H., Moss, C.J., & Brown, J.L. (2005). Elephant breakdown. *Nature*, 433, 807.
- Bradshaw, G.A., & Schore, A.N. (2007). How elephants are opening doors: developmental neuroethology, attachment and social context. *Ethology*, 113, 426-436.

Elephant breakdown

Social trauma: early disruption of attachment can affect the physiology, behaviour and culture of animals and humans over generations.

G.A. Bradshaw, Allan N. Schore, Janine L. Brown, Joyce H. Poole and Cynthia J. Moss

The air explodes with the sound of high-powered rifles and the startled infant watches his family fall to the ground, the image seared into his memory. He and other orphans are then transported to distant locales to start new lives. Ten years later, the teenaged orphans begin a killing rampage, leaving more than a hundred victims.

This scene is strikingly similar to post-traumatic stress disorder (PTSD) observed in Kosovo and Rwanda, but here, the teenagers are young elephants and the victims, rhinoceroses. In the past, animal studies have been used to make inferences about human behaviour. Now, studies of human PTSD can be instructive in understanding how violence also affects elephant culture.

Psychobiological trauma in humans is increasingly encountered as a legacy of war and socio-ecological disruptions. Trauma affects society directly through an individual's experience, and indirectly through social transmission and the collapse of traditional social structures. Long-term studies show that although many individuals survive, they may face a lifelong struggle with depression, suicide or other behavioural dysfunctions. In addition, their children and families can exhibit similar symptoms, including domestic violence. Trauma can define a culture.

How PTSD manifests has long been a puzzle, but researchers today have a better idea as to why effects of violence persist so long after the event. Studies on animals and human genocide survivors indicate that

Social bonds guide an elephant's development.

decimated by mass deaths and social breakdown from poaching, culls (systematic killing to control populations), and habitat loss. With an estimated ten million elephants in the early 1900s, there are only half a million left today. Wild elephants are displaying symptoms associated with human PTSD — abnormal startle response, depression, unpredictable asocial behaviour, and hyper-aggression.

Elephants are renowned for their close relationships. Young elephants are reared in a matriarchal society embedded in complex layers of extended family. Culls and illegal poaching have fragmented these patterns of social attachment by eliminating the supportive stratum of the matriarch and older female caretakers (allomothers).

Calves witnessing culls and those raised by young, inexperienced mothers are high-risk candidates for later disorders, including an inability to regulate stress-reactive aggressive states. Even the fortunes of young ones

demonstrated when researchers re-introduced older bulls to quell the young males' violence. Hyperaggression and abnormally early musth cycles (periods of sexual activity and hormonal shifts) both ceased.

Elephant hyperaggression is not an isolated event. At another heavily impacted African park, intraspecific mortality among male elephants accounts for nearly 90% of all male deaths, compared with 6% in relatively unstressed communities. Elsewhere, including Asia, there are reports of poor mothering skills, infant rejection, increased 'problem animals', and elevated stress-hormone levels.

Elephant sociality is both a strength and weakness. As with humans, an intact functioning social order helps buffer trauma. But as human populations increase, more elephants are likely to live in environments characterized by severe anthropogenic disturbance. Current methods for conserving both wild and captive elephant populations fail to preserve elephant social systems. Even successful rehabilitation centres, such as The David Sheldrick Wildlife Trust, can only partially restore social processes because there are too few older herd members. There is an added danger to social breakdown, namely that selection for asocial heritable traits in the absence of normal socialization may increase under adverse conditions. All these factors bring into question what kinds of behaviour are being promulgated in both *ex situ* and *in situ* conservation programmes and compel new conservation strategies that promote normal social patterns.

Neuroscience has demonstrated that all mammals share a ubiquitous developmental attachment mechanism and a common stress-