New technology has enabled enormous growth in research relating to the structure, function and development of the human brain. The research findings support and extend attachment theory in ways likely to revolutionise the practice of psychotherapy. In this article I will outline some of the most relevant findings and suggest implications for the practice of psychotherapy.

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Attachment relationships in the first year of life are likely to be the most significant determinant of a person’s level of lifelong wellbeing. Early attachment experiences provide the context for formation of an implicit sense of self, development of foundations for social, emotional and relational functioning and establishment of ways of coping with perceived threats to survival (Schore, 2002, P. 11). The attachment relationship, particularly in the first year, influences the structure and function of the developing brain in profoundly significant ways. Neurobiological research over the past ten years transforms attachment theory to a regulation theory and integrates psychological, neurological and biological models of human development in a way that brings a paradigm shift to concepts of psychotherapy (Schore, P.3, 2009a).

I began working with trauma clients some time before the most recent research findings were available. In retrospect, I can see the reality of the deficits wrought by attachment trauma and neglect in a number of clients and I always assess for attachment trauma and style now. One client, Jennifer,* presented after a life threatening medical crisis had triggered early life trauma leaving her extremely fragile, destabilised and with few apparent coping resources. As an infant there had most likely been significant transmission of intergenerational trauma from a mother who had experienced extreme abuse as a child, which had never been resolved (see Hesse et al., cited in Solomon & Siegel, 2003).

The mother, however, was extremely dedicated and so determined to remain with her baby that she chose to have daily consultations with a local doctor rather than going to hospital for treatment for a nervous breakdown. (In the absence of recent research into right hemisphere to right hemisphere unconscious communication, this information may have lead to assumption of good enough attachment.) Jennifer was dissociative and had little sense of self. She had experienced severe sexual abuse throughout middle childhood at the hands of neighbors and had previously done quite a bit of work relating to the sexual abuse but without connecting with the emotions involved. In contrast, being flooded with emotions had become an almost constant experience since the medical crisis, particularly self condemnation for not retaining more control over things which had happened and unrealistic self blame for some of the ongoing symptoms.

The early work of therapy was focused primarily upon building relationship; being there, hearing and empathising. Words flooded, emotions jumbled. Providing concepts, words, ways of understanding and normalizing, helped to bring coherency, groundedness and connection. Often, as I tried to form clearer pictures of her life, places, relationships, and sequences of events, I used diagrammatic representations on large pieces of paper in attempts to bring order to the disintegrated jigsaw of her life. These seemed to support greater coherence in her own understanding and narrative of her life. During the time I worked with Jennifer, I encouraged her participation in “The Women’s Circus” as a supportive but challenging social situation. After that she began a new sport to hopefully build some new, healthier connections as she’d realized most previous relationships had been with very controlling people.
situations presented. Gradually as Jennifer talked about the sexual abuse, she became more aware of body sensations and emotions. She learned to recognise when she dissociated and regrounded herself and so developed greater emotional regulation. It often felt as if the relationship we had formed and the connection between us “held” her present as she coped with more and more distressing emotions and memories without having to dissociate. I now think of this as an interrelational regulation of emotions. Jennifer’s survivor attachment pattern was avoidant and she would often collapse into states of helplessness and hypo-arousal. I often encouraged her to stand and walk around during sessions to move out of these states. As she realized the effectiveness of this strategy she began to use it in everyday life and relationships, particularly when she needed to feel empowered. Beneath the survivor avoidant pattern was disorganisation, dissociation and extensive internal conflict and confusion.

Recently the medical trauma was repeated. This time Jennifer has been able to assert herself, make choices and overall keep a significant degree of control over her situation. She has known when things have been triggered and managed them reasonably well. Because of distance and medical realities, we’ve had only one face to face and three phone sessions in the nine months since this last medical challenge began. Jennifer is pleased with how she has coped with things this time and is now talking about what she wants to do with the rest of her life. While this is in part due to facing her mortality, it is also a sign of greater selfhood and freedom from having to live according to the expectations of those around her which had been a hallmark of her life until recently. This client seems to have grown from the long term consistency, acceptance, respect, support and care of the therapeutic relationship from avoidant and disorganised attachment styles to “earned secure” attachment. She has developed a reasonably integrated sense of self and is beginning to find and choose things in her life which nurture and fulfill her. In total, I worked with Jennifer for about 60 sessions spaced fortnightly over three years with extended breaks over some holiday periods. Ideally further therapy would help secure these achievements, however it is possible that, having developed more sense of self, Jennifer will continue to grow without this further support.

The human brain’s growth and development is use dependent and influenced by experience to a far greater degree than the human body. The brain develops in response to repeated patterned experiences at particular critical phases of development. Neural firing happens in response to experiences, and, with repeated neural firing, neural pathways are created and strengthened. Types of experience or absences of experience impact brain development (Perry, 2004, P. 9). This is particularly true in the first year of life, during which brain size increases radically (101% overall size and subcortical 130%, Knickmeyer et al. cited Schore, 2009a P.7). The brain of a severely neglected child will be as much as one third smaller and much less developed than that of a normal child, by the age of three (Perry, 2004). Throughout the first year the right brain develops most rapidly. Attachment relationships during this year provide most of the repeated patterned experience required for this phase of development and have most impact on the development of the right brain.

The brain hemispheres are not two halves of one brain but more accurately, two cortical and subcortical systems, each unique in structure and function. The left hemisphere begins to develop later than the right, is more involved in conscious, explicit, linear and logical processing. It is not only much slower in functioning than the right hemisphere but is also limited in its capacity to influence the right hemisphere (see Diagram. 1). The right hemisphere is dominant “for maintaining a coherent, continuous and unified sense of self” (Devinsky cited in Schore 2009b, P. 195). The right hemisphere processes information more rapidly and holistically, responds with immediacy to environmental threats and pain and is pre-eminent in all unconscious relational interactions. Right brain to right brain communication facilitates the maturation of the right brain. In RH – RH intersubjective attachment transactions, the attuned mother co-creates a growth facilitating environment that allows the infant to learn how to be with another and in the process to learn how to be (Rotenberg cited in Schore, 2009a, P. 10). Schore describes the right brain implicit self as “a cohesive, active mental structure that continuously appraises life’s experiences and responds according to its scheme of interpretation - clinical models now refer to a relational unconscious whereby one unconscious mind communicates with another unconscious mind” (Schore, 2009a, P. 2). Preverbal communication is the realm of non-consciously regulated intuitive behavior and implicit relational knowledge. Whether information
Diagram 1

is transferred or shared, which information gets across, and on which level it is 'understood', does not necessarily depend on the sender's intention or conscious awareness (Papousek, cited in Schore, 2009a, P.5). Within the right hemisphere are the structures that determine our implicit self, our emotional or core self and the early developing unconscious that drives emotion, cognition and behavior (Schore, 2009a). The quality of attachment relationships is much more significant than previously thought due to right hemisphere dominance in areas vital to relationship and survival.

Attachment theory delineates four attachment styles which are stable by the end of the first year and tend to remain stable throughout life in the absence of reparative relationships (Cozolino P. 71 & 148, Badenoch, 2008, P. 54). Attachment patterns also tend to pass down through generations, as the attachment style of the mother is 85% predictive of the attachment style developed by the child (Hesse, cited in Badenoch, 2008, P. 53). Alarminglly, in the US between 1995 and 2005 there was a 10% decrease to 55% in secure attachments (Sroufe, Egland Carlson & Collins, 2005 cited in Badenoch, P. 63). Children judged secure during infancy, were found throughout childhood to be "more ego – resilient, more popular with peers, more competent and happier than formerly insecure children.” (Weinfield, Sroufe, Egeland & Carlson, 1999, cited in Solomon & Siegel, P. 71). In contrast, children whose attachment figures are unsafe, abusive, uncaring or unavailable, suffer long term fear and emotional deregulation. "When stress is extreme, prolonged, or we are too young to adapt, brain functioning and behavior become organized around fear, rigidity, and an avoidance of stimulation and exploration” (Cozolino P. 214). Unfortunately neglect has been found to have as much as or more effect than abuse. For an infant or child to be alone and unprotected is to be, experientially, without the means to survive. 82% of children who are neglected or abused have disorganized attachment (Carlson et al., 1989, cited in Badenoch, P. 136). Disorganised attachment is associated with psychopathology and high levels of aggression in both childhood and adolescence (Solomon & Siegel P.60). Between these two extremes of secure and disorganised attachment are avoidant and anxious-ambivalent attachment styles, which were, at first, considered signs of “good enough” mothering however recent research findings bring this into question. One of the most significant effects of early attachment relationships is the development of bodily regulation.

**BODILY REGULATION**

It has become clear that attachment styles actually reflect HPA arousal biases more than coping styles (Cozolino, P. 147). With secure attachment, the comforting presence of the attachment figure is internalized, enabling development of the successful use of other people to modulate and manage stress. Avoidant attachment leads to a bias in the autonomic nervous system towards
parasympathetic arousal. This is reflected in withdrawal, low levels of emotional expression, helplessness, lower heart rate and decreased activity (Cozolino, P.147). Conversely anxious – ambivalent attachment leads to a bias towards sympathetic arousal in the autonomic nervous system indicated by emotional disregulation, irritability, acting out, dependency and low ability to cope with or recover from stress (Cozolino, P147). Disorganised attachment seems to be indicative of highly unregulated arousal and behavior where the conflict between approach and avoidance impulses completely overwhelms the child’s attempts to cope. It is becoming clear that the capacity to dissociate is a “bottom line survival defense against overwhelming, unbearable emotional experiences----the escape when there is no escape” (Schore P. 195 2009b). Ogden (2006, P. 57) argues that dissociation can be either extreme hyperarousal or hypoarousal. (see diag. 2). Whatever the attachment pattern, the degree of bodily regulation and the continued use of strategies used in early attempts to survive become embedded in early developing right brain structures related to survival and tend to continue throughout life.

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Survival has primacy in the human organism and the brain develops and functions sequentially and hierarchically to enable this primacy. The amygdala, functional one month before birth, instantaneously assesses incoming sensory data for environmental danger and upon perception of threat, triggers rapid automatic, survival reactions which activate the fight/flight/freeze response. Early exposure to trauma or stress sensitizes the amygdala to danger (Cozolino, 2006. P. 56 & 60). The brainstem and hypothalamus, which regulate survival responses, brain and body arousal, bodily processes, temperature, hunger, thirst, and activity level, seem to be fully developed by nine months of age. Stress and trauma, both prenatally and during the first 9 months of life, influence the development of these structures, compromising bodily regulation. It seems that the influences during this stage of life establish biological set points which can endure throughout life. The individual becomes primed to respond to perceived threat with primitive survival mechanisms throughout life or until effective interventions change what becomes a sub-cortical, habitual response to perceived threat (Ogden, 2006, P. 33 – 35).

**LONG TERM EFFECTS OF BODILY DISREGULATION**

When danger is perceived, which happens more readily when the amygdala is sensitized to danger, arousal mechanisms are activated to respond to immediate threat (short term survival). At the same time activity important to long term survival, such as digestion and immune response, is reduced. Individuals with secure attachment can use relationships to cope with stress and return to homeostatic balance, which is adaptive for long term survival. Those without this capacity tend to remain at higher or lower than optimum levels of arousal, chronically disrupting their homeostatic balance and compromising physiological, emotional and immunological functioning (Cozolino, 2006. P. 60-61). The hierarchical functioning of the brain means that when a fight, flight or freeze responses is triggered, energy is diverted from all other aspects of life.

**IMPACT OF HIERARCHICAL FUNCTIONING**

When a child is stressed or feels unsafe, cortical function is inhibited and learning is impeded (Ogden, 2006, P. 36). Ogden notes eight action systems which have been delineated: defense, attachment, exploration, energy regulation, caregiving, sociability, play and sexuality. These fall into two categories, those needed for defense and those pertaining to daily life. The defense systems take precedence in situations of perceived threat until this has passed. The attachment system “because of its role in ensuring survival and providing the necessary biopsychosocial regulation for optimal brain development provides the foundation for all other systems” (Ogden, 2006, P. 111). When they are endangered, children instinctively reach out to attachment figures for support (Ogden, 2006, P. 90). Children who because of insecure attachment, are focused upon survival to the exclusion of exploration, sociability and play, face impoverished social capacities.
“In the face of early interpersonal trauma, all of the systems of the social brain become shaped for offensive or defensive purposes. Mirror systems are employed to defend instead of cooperate: attachment schemas are used as battle plans instead of ways of connecting. Faces are explored for signs of disapproval. Regulatory systems become biased toward arousal and fear, priming our bodies to sacrifice well-being in order to stay on full alert at all times. Reward systems designed to make us feel good through contact with loved ones are manipulated with drugs, alcohol, compulsive behaviors, and self harm. When the brain is shaped in this way, social life is converted from a source of nurturance into a minefield.”

(Cozolino, P.230-231)

Interpersonal trauma, in infancy within the context of the attachment relationship causes a cascade of effects upon all following social, emotional and intellectual development.

The middle prefrontal regions (MPF) (including medial, ventral, anterior cingulate and orbitofrontal cortex) of the right hemisphere of the brain are particularly impacted by insecure attachment (Cozolino, 2006, P. 71 & 72). Optimum development of these regions is vital for affect regulation. The MPF are genetically primed to form connections through early relational experiences. Neural circuits in this brain area integrate and connect the body, brainstem, limbic, cortical and social processes. Optimal integration of these neural networks enables more complex input to become integrated into decisions. These regions seem to function as a feedback loop which enables balancing or modulation of more primitive reactions and reflexes. Put very simply, the connective network between the cortical and subcortical structures enables modulation of survival responses so that they are based more upon current reality than previous traumatic conditioned fear responses. Siegel (2007) found a number of vitally important areas of functioning mediated by the middle prefrontal regions of the brain

1. Bodily regulation – sympathetic and parasympathetic systems working in balance and returning to homeostasis. Integration with the middle prefrontal cortex slows processing and modulates the more primitive fight/flight/freeze responses of the limbic system.
2. Attuned communication – coordination of own and another’s mind involves resonance processes in middle prefrontal areas.
3. Emotional regulation – the capacity to be emotionally alive, but not overwhelmed by chaotic, intense emotions, is supported by integration of middle prefrontal regions
4. Response flexibility – the capacity to pause, recognise, evaluate and choose from various options before action or reaction
5. Empathy – capacity to resonate internally with another, based upon mirror neurons which form resonance circuits. This involves awareness of bodily states, understanding of our feelings and attribution that it may also be happening in another.
6. Self awareness and insight – the ability to shape and tell our story with coherence and emotional connection
7. Fear regulation – development of the middle prefrontal regions enables flow of the calming neurotransmitter GABA bringing modulation of the amygdala’s fear based reactions.

Not only do these regions enable appropriate evaluation of and response to perceived threats to survival, all of these capacities are foundational to effective social interaction. Resilience in the face of illness, stress, catastrophe and loss is closely connected to access to a supportive, healthy network of relationships. Those without secure attachment rarely have this benefit. Those with extremely disrupted functioning in these areas, due to poor attachment and particularly attachment trauma (Schore, 2002, P.11), are likely to experience debilitating isolation.

SOME IMPLICATIONS FOR THERAPY AND THE THERAPEUTIC RELATIONSHIP

The therapeutic relationship is central to healing

Schore points out that at the more severe levels of psychopathology, it is not a question of making the unconscious conscious: rather it is a question of restructuring the unconscious itself. The therapeutic relationship can act as a growth-facilitating environment for the right brain, biological substrate of the unconscious, thereby releasing interrupted and blocked developmental processes (Alvarez, Journal of Child Psychotherapy, 2006 cited in Schore, 2009a, P. 4). It has become clear that the brain remains plastic and that the therapeutic alliance can facilitate increasing integration in the brain. There is no longer any doubt that psychotherapy can result in detectable changes in the brain. These changes occur in the emotional, right-brain psychobiological substrate of the unconscious dominant for implicit learning (Etkin, Prittenger, Polan & Kandel Journal Neur, Clin. Neur., 2005 cited in Schore, 2009a, P. 34). The quality of the therapeutic relationship has consistently been found the most significant predictor of treatment success (Saffran & Muran, 2000, cited in Schore, 2009a P. 4 additional notes). The unconscious, implicit, intersubjective communication between therapist and client is far more significant than the content communicated between
Understanding how the therapeutic relationship can change the brain

Caregiver - infant and therapist – client relationships both involve right hemisphere to right hemisphere emotional interaction and regulation and involve the same regions of the brain. In therapy we can assist development of integration of the middle prefrontal regions of the right brain (the areas directly compromised by insecure attachment or attachment trauma) by helping clients to become increasingly aware of the bodily expression of their emotions. By maintaining authentic, empathic attunement with clients as they relive traumatic experiences, greater emotional regulation is facilitated (Badenoch, 2006, P.34). In infant – caregiver dyads the repair of ruptured relationship is vital in developing secure attachment. In the therapist - client relationship recognition of relational stresses, strains and failures and subsequent repair is vital in bringing healing at deep relational levels (Badenoch, 2006, P.34).

Greater integration between left and right hemispheres can be facilitated as clients are supported in becoming able to name emotions and body sensations and verbally express more emotionally coherent and detailed autobiographical narratives. Acceptance and nurturing of previously alienated “parts” of self or states of being within the therapeutic relationship can bring greater integration of the whole person. Siegel outlines nine domains of neural integration in which therapists can facilitate integration for their clients (Siegel, 2007, P. 292ff). Awareness of these domains can assist therapists to be more effective in their work with clients.

Assessment for attachment trauma is extremely important in trauma work. People with significant attachment trauma lack resilience and may be overwhelmed and destabilized by the intensity of processing traumatic material. More attention needs to be placed upon the therapeutic relationship where attachment trauma or early trauma has compromised development (see Vivekananda, 2002, P. 14ff.). It has been suggested that short term therapy returns people to their “premorbid attachment style” while long term therapy supports attainment of earned secure attachment (Schore, 2009a, P. 6 additional slides). It has been found that any long term healthy supportive relationship can bring healing enabling the development of a secure attachment pattern.

Adult attachment styles can be assessed using the Adult Attachment Interview developed by Main and Goldwyn in 1998. Research indicates that a person’s capacity to communicate coherently about their childhood reflects the development and integration of neural systems which are impacted by early social experience, bonding and attachment. Adults with secure childhood attachment have detailed memory of childhood, a balanced perspective including both positive and negative aspects of their parents and childhoods and their narratives are coherent. They have resolved any negative or traumatic experiences and seem able to be emotionally available to their children (Cozolino, 2006, P. 144 – 146). Those with avoidant attachment tend to be unemotional, have little recall for their childhoods, minimise the importance of and idealise aspects of both their childhood and their parents and narratives of their childhood are incoherent apparently due to lack of information and significant gaps in time (Ibid).

Anxious-ambivalent attachment narratives about childhood are disorganised with excessive verbal output, mixing past and present events and show little awareness of the listener (Ibid). Disorganised attachment narratives are highly incoherent, with verbal and emotional disorganization, missing information, emotional intrusions and content indicative of unresolved trauma and loss (Ibid). Whilst the AAI needs to be applied accurately for research purposes, for counselling a broad understanding of the four AAI categories combined with observation of the seven capacities developed with secure attachment (Siegel, P. 44) could be a useful informal indication of a person’s attachment style and early childhood environment.

For those who believe in and know the God of love
and relationship, current research is affirming of our belief that healthy relationship is central to human development and well-being. Relationship has both the capacity to wreak the most destruction and the power to bring the greatest healing to human beings. Humans are created to grow, be and become in the context of relationships. Research has shown that empathy and the therapeutic relationship are the most significant factors in the success of counselling relationships, irrespective of counselling strategies or orientation used. Because of the plasticity of the brain, the therapist’s capacity to know, accept, connect empathically and with loving kindness or unconditional positive regard can bring growth, health and healing to both the human brain and the human being. Understanding and integration of these research findings into our work as therapists has the potential to increase our awareness and effectiveness.

*Names and other details have been changed to protect identity.

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Diagram 1 is adapted from Schore, 2009 ACF conference.
Diagram 2 is by Wheatley-Crosbie, adapted from Levine, Porges and Ogden also cited in Schore ACF conference 2009.