The Neurosequential Model of Therapeutics

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Going beyond the medical model, The Neurosequential Model of Therapeutics maps the neurobiological development of maltreated children. Assessment identifies developmental challenges and relationships which contribute to risk or resiliency. Formal therapy is combined with rich relationships with trustworthy peers, teachers, and caregivers.

The developing child is a miracle of complexity. Billions of dynamic processes, internal (e.g., release of neurotransmitter at the synapse) and external to the child (e.g., interactions with caregivers and family), work together to influence, shape, and create the individual. Each person becomes unique, with his or her collection of strengths and vulnerabilities. In some cases the vulnerabilities can be profound, interfering with the capacity to engage others, participate in, contribute to, and appreciate the fullness of life. For centuries scholars have known to some degree that the capacity to express full human potential is related to the balance of developmental opportunities and challenges. In extreme cases of developmental challenge such as maltreatment—threat, neglect, humiliation, degradation, deprivation, chaos, and violence—children express a range of serious emotional, behavioral,

cognitive, and physiological problems. These myriad problems impact the individual, family, community, and society; in the United States these problems are the target of billions of dollars and even more hours of work to educate, protect, enrich, and heal children impacted by developmental maltreatment.

Despite these efforts and expenditures, the results of policy, programs, and practice tend to be ineffective and incomplete. Millions of children remain scarred by childhood trauma and maltreatment, expressing only a fraction of their full potential. The developmental insults create a lifetime of vulnerability to emotional, physical and social health problems (Anda et al., 2006).

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One contributing factor in this inefficiency is insensitivity to the fundamental principles of brain organization, development, and functioning. It is the brain, after all, that is the origin of the major problems addressed in education, mental health, child protection, juvenile justice, and substance abuse interventions. Yet without understanding the basic principles of how the brain develops and changes, one cannot expect to design and implement effective interventions. Efforts that are well intended may be developmentally misinformed. This is very evident in therapeutic efforts with traumatized and maltreated children. It is the hope, for example, that some therapy typically provided for 45 minutes, once a week, will reverse ten years of abuse, neglect, humiliation, degradation, chaos, threat, and fear. This is an unrealistic hope. The neural systems that have been altered by developmental trauma (i.e., those systems mediating neuropsychiatric symptoms) have been shaped over years with hundreds of thousands of repetitions. Traditional therapies alone, constrained as they are in time and duration by many factors including medical-economic, provide but a fraction of the reorganizing input required for meaningful and sustained change.

Over the last twenty years, the clinical teams at The ChildTrauma Academy have been adapting their clinical practice to be better informed by the core principles of neurodevelopment and neuroscience. The hope is that by better understanding how the brain changes they will better understand the effects of maltreatment on the child and, thereby, potential strategies for effective intervention. The results have been promising. As teams have moved from a traditional medical model approach to severely traumatized and maltreated children to more developmentally sensitive, neurobiology-guided practices, the outcomes for clients have significantly improved (see Perry, 2006; Barfield et al., submitted). The current iteration of this approach is coined The Neurosequential Model of Therapeutics (NMT).

The Neurosequential Model of Therapeutics

The Neurosequential Model of Therapeutics is not a specific therapeutic technique or intervention; it is a developmentally sensitive, neurobiologically informed approach to clinical work. The NMT integrates several core principles of neurodevelopment and traumatology into a comprehensive approach to the child, family, and their broader community (see below). The NMT process helps match the nature and timing of specific therapeutic techniques to the developmental stage and brain region and neural networks mediating the neuropsychiatric problems. The goal of this approach is to structure the assessment of the child, articulation of the primary problems, identification of key strengths, and application of interventions (educational, enrichment and therapeutic) in a way that will help family, educators, therapists, and related professionals best meet the needs of the child.

NMT Assessment *Where the child has been:* The brain is composed of billions of neurons and glial cells that divide, move, specialize, connect, interact, and organize until they have formed a hierarchical group of functional structures. The "lower" parts of the brain mediate "simple" functions that exist to keep the body alive (e.g., respiration, heart rate, and body temperature), and the "higher" cortical parts mediate such complex functions as language and abstract thinking. Neuronal networks facilitate intra-structure communication that allows an individual to perform daily tasks. Thus, the human brain is continually sensing, processing, storing, and acting in response to information from external and internal environments. The first "stops" for input from the outside environment (e.g., light, sound, and taste) and from the inside body (e.g., temperature) are the "lower" regulatory areas of the brain—the brainstem and diencephalon, which are incapable of conscious perception.

During development, the brain organizes from bottom to top, with the lower parts of the brain developing earliest, the cortical areas entering final developmental processes much later in life, and major changes taking place as late as early adult life. The majority of brain organization, however, takes place in the first four years of life. Because this is the time when the brain makes the majority of its "primary" associations and the core neural networks organize as a reflection of early experience, early developmental trauma and neglect have disproportionate influence on brain organization and later brain functioning. Children exposed to consistent, predictable, nurturing, and enriched experiences develop neurobiological capabilities that increase their chance for health, happiness, productivity, and creativity, while children exposed to neglectful, chaotic, and terrorizing environments have an increased risk of significant problems in all domains of functioning. Dysfunctional symptoms and functional assets in children are both related to the nature, timing, pattern, and duration of their developmental experiences. In a child who has experienced chronic threats, the result is a brain that exists in a persisting state of fear. These trauma-invoked, repetitive alterations have made the child's stress response oversensitive, overreactive, and dysfunctional because of overutilization of brainstem-driven reactions. These primitive reactions, such as dissociation and hypervigilence, were adaptive while the stressor was present. However, the primitive reactions become entrenched over time, and the "lower" parts of the brain house maladaptive, influential, and terrifying preconscious memories that function as the general template for a child's feelings, thoughts, and actions.

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The brain, therefore, is an historical organ. As it is organizing, experiences both good and bad shape its many systems. In order to understand an individual one needs to know his or her history. The NMT assessment is very focused on understanding the developmental history of the child. The NMT Core Assessment begins with a review of the key insults, stressors, and challenges present during development. The timing, nature, and severity of these developmental challenges are systematically reviewed and scored, resulting in an estimate of developmental "load." Because different brain systems and areas are developing at various times throughout childhood, an estimate of the neural networks and functions compromised by the child's developmental challenges can be made (Perry, 2001). For example, intrauterine insults such as alcohol use or perinatal caregiving disruptions (such as an impaired inattentive primary caregiver) will predictably alter the norepinephrine, serotonin, and dopamine systems of the brainstem and diencephalon that are rapidly organizing during these times in life. These early life disruptions, in turn, will result in a cascade of functional problems in the various brain areas these important neural systems innervate (for more, see Perry, 2008). Hence, the rationale for the NMT's primary focus is on developmental history as a key part of the assessment.

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A second important element of the NMT Core Assessment is review of the relational history of the child during development. This NMT Relational Health History provides important insights into attachment and related resiliency or vulnerability factors that may have impacted the functional development of the child (see text in Fig. 1).

NMT Functional Review *Where the child is:* The second component of the NMT process is a review of current functioning which allows estimates to be made of which neural systems and brain areas are involved in the various neuropsychiatric symptoms and the key strengths of the child (see Fig. 2). An interdisciplinary staffing is typically the method for this functional review. This process helps develop a working Functional Brain Map for the individual. This visual representation gives a quick impression of developmental status in various domains of functioning. A ten-year-old child, for example, may have the speech and language capability of an 8-year-old, the social skills of a five-year-old, and the self-regulation skills of a two-year-old. This visual "map" is very helpful when talking about trauma, brain development, and the rationale for various recommendations with educators, mental health staff, caregivers, and clients. It is also very useful to help track progress. Improvement, as shown in changes in the shadings of various brain areas, is quickly seen in the comparison of today's brain map with one from six months ago and is a powerful reinforcement for tired parents and hard-working frontline staff who feel their efforts are for naught.

Developmental History

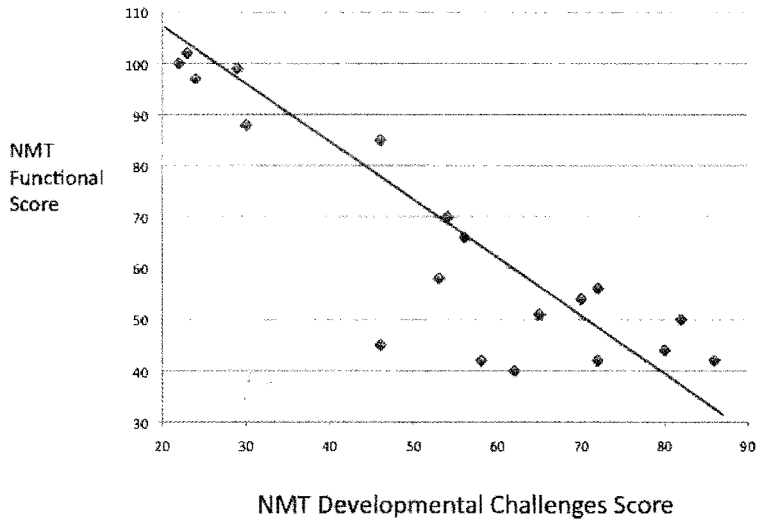

Figure 1: Relationship between developmental insults (trauma and neglect) and functional organization of the brain. Using the NMT Developmental History measure (higher scores indicate more developmental insult such as trauma and neglect) and the NMT Functional Brain Mapping scores (higher scores indicate positive functioning), a linear relationship is seen between number and intensity of developmental insults and the compromise in normal development and functioning of the brain.

It is of interest to note that individuals who fall below the line have more profound relational poverty (e.g., multiple placements, disengaged or unhealthy primary caregiving) during development and those above the line had relatively more protective relational health (e.g., extended family, few placement disruptions, more stable family relationships).

FIGURE 1

Functional Brain Map

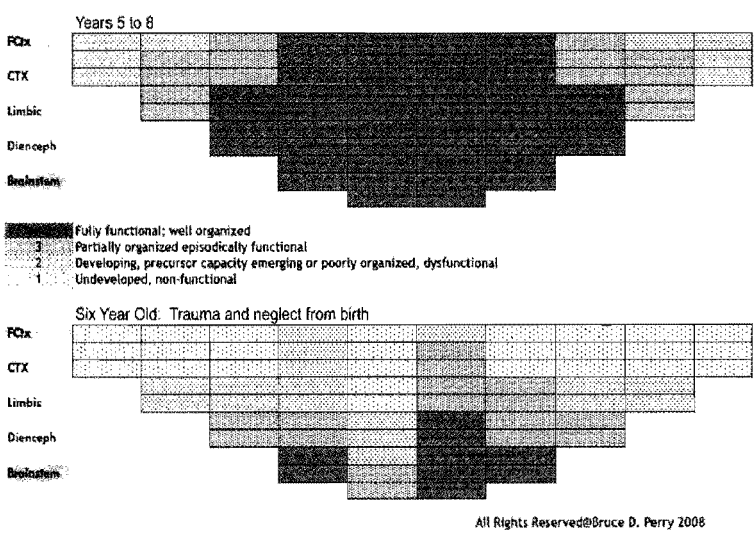

FIGURE 2

Figure 2: NMT Functional Brain "Map": Six-year-old traumatized and neglected child vs comparison child (normal development). This map is generated from an interdisciplinary staffing process examining the presence and functional status of various brain-mediated functions. Each rectangle in the brain triangle diagram indicates a specific brain function. Each rectangle is shaded to indicate functional status (see key above).

Brain functions (e.g., regulation of heart rate: Brainstem; speech and language: CTX; attunement: Limbic) are "localized" to the brain region mediating the core aspects of the specific function (this oversimplification attempts to assign function to the brain region that is the final common mediator of the function with the knowledge that almost all brain functions are influenced and mediated by complex, trans-regional neural networks).

This approximation allows a useful estimate of the developmental/functional status of the child's key functions, helps establish the "strengths and vulnerabilities" of the child, and helps determine the starting point and nature of enrichment and therapeutic activities most likely to meet the child's specific needs. Most important, this functional map helps to document progress and to create a developmentally sensitive sequence to the enrichment, educational, and therapeutic work.

This review requires a working knowledge of neural organization and functioning. In order to "localize" a set of functions to any set of brain networks or regions, the senior clinician leading the interdisciplinary NMT staffing must know child development, clinical traumatology, and developmental neurosciences. This is the major impediment in exporting of NMT approach: it requires a senior clinician to lead the process with a unique combination of clinical and pre-clinical skills.

NMT Recommendations *Where the child should go:* The third major element of the NMT process is providing specific recommendations. The NMT "mapping" process helps determine a unique sequence of developmentally appropriate interventions that can help the child re-approximate a more normal developmental trajectory. As outlined in brief below, these recommendations are made with various principles of neurobiology in mind. While many deficits may be present, the sequence in which these are addressed is important. The more the therapeutic process can replicate the normal sequential process of development, the more effective the interventions are (see Perry, 2006). Simply stated, the idea is to start with the lowest (in the brain) undeveloped/abnormally functioning set of problems and move sequentially up the brain as improvements are seen. This may involve initially focusing on a poorly organized brainstem/diencephalon and the related self-regulation, attention, arousal, and impulsivity by using any variety of patterned, repetitive somatosensory activities (which provide these brain areas patterned neural activation necessary for re-organization) such as music, movement, yoga (breathing), and drumming or therapeutic massage. Once there is improvement in self-regulation, the therapeutic work can move to more relational-related problems (limbic) using more traditional play or arts therapies and ultimately, once fundamental dyadic relational skills have improved, the therapeutic techniques can be more verbal and insight oriented (cortical) using any variety of cognitive-behavioral or psychodynamic approaches.

Neurons are uniquely designed to change in response to activity. Therefore, neural networks change in a "use-dependent" fashion. Because patterned, repetitive activity shapes and changes the brain, chaotic experiences that occur during sensitive times in the child's development create chaotic, developmentally delayed dysfunctional organization. Neural systems, and thus children, can change with dedicated amounts of focused repetition. For example, a neural system cannot be changed without activating it, just as one cannot learn how to write by just hearing about how to write without practicing. Moreover, therapeutic efforts must activate the neural systems that mediate that particular child's symptoms. To date, most therapeutic interventions do not achieve this goal. Because the brain is organized in a hierarchical fashion, with symptoms of fear first arising in the brainstem and then moving all the way to the cortex, the first step in therapeutic success is brainstem regulation. The process of administering repetitive experiences that allow a neglected or traumatized child to regain functioning is not time-limited. It is long, frequent, and requires a global understanding of development. Children must receive care that is developmentally appropriate, but also not age-inappropriate (or at a minimum age-acceptable), and therefore the balance can be difficult to achieve, especially as children age.

An example of a repetitive intervention is positive, nurturing interactions with trustworthy peers, teachers, and caregivers, especially for neglected children who have not had enough neural stimulation to develop the capacity to bond with others. Other examples are dance, music, or massage, especially for children whose persisting fear state is so

overwhelming that they cannot be expected to improve via increased positive relationships or even therapeutic relationships until their brainstem is regulated by safe, predictable, repetitive sensory input. Appointed hours of developmentally sensitive therapy are not detrimental to the child, but they are rarely enough. Ideally the care of the maltreated child must extend to every influential person the child encounters.

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A major element of the NMT staffing process and the resulting set of recommendations is reviewing the current relational milieu of the child. A primary finding of years of clinical work is that the relational environment of the child is the mediator of therapeutic experiences. Children with relational stability and multiple positive, healthy adults invested in their lives improve; children with multiple transitions, chaotic and unpredictable family relationships, and relational poverty do not improve even when provided with the best "evidence-based" therapies. The healing environment is a safe relationally enriched environment. The NMT Relational Health measure makes a simple determination of whether there are sufficient relational supports present to actually provide the safe, nurturing, and attuned environment required to deliver effectively the recommended therapeutic, educational and enrichment activities with sufficient repetition. In many cases, the specific interventions required to help the child are obvious, but the relational environment is so chaotic, so empty, and so transitional that the outcomes will be poor.

Future Directions

The application of the NMT in various clinical settings and with all age groups has resulted in positive outcomes as reported by multiple clinicians using this approach (Perry, 2006) and in independent application of the NMT in a therapeutic pre-school setting (Barfield et al., submitted). The ChildTrauma Academy is currently training individuals and programs in the use of NMT, and an NMT certification process has been developed (see www.ChildTrauma.org). The major challenge, as mentioned above, is developing a cadre of senior clinicians who are capable of leading NMT staffings in their home programs. In order to help with this process, the CTA has been developing both Train-the-Trainer models and Advanced NMT Certification for Senior Clinicians. While in its "infancy" the NMT, along with other neurobiologically-informed, developmentally-sensitive clinical approaches, offers much promise. Continued learning creates hope that this biologically-informed, developmentally-sensitive approach will help professionals better understand and heal maltreated children.

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