IMPACT OF TRAUMA ON CHILDHOOD DEVELOPMENT
IMPLICATIONS FOR THE EDUCATION AND
SOCIAL PROWESS OF REFUGEE CHILDREN

C. Richard Clark  BA (Hons), PhD, MACS, BCN, FANSA, FASSA
Emeritus Professor, Flinders University,
Clinical Director Brain Clinics Australia

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1. BRAIN DEVELOPMENT
Development of neuronal architecture - dendritic fields become progressively more complex through to two years of age

100 million neurons or so developed by birth

700 new neural connections normally develop every second in first few years of life

Source: Fuster, 2015
Traumatised children (e.g. malnourished, impoverishment, poor stimulation, poor social interaction, abuse) show poor physical growth, reduced brain size, retarded cognitive and motor development.
Traumatic environments impact on neural development

Severely traumatised children with PTSD have smaller whole brain and corpus callosum volume and alterations in structure of the cerebellum (Anderson 2002) and frontal cortex. Source: Anda et al 2006

Left CT - healthy 3yo with average brain size. Right CT - 3yo following severe neglect during early childhood - abnormal development of in cortical, limbic & brainstem areas.

Source: Perry, BD, 1997

Normal

Extreme Neglect
Human brain development

Timeframe of early synapse and circuit formation – interference with development could impact on potential of critical functions.

Impact on remediation if circuits not properly wired.
SUBSEQUENT GRAY MATTER PRUNING "LOCKS IN" STAGED DEVELOPMENTS – LIMITS FOR REMEDIATION

Ontogenetic changes over childhood and adolescence in the neural mass
Source: Toga et al, TINS 29, 2006; Gogtay et al, 2006

Ontogenetic development over childhood and adolescence of brain indices of working memory
Source: Keage, Clark et al, Neuroreport, 2008
2. NEUROPSYCHOLOGICAL FUNCTION
EFFECTS OF TRAUMA ACROSS MULTIPLE SYSTEMS AND NETWORKS DURING NEUROPSYCHOLOGICAL FUNCTION

Lateral and superior cortex (sensory-motor-cognitive-executive function)

Septal area (reward, reinforcement, conflict and approach-avoidance)

Amygdala (memory and trigger for anger, fear, sadness, aggression ...)

Hippocampus (episodic memory)

Basal ganglia (motor hold and release)

Insula (visceral mapping, salience)

DMPFC (amygdala modulation)

rACC (Affect: regulation)

OMPFC (attention related decision making)

Hypothalamus & pituitary (ANS regulation, hormonal release; mediation of emotion)

Amygdala (memory and trigger for anger, fear, sadness, aggression ...)

Posterior Cingulate (NCC?)

dACC (Conflict resolution, Attention)

Stria terminalis (amygdala--> hypothalamus via bed nucleus (threat monitoring?)

Retrosplenial Cortex (episodic processing)

Thalamus (sensory-motor relay; inter-cortical connectivity)

Mammillary body (memory)

Brainstem monoamines (neuromodulation)

Sympathetic nervous system

Adrenal cortex (release of stress)

Cognitive

Affective

Neuromodulatory

Neuroendocrine, Autonomic

EFFECTS OF TRAUMA ACROSS MULTIPLE SYSTEMS AND NETWORKS DURING NEUROPSYCHOLOGICAL FUNCTION
CREATION OF TRAUMATIC MEMORIES

- Intense threat - UCS activates amygdala
- Activates monoamines -> DMPFC overarousal
- WM; DMPFC control on amygdala
- Fear conditioning and creation of traumatic memory – associates threat & ‘neutral’ context.

Normal regulatory control over amygdala is lost
FLIGHT OR FIGHT

- Loss of mPFC control – Amygdala control
- Triggers hypothalamus/brainstem activation
- Neuroendocrine and autonomic activity (e.g. cortisol release) and fight or flight response
- Cardiovascular effects

Source: Pitman et al, 2012
CORTICAL OVERAROUSAL

- Experience/re-experience overarouses the brain cortex with increase in noradrenergic activity – hypervigilance – inverted U model applies
- Impairs integrity of brain information processing

**Source:** Pitman et al, 2012
**REACTIVATION OF TRAUMATIC MEMORIES**

- Fear memory reactivated by associated, neutral triggers – flashbacks and re-experiencing
- Reactivation of physiological and emotional response as per original trauma
- Further reinforces fear memory

Source: Pitman et al, 2012
SALIENCE SYSTEMS PROCESSING VISCERAL SENSATIONS
DIRECT ATTENTION TO TRAUMATIC MEMORY

• Emotional response to re-experiencing is mapped and processed in insula
• Response drives direction of attention & awareness to traumatic memory
LONG TERM: AVOIDANCE, NEGATIVITY, DEPRESSION

- Long term, non-rewarding effects of stress and avoidance lead to dymental consequences – rumination, avoidance, negative thinking patterns
- Depression of DA, Serotonin lowering frontal lobe function via habenula
- Results in reduced motivation & drive, anhedonia and apathy, WM issues
WIDE RANGING IMPACT ON CAPACITIES FROM LONG TERM DISRUPTION TO NEUROMODULATORY FUNCTION

NEUROMODULATION

- Noradrenaline: arousal & sleep-wake modulation
- Serotonin: mood, reward systems
- Dopamine – motivation, drive, reward, fine motor

ADHD, OCD, Impulsivity

Personality and planning disorders

Low motivation, hyperactivity, agitation

Anhedonia, addictions

Impaired awareness

Mood disorders

Sleep and arousal issues

Intellectual function

Motor control

Sensory integration, learning and attentional issues

Affective brain

Cognitive brain

Impaired awareness

Maximum performance

Poor performance (underactive)

Poor performance (overactive)

ACTIVATION
IMPACT OF EARLY TRAUMA ON DEVELOPMENT OF CONNECTIVITIES FOR SELF-REGULATION

Acquiring and applying a capacity for socially effective, self-generated action in need satisfaction

- Self-generated conceptual planning (language, images), goal setting and perceptual priming
- Motor plans
- Programs

Evaluation of self-related events (moral, social sense, theory of mind) (drives social and emotional behaviour)

Integration of current self-related events (perceptual awareness)

Representational model of stimuli related to self (self-concept) (self-awareness)

Transformative phylogeny creating agency, self-directed action & awareness. Part of representational memory. Advance on older, simpler sensory-motor brain

IMPACT OF EARLY TRAUMA ON DEVELOPMENT OF CONNECTIVITIES FOR SELF-REGULATION

Acquiring and applying a capacity for socially effective, self-generated action in need satisfaction

Early trauma inhibits effective connectivity in these systems; esp. if associated with lack of attachment and/or the supervisory training/modelling needed for early development.
Impact on neural mass
Loss of developmental potential

Amygdala, DMPFC, brainstem (DA, 5HT)
Traumatic memories, fear conditioning

DMPFC, PMC
Poor self-regulation; social ineptitude; relationship failure

OMPFC
Poorly developed self concept

mPFC, PMC
Negativity bias, avoidance

Brainstem (DA, 5HT), PFC, Striatum
Mood, loss of drive and apathy, motor dysregulation, anhedonia, learning issues

Autonomic
Fight or flight; anxiety, stress

Brainstem (NA)
Overarousal; poor sensory integration, learning difficulties

Triggers, amygdala, ACC
Dominance of fear memory in emotion, feelings and attention

SUMMARY: THE GLOBAL IMPACT OF EARLY LIFE STRESS AND TRAUMA
THANK YOU

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