Biological embedding and the impact of childhood adversity: 
What can we learn?

SafeLives 25th February 2015

Eamon McCrory  PhD  DClinPsy
Infancy ............ Childhood ............ Adolescence ............ Adulthood
Psychiatric disorders
Attainment
Economic productivity
Physical Health

Infancy............Childhood.............Adolescence..............Adulthood
How is it that the impact of domestic violence and maltreatment can endure across the lifespan with such varied outcomes?

- The concept of **Latent Vulnerability** as a framework for thinking about possible mechanisms of vulnerability that increase risk of psychiatric disorder.
Genetic

Neurobiological

Cognitive

Behavioural

Maltreatment / Domestic Violence
Epigenetics

The study of changes in gene expression without changes to the genes themselves.

Telomere Length

...telomeres shorten, and eventually cell division stops.
Genetic

Neurobiological

Cognitive

Behavioural

Maltraitment / Domestic Violence
The concept of Latent Vulnerability
McCrorry & Viding, *in press*
*Development and Psychopathology*

*Development and Psychopathology* 27 (2015), 493–505
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doi:10.1017/S0954579415000115

The theory of latent vulnerability: Reconceptualizing the link between childhood maltreatment and psychiatric disorder
An index of Latent Vulnerability captures the degree to which an ostensibly healthy individual previously exposed to maltreatment or domestic violence is at future risk of developing a psychiatric disorder.”
Latent Vulnerability

- A systems level approach
- Multiple systems recalibrated to ‘fit’ with adverse environment
- Markers of latent vulnerability are not necessarily symptoms
- Latent vulnerability is present and can be indexed prior to onset of psychiatric disorder
- A true marker of latent vulnerability must have a predictive value
Threat appraisal

Psychiatric Vulnerability

Maltreatment / Domestic Violence
Altered threat processing as one candidate system
Altered threat appraisal

Children exposed to physical maltreatment have been shown to have altered processing of angry faces:

- able to more accurately identify angry facial expressions using sparse perceptual information than peers
- devote more attentional resources to the processing of angry faces
- Interpreted as increased hypervigilance to threat

Development of perceptual expertise in emotion recognition

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What is the neural basis of altered face processing in maltreated children?
Children exposed to maltreatment (MT)

- Aged 10-14 male and female
- Recruited from a Social Services department
- Documented experiences of abuse:
  - Physical abuse: 45%
  - Sexual abuse: 30%
  - Domestic violence: 84%
  - Neglect: 90%
- Without formal diagnosis of psychiatric disorder.

Control children recruited from local schools, matched for:

- Age – Pubertal stage – IQ – Gender – Ethnicity – Socioeconomic status
<table>
<thead>
<tr>
<th>Child rated</th>
<th>Non-maltreated group (n = 23)</th>
<th>Maltreated group (n = 18)</th>
<th>P</th>
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<tbody>
<tr>
<td>Mood and Feelings Questionnaire, total score</td>
<td>11.70 (7.90)</td>
<td>11.17 (9.17)</td>
<td>0.85</td>
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<td>Trauma Symptom Checklist for Children</td>
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<td>Anxiety</td>
<td>46.95 (12.03)</td>
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<td>Depression</td>
<td>44.68 (9.38)</td>
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<td>Anger</td>
<td>43.32 (7.83)</td>
<td>46.65 (10.77)</td>
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<td>Post-traumatic stress</td>
<td>44.50 (6.30)</td>
<td>49.53 (11.60)</td>
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<td>Dissociation</td>
<td>46.32 (6.40)</td>
<td>51.76 (10.99)</td>
<td>0.06</td>
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<td>State–Trait Anxiety Inventory for Children</td>
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<tr>
<td>Trait</td>
<td>32.61 (7.68)</td>
<td>32.24 (8.58)</td>
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<tr>
<td>State</td>
<td>27.57 (4.53)</td>
<td>25.76 (2.82)</td>
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<td>Total</td>
<td>60.17 (10.29)</td>
<td>58.69 (9.78)</td>
<td>0.65</td>
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<tr>
<td>Parent rated</td>
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<tr>
<td>Strengths and Difficulties Questionnaire</td>
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<tr>
<td>Conduct problems score</td>
<td><strong>2.83 (1.78)</strong></td>
<td><strong>2.78 (1.59)</strong></td>
<td><strong>0.03</strong></td>
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<td>Hyperactivity score</td>
<td>1.48 (1.24)</td>
<td>3.44 (2.28)</td>
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<td>Peer problems score</td>
<td>3.43 (2.76)</td>
<td>5.57 (3.04)</td>
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<tr>
<td>Prosocial behaviour score</td>
<td>8.26 (2.38)</td>
<td>7.99 (1.96)</td>
<td>0.70</td>
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</table>
Heightened neural reactivity to threat in child victims of family violence

Eamon J. McCrory¹,²,*
Stéphane A. De Brito¹,²,*
Catherine L. Sebastian¹
Andrea Mechelli³, Geoffrey Bird⁴,⁵
Phillip A. Kelly¹,², and Essi Viding¹
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Increased right amygdala reactivity and increased bilateral anterior insula reactivity to angry vs. calm faces in children exposed to family violence.

Meta-analysis of adults with anxiety disorders indicates that this is a common neural signature in clinical populations (Etkin & Wager, 2007).
Left anterior insula activation was greatest in those children exposed to higher levels of family violence.
Exposure to family violence may ‘recalibrate’ responsiveness of the anterior insula and amygdala in processing potential threat.

But is this a conscious process? In other words, is this hypervigilance to threat under higher order regulatory influence?
Amygdala activation in maltreated children during pre-attentive emotional processing

Eamon J. McCrory, Stéphane A. De Brito, Philip A. Kelly, Geoffrey Bird, Catherine L. Sebastian, Andrea Mechelli, Sophie Samuel and Essi Viding
Thalamus

Cortex
“high road”

“low road”

LGN
Pulv

Amygdala

emotional stimulus

emotional response

SC
<table>
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<th>Congruent</th>
<th>Duration (ms)</th>
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<tr>
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<tr>
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<td>68</td>
</tr>
<tr>
<td><img src="image6.png" alt="Image" /></td>
<td>1100</td>
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</tbody>
</table>
Angry > Neutral

Happy > Neutral

Y = -1
1. Is amgydala reactivity calibrated in response to environmental adversity?
Duration of abuse associated with amygdala response in children

Amygdala activation

Age of onset of neglect (years)

$r^2 = 0.57$

McCrory et al., 2013
Severity of abuse associated with amygdala response in adults

Severity of abuse (CTQ score)

Amygdala activation

$r^2 = 0.37$

Dannlowski et al., 2013
Collectively, these findings suggest that the responsiveness of the amygdala is calibrated and adapts to the degree of environmental threat.
2. Do higher levels of amygdala reactivity to threat predict future psychopathology?
Amygdala reactivity BEFORE stress predicts future symptoms

Amygdala activation before combat (T value)

Change in PTSD Symptoms

$R^2 = 0.45$

Admon et al., 2009
3. Is altered amygdala reactivity to threat implicated in disorders associated with maltreatment?
YES: Heightened amygdala reactivity is associated with anxiety/depression in adolescents and adults

- Altered threat bias to consciously perceived threat cues is associated with PTSD and anxiety disorders (Bar-Haim et al., 2007)

- Amygdala hyper-activation is observed during conscious and pre-attentive threat processing (Etkin & Wager, 2007; Fales et al., 2008; Liberzon et al., 1999)
  - in adults with anxiety disorder and depression
  - In soldiers with PTSD
  - in children and adolescents with generalised anxiety disorder

Monk et al., 2008
Infancy — Childhood — Adolescence — Adulthood

Healthy — Unhealthy

Outcome

Domestic violence / Maltreatment

Clinical Threshold

Environment

• Threat bias
• Autobiographical memory
• Risk Taking

Infancy — Childhood — Adolescence — Adulthood
Infancy  Childhood  Adolescence  Adulthood

Healthy                           Unhealthy

Clinical Threshold

Domestic violence / Maltreatment

Outcome

Healthy

Infancy  Childhood  Adolescence  Adulthood
Summary

• Functional correlates of domestic violence and maltreatment imply that children have adapted to the demands of their early environment.

• Such apparent adaptations may confer short-term functional advantages in enhancing a child’s vigilance to threat.

• However, there may be ‘real-time’ costs in limiting attentional capacity for mastering age-appropriate skills in social /academic domains (chains of risk), but also ongoing costs in predisposing to an increased risk of internalising or externalising psychopathology. This emphasises the importance of primary prevention.

• The concept of Latent Vulnerability provides a framework for a mechanistic understanding of psychiatric risk following exposure to domestic violence and maltreatment. Identifying those neurocognitive systems which most sensitively index latent vulnerability could provide opportunities to develop a preventative psychiatry approach.