How Adversity and Trauma Affect the Brain and Get “Under the Skin”

Bruce McEwen, Ph.D.
Alfred E. Mirsky Professor and Head
Harold and Margaret Milliken Hatch
Laboratory of Neuroendocrinology
The Rockefeller University

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## Table 1. Health and social problems and the ACE score

<table>
<thead>
<tr>
<th>Problems from the baseline data</th>
<th>Outcomes associated with the ACE score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalent diseases</td>
<td>Ischemic heart disease, cancer, chronic lung disease, skeletal fractures, sexually transmitted diseases, liver disease</td>
</tr>
<tr>
<td>Risk factors for common diseases/poor health</td>
<td>Smoking, alcohol abuse, promiscuity, obesity, illicit drug use, injection drug use, multiple somatic symptoms, poor self-rated health, high perceived risk of AIDS</td>
</tr>
<tr>
<td>Mental health</td>
<td>Depressive disorders, anxiety, hallucinations, panic reactions, sleep disturbances, memory disturbances, poor anger control</td>
</tr>
</tbody>
</table>

| Sexual and reproductive health | Early age at first intercourse, sexual dissatisfaction, teen pregnancy, unintended pregnancy, teen paternity, fetal death |
| General health and social problems | High perceived stress, impaired job performance, relationship problems, marriage to an alcoholic, risk of perpetrating or being a victim of domestic violence, premature mortality in family members |

- Heart disease, smoking, obesity
- Drug abuse, high risk for AIDS
- Depression, anxiety, anger control
- Anti-social behavior

Levels of stressful experiences:
Their causes, consequences and why we experience them!

Positive Stress
- A personal challenge that has a satisfying outcome
  - Result: Sense of mastery and control
    --HEALTHY BRAIN ARCHITECTURE
    --good self esteem, judgment and impulse control

Tolerable Stress
- Adverse life events buffered by supportive relationships
  - Result: Coping and recovery
    -HEALTHY BRAIN ARCHITECTURE
    --good self esteem, judgment and impulse control

Toxic Stress
- Unbuffered adverse events of greater duration and magnitude
  - Result: Poor coping and compromised recovery
  - Result: Increased life-long risk for physical and mental disorders
    -COMPROMISED BRAIN ARCHITECTURE
    -Dysregulated physiological systems
Normal Brain Development
Developmental Issues for Children
Sources of Toxic Stress

Low socioeconomic status
Poor language skills and executive function
and other effects on learning ability
Hart and Risley “Meaningful Differences”

Chaos in home
- Greater helplessness and distress, poor self regulatory behavior
- Obesity, elevated blood pressure and cardiovascular reactivity

Lasting effects of early life adversity on body fat accumulation,
  systemic inflammation and poor dental health

Abuse and neglect
Impaired lifelong physical and mental health
Shorter lifespan

“Risky families” - cold and unsupportive
Many same consequences but not as extensively studied
Toxic stress effects and brain development
The Human Brain Under Stress: Other key brain regions

**Prefrontal cortex**
- Decision making, working memory
- Self regulatory behaviors: mood, impulses
- Helps shut off stress response

**Hippocampus**
- Contextual, episodic, spatial memory
- Helps shut off stress response

**Amygdala**
- Emotion, fear, anxiety, aggression
- Turns on stress hormones and increases heart rate
Remodeling of neural architecture

Dendrites
Shrink and expand

Synapses
Disappear and are replaced

Neurogenesis
Continues in some brain areas
The Human Brain Under Stress: Developmental effects on hippocampus

Prefrontal cortex
Decision making, working memory,
Self regulatory behaviors: mood, impulses

Hippocampus
Contextual, episodic, spatial memory
- Early life abuse
- Low self esteem
- Risk for PTSD

Amygdala
Emotion, fear, anxiety, aggression
The Human Brain Under Stress: Developmental effects on amygdala

Prefrontal cortex
Decision making, working memory, Self regulatory behaviors: mood, impulses

Hippocampus
Contextual, episodic, spatial memory
Self-esteem

Amygdala
Emotion, fear, anxiety, Aggression
Larger and more active in depression, anxiety disorders
The Human Brain Under Stress: Developmental effects on prefrontal cortex

**Prefrontal cortex**
Decision making, working memory, Self regulatory behaviors: mood, impulses
Underdeveloped with chaos, early life abuse

**Hippocampus**
Contextual, episodic, spatial memory
Self-esteem

**Amygdala**
Emotion, fear, anxiety, aggression
Developmental Issues for Children

What we are beginning to know from research on animal models

- Maternal care - quality and frequency but also consistency
  - Benefits of novel experiences
  - Neural basis of attachment in spite of abuse
  - Deleterious effects of maternal anxiety
- Importance of intrauterine environment - metabolism, obesity
Adult Disease Prevention Begins With Reducing Early Toxic Stress.

Early Childhood Programs Benefit Lifelong Health, Not Just Education.

Promoting physical health benefits the brain


- for example, the Nurse Family Partnership  David Olds

- Harlem Children’s Zone  Jeffrey Canada and “baby college”
Cost/Benefit Analyses Show Positive Returns

Early Childhood Programs Demonstrate Range of Benefits to Society

<table>
<thead>
<tr>
<th>Program</th>
<th>Return per $1 Invested</th>
</tr>
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<tbody>
<tr>
<td>Abecedarian Project (through age 21)</td>
<td>$4.10</td>
</tr>
<tr>
<td>Nurse Family Partnership (High Risk Group)</td>
<td>$5.70</td>
</tr>
<tr>
<td>Perry Preschool (through age 40)</td>
<td>$9.20</td>
</tr>
</tbody>
</table>

Looking to the Future

The adult brain shows plasticity and we are only beginning to recognize its potential!

Dendrites
Shrink and expand

Synapses
Disappear and are replaced

Neurogenesis
Continues in some brain areas

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