THE IMPACT OF TRAUMA ON THE BRAIN AND MIND/BODY

NATHAN A. FOX, PH.D
DISTINGUISHED UNIVERSITY PROFESSOR
UNIVERSITY OF MARYLAND

THE SCIENCE OF TRAUMA
CONGRESSIONAL BRIEFING
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OUTLINE OF TALK

Impact of Trauma on the Brain

Principles of brain and behavioral development

- brain architecture
- serve and return
- air traffic control-executive function
- toxic stress
- neglect

Implications for policy
Toxic Stress Changes Brain Architecture

Normal

Typical neuron—many connections

Prefrontal Cortex and Hippocampus

Toxic stress

Damaged neuron—fewer connections

Sources: Radley et al. (2004)
Bock et al. (2005)
PSYCHOSOCIAL NEGLECT AFFECTS BRAIN ACTIVITY

Alpha, 6-9 Hz

Institution

Community

Proportion

0.58

0.46

Marshall, Fox & BEIP group (2007)
CORE PRINCIPLES OF BRAIN DEVELOPMENT

Brains are built over time

Positive Responsive Relationships are an integral part of Healthy Brain Development

Brain Development Does not End at Age 3---Important Changes Occur in the Preschool Period

Toxic Stress Can Derail Brain Development In Infancy and Beyond

Neglect is the most common form of maltreatment for children in the United States

Positive Supports and Responsive Relationships Can Buffer Stress
Brains are built over time, starting in the earliest years of life. Simple skills come first; more complex skills build on top of them.

Cognitive, emotional, and social capabilities are inextricably intertwined throughout the life course.

A strong foundation in the early years improves the odds for positive outcomes and a weak foundation increases the odds of later difficulties.
The Ability to Change Brains Decreases Over Time

Source: Levitt (2009)

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Normal Brain Plasticity Influenced by Experience</th>
<th>Physiological “Effort” Required to Enhance Neural Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth</td>
<td>Decrease</td>
<td>Increase</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
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<tr>
<td>20</td>
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<td>60</td>
<td></td>
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</tr>
<tr>
<td>70</td>
<td></td>
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</tbody>
</table>

Source: Levitt (2009)
Neural Circuits are Wired in a Bottom-Up Sequence

Sensory Pathways (Vision, Hearing)
Language
Higher Cognitive Function

Birth (Months)  (Years)

Experience Shapes Brain Architecture by Over-Production Followed by Pruning
(700 synapses formed per second in the early years)
Serve & Return Builds Brains and Skills

Young children naturally reach out for interaction through babbling, facial expressions, and gestures, and adults respond in kind.

These “serve and return" interactions are essential for the development of healthy brain circuits.

Therefore, systems that support the quality of relationships in early care settings, communities, and homes also support the development of sturdy brain architecture.
Barriers to Educational Achievement Emerge at a Very Young Age

![Graph showing cumulative vocabulary growth by children's age (16 mos., 24 mos., 36 mos.) for College Educated Parents, Working Class Parents, and Welfare Parents.]

An “Air Traffic Control System” in the Brain

Executive functioning is a group of skills that help us to focus on multiple streams of information at the same time, set goals and make plans, make decisions in light of available information, revise plans, and resist hasty actions.

- a key biological foundation of school readiness as well as outcomes in health and employability
What are Executive Function Skills?

**Inhibitory Control** — filter thoughts and impulses to resist temptations and distractions

**Working Memory** — hold and manipulate information in our heads over short periods of time

**Cognitive flexibility** — adjust to changed demands, priorities, or perspectives
Developmental Opportunities for Executive Function Skills

The Biology of Adversity: Three Levels of Stress

**POSITIVE**
Brief increases in heart rate, mild elevations in stress hormone levels.

**TOLERABLE**
Serious, temporary stress responses, buffered by supportive relationships.

**TOXIC**
Prolonged activation of stress response systems in the absence of protective relationships.
Learning how to cope with moderate, short-lived stress can build a healthy stress response system.

Toxic stress—when the body’s stress response system is activated excessively—can weaken developing brain architecture.

Without caring adults to buffer children, toxic stress associated with extreme poverty, neglect, abuse, or severe maternal depression can have long-term consequences for learning, behavior, and both physical and mental health.
Secure Relationships Calm Children’s Stress Hormone Response

Source: Nachmias et al. (1996)
Instability Disrupts the Stress Response System — But Relationships Reverse the Effect

Early Enrichment Prevents Stress-Induced Cognitive Disruption

Correct choices on memory test

Source: Cui et al. (2006)
Early Enrichment Prevents Stress-Induced Depressive-Like Behavior

Source: Cui et al. (2006)
Sources of Toxic Stress in Young Children

- Maltreatment: 75 (per 1,000)  
  Source: Finkelhor et al. (2005)

- Postpartum Depression: 130  
  Source: O-Hara & Swain (1996)

- Parental Substance Abuse: 136  
  Source: SAMHSA (2009)
Significant Adversity Impairs Development in the First Three Years

Source: Barth, et al. (2008)
Risk Factors for Adult Heart Disease are Embedded in Adverse Childhood Experiences

Source: Dong et al, 2004
Risk Factors for Adult Substance Abuse are Embedded in Adverse Childhood Experiences

Self-Report: Alcoholism

Source: Dube et al, 2002

Self-Report: Illicit Drugs

Source: Dube et al, 2005
Risk Factors for Adult Depression are Embedded in Adverse Childhood Experiences

Source: Chapman et al, 2004
1995: Kaiser study links ACEs to a range of poor outcomes in adulthood.

2005: NSCDEC identifies “toxic stress” as a potential causal mechanism explaining why ACEs and other stressors outside the family have long-term effects.

Screen for ACEs & refer

Improve understanding & treatment of pathophysiology

Safety • Trustworthiness • Transparency
Peer support • Collaboration and Mutuality
Empowerment • Voice and Choice
Cultural, Historical, and Gender Issues

2015: An integrated framework for advancing the management of stress-related impairments in learning, behavior, and health?
Neglect is the Most Prevalent Form of Child Maltreatment

Institutionalization and Neglect of Young Children Disrupts Stress Regulation

<table>
<thead>
<tr>
<th>Percent of Children with Abnormal Stress Hormone Regulation</th>
<th>Middle Class US Toddlers in Birth Families</th>
<th>Neglected/Maltreated Toddlers Arriving from Orphanages Overseas</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>Yellow bar</td>
<td>Red bar</td>
</tr>
<tr>
<td>10%</td>
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<td>15%</td>
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<td>30%</td>
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</tr>
<tr>
<td>35%</td>
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</table>

Source: Gunnar & Fisher (2006)
Neglect Can Be a Greater Threat to Development than Abuse

- More likely to have anxiety, depression, personality disorders
- More academic problems and special education referrals
- Lower IQ, poorer reading skills, less likely to graduate high school
- Poorer responses to frustrating situations

Source: Egeland, et al. (1983)
Prompt Provision of Responsive Relationships Restores Disrupted Development

*Bucharest Early Intervention Program*

<table>
<thead>
<tr>
<th>IQ/DQ (Mean)</th>
<th>Tested at 3 1/2 Years Old</th>
<th>Tested at 4 1/2 Years Old</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-18</td>
<td>18-24</td>
<td>24-30</td>
</tr>
<tr>
<td>“normal” range</td>
<td>“normal” range</td>
<td></td>
</tr>
</tbody>
</table>

Age of placement in foster care (months)

Source: Nelson et al. (2007)
Current Conceptual Framework Guiding Early Childhood Policy and Practice

Significant Adversity

Readiness to Succeed in School

Impaired Development

Parenting Education, Sound Nutrition, Stimulating Experiences, and Health-Promoting Environments
Designing an Enhanced Framework that Balances Enrichment, Prevention, and Protection

Significant Adversity

Address Sources and Effects of Toxic Stress

Healthy Developmental Trajectory

Supportive Relationships, Stimulating Experiences, and Health-Promoting Environments
Addressing the Distinctive Needs of Children Exposed to Trauma including Serious Neglect

Increase public awareness and professional training for personnel in health services, early care and education, and child welfare.

Coordinate efforts across sectors to identify vulnerable children and families as early as possible and improve access to services.

Develop more effective prevention programs in coordination with specialized services to address co-occurring medical, economic, and social needs.
Nathan A. Fox, PH.D.
Distinguished University Professor
University of Maryland

e-mail fox@umd.edu

www.developingchild.harvard.edu