The Impact of Toxic Stress on Brain Development and Health

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The Foundations of Prosperity and Sustainability Begin in Early Childhood

The healthy development of young children provides a strong foundation for a healthy and competent adulthood:
- responsible citizenship,
- economic productivity,
- competent parenting of the next generation

By extension, ensuring the healthy development of children, supports strong communities, and a just and fair society.

Building Healthy Brain Architecture – The Ingredients

Our genes, and ultimately our developing brain architecture, are influenced powerfully by positive early experiences—and negative ones, too.
Genes provide the hardware, but early experience is the software that drives the system.
Four Numbers to Remember

- 700 per second
- 18 months
- 90-100 percent
- 3:1 odds

Experience Shapes Brain Architecture by Over-Production Followed by Pruning
(700 synapses formed per second in the early years)

Neural Circuits are Wired in a Bottom-Up Sequence

Interaction as Serve and Return

Healthy development of brain architecture depends on interaction experts call **Serve and Return**, based on games like tennis and volleyball.

Young children instinctively reach out for interaction, through babbling, facial expressions, words, gestures, cries, etc. and adults respond by getting in sync and doing the same. **Serve and Return** works best with adults who are familiar to the child, like familiar partners. It affects everything in the brain from the chemicals to physical structures and connections.

Brains and Skills are Shaped by the "Serve and Return" Nature of Human Interaction

Four Numbers to Remember

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Barriers to Educational Achievement Emerge at a Very Young Age

Experiences in childhood have a lasting impact on how our fear and anxiety systems work

Early Childhood Adversity Can Influence a Range of Lifelong Outcomes

Research on the biology of stress helps explain some of the underlying reasons for differences in learning, behavior, and high risk for physical (cardiovascular disease, diabetes), and mental health disorders.
Experiences in childhood have a lasting impact on how our fear and anxiety systems work.

A balancing act
New homeostatic "set point"

Institutionalization and Neglect of Young Children Disrupts Body Chemistry

Source: Gunnar & Fisher (2006)

The Brain Architecture of Anxiety and Fear
The Brain Architecture of Memory and Learning

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.

Source: Pollok & Kistler (2002)
Four Numbers to Remember

700 per second
18 months
90-100 percent
3:1 odds

Sources of Toxic Stress in Young Children

- Risk Factors
  - Neglect
  - Abuse
  - Exposure to Violence
  - Parental Mental Illness
  - Parental Substance Abuse
  - Homelessness/High Mobility
  - Death of parent
  - Incarceration of Parent
  - Etc.

Significant Adversity Impairs Development in the First Three Years

Percentage of Children with Developmental Delays

<table>
<thead>
<tr>
<th>Number of Risk Factors</th>
<th>1-2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<td>100%</td>
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</tbody>
</table>

Source: Barth et al. (2008)
Four Numbers to Remember

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- 18 months
- 90-100 percent
- 3:1 odds

Concept:

Adverse Childhood Experiences (ACEs) early in life contribute directly to the risk for long-term physical and mental health.

Risk Factors for Adult Heart Disease are Embedded in Adverse Childhood Experiences

Source: Dong et al. (2004)
New Biological Evidence Links Maltreatment in Childhood to Greater Risk of Adult Heart Disease

Percent of adults with biological marker for greater risk of heart disease (increased blood level of CRP)

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Maltreated (as a child)</th>
<th>Depression (age 32) + Maltreated (as a child)</th>
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</thead>
<tbody>
<tr>
<td>10%</td>
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<td>40%</td>
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<tr>
<td>50%</td>
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</table>

Source: Danese et al. (2008)

Toxic Stress Changes Brain Architecture

Normal

Typical neuron—many connections

Toxic stress

Damaged neuron—fewer connections

Prefrontal Cortex and Hippocampus

Sources: Radley et al. (2004)

Bock et al. (2005)

The Childhood Roots of Health Disparities: How Adversity is Built Into the Body

Low Income 20%

Physiological Disruption

• Neurodevelopmental
• Immune
• Metabolic
• Neuroendocrine
• Cardiovascular

Disease/Disability

Health-Threatening Behavior

Low Educational Achievement

Death
Research Says that Remediation and Prevention ARE Possible

Delayed Intervention Harms Development
Bucharest Early Intervention Program

How Should We Act On the Science?
**Keys to Healthy Brain Development**

Supportive relationships and positive learning experiences that begin in the home but can be strengthened by outside assistance when families need help.

A balanced approach to emotional, social, cognitive, and language development.

Highly specialized interventions as early as possible for children and families experiencing significant adversity.

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**Preventive Intervention is More Efficient and Produces More Favorable Outcomes Than Later Remediation**

Rates of return to human capital investment:
- Preschool programs: K-12 schooling, College, job training

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**Building a New Science-Based Approach to Promoting Health and Preventing Disease**

A healthier population begins with reducing toxic stress in early childhood, not just trying to change adult behavior.

Early childhood intervention programs can be a vehicle for enhancing lifelong health, not just preparing children to succeed in school.

A redesigned child welfare system could improve health outcomes by promoting positive relationships and adaptive development, not simply focusing on physical safety and custody.
Maximizing Return on Investment

The basic principles of neuroscience indicate that later remediation will be more costly than preventive intervention in the first years of life.

Brains: more physiological energy needed to compensate for poorly formed neural circuits.

Society: higher cost of remedial education, clinical treatment, crime.

Think Broadly About Children’s Environment of Relationships

Plan from pregnancy to kindergarten, and look beyond education and health care.

Invest in the development and retention of a skilled early childhood workforce.

Make sure vulnerable children have access to stable, supportive relationships with adults—as early and as consistently as possible.

http://www.developingchild.net
http://www.developingchild.harvard.edu

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Science Points Toward a 3-Tiered Approach to Ensuring Healthy Development

1: Basic health services and early care and education available to all children to help build and sustain strong brains and bodies.

2: Broadly targeted interventions for children in poverty (e.g., income supports and early enrichment) to give all the chance to succeed.

3: Narrowly targeted, specialized services for children experiencing tolerable or toxic stress to prevent later problems.

Sources of Toxic Stress in Young Children

<table>
<thead>
<tr>
<th>Source</th>
<th>Percent of U.S. Children Ages 2-5 Experiencing Toxic Stress</th>
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<tbody>
<tr>
<td>Maltreatment</td>
<td>75 (per 1,000)</td>
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<tr>
<td>Parental Substance Abuse</td>
<td>98</td>
</tr>
<tr>
<td>Postpartum Depression</td>
<td>130</td>
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</table>

Sources of Toxic Stress in Young Children

Source: Finkelhor et al. (2005) for Maltreatment
Source: SAMHSA (2002) for Parental Substance Abuse
Source: O'Hara & Swain (1996) for Postpartum Depression