

## **Toxic Stress and its Impact on Early Learning and Health: Building a Formula for Human Capital Development**

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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 healthy and competent adulthood, responsible citizenship, economic productivity, strong communities, and a just and fair society.

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## **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.

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**Four Numbers to Remember**

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

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



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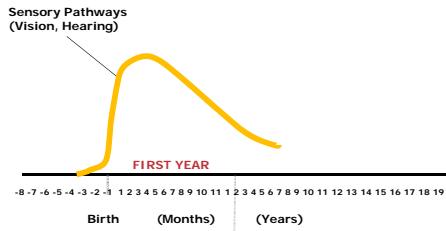
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### Neural Circuits are Wired in a Bottom-Up Sequence



Source: C.A. Nelson (2000)

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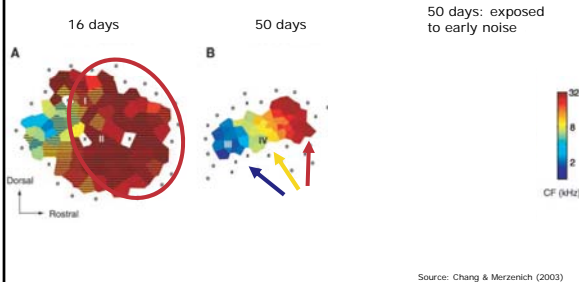
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### Extreme Early Experiences Can Dramatically Disrupt How Senses Form



Source: Chang & Merzenich (2003)

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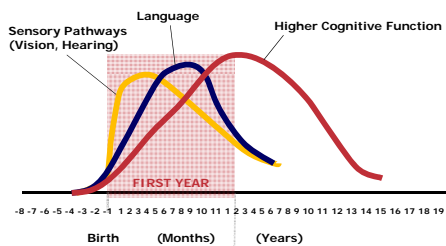
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### Neural Circuits are Wired in a Bottom-Up Sequence



Source: C.A. Nelson (2000)

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### Early Experiences Influence Brain Architecture and Function



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### Interaction as Serve and Return



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



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**Remember.....**

**Development is not a blank slate**

**Skill begets skill**

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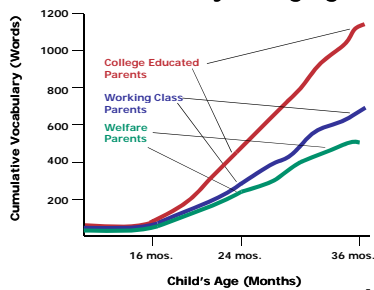
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**Barriers to Educational Achievement Emerge at a Very Young Age**



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**Beyond Learning, Our Emotional Development Depends Upon Early Experiences**

Fear and anxiety are essential to facilitate the detection of danger in the environment.

Threatening stimuli receive more attention than non-threatening stimuli.



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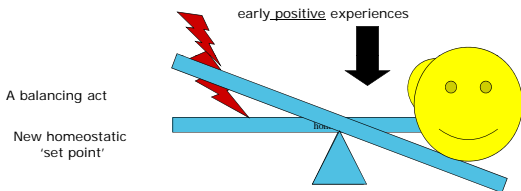
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**Experiences in childhood have a lasting impact on how our fear and anxiety systems work**



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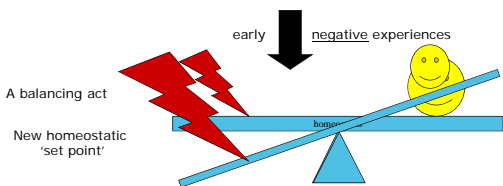
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**Experiences in childhood have a lasting impact on how our fear and anxiety systems work**



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### 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.

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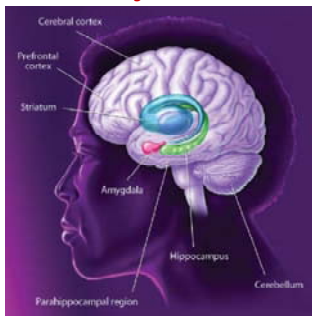
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### The Brain Architecture of Anxiety and Fear



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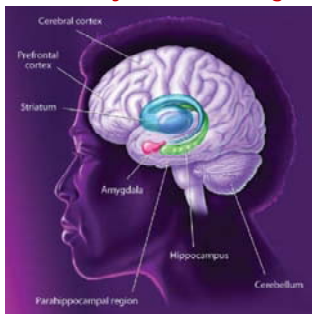
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### The Brain Architecture of Memory and Learning



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**Concept:**

**Early Adverse Experiences (ACEs) contribute directly to the risk for long-term physical and mental health.**

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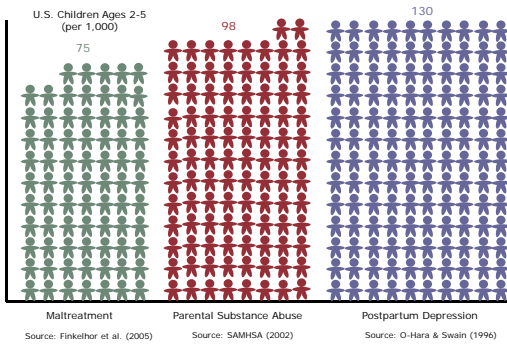
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**Sources of Toxic Stress in Young Children**



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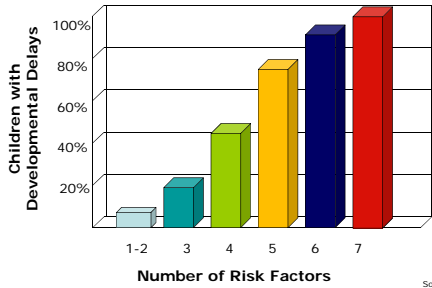
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### Significant Adversity Impairs Development in the First Three Years



Source: Barth et al. (2008)

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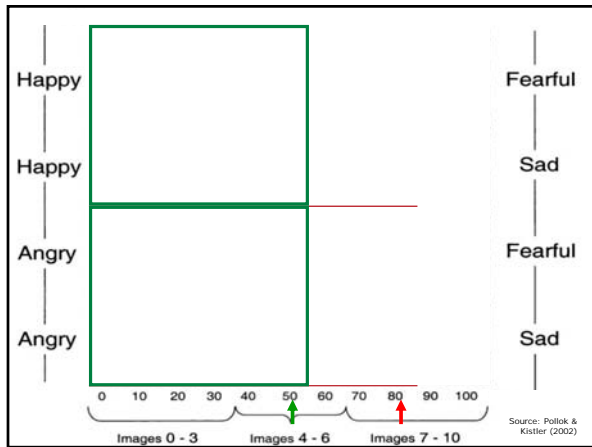
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Source: Pollak & Kistler (2002)

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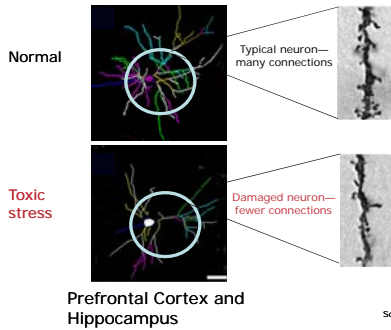
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### Toxic Stress Changes Brain Architecture



Sources: Radley et al. (2004)  
Bock et al. (2005)

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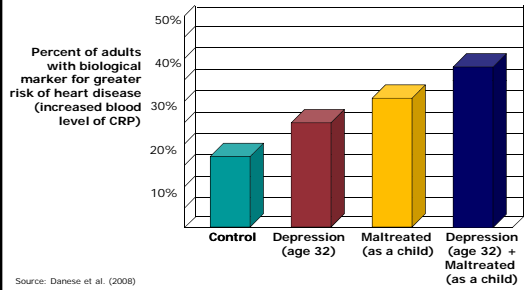
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### New Biological Evidence Links Maltreatment in Childhood to Greater Risk of Adult Heart Disease



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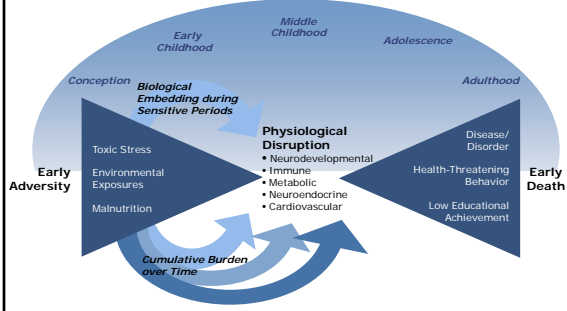
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### The Childhood Roots of Health Disparities: How Adversity is Built Into the Body



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## How Should We Act On the Science?

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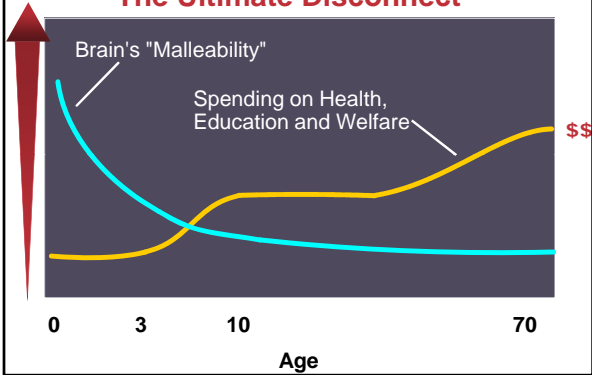
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## The Ultimate Disconnect



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## 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.

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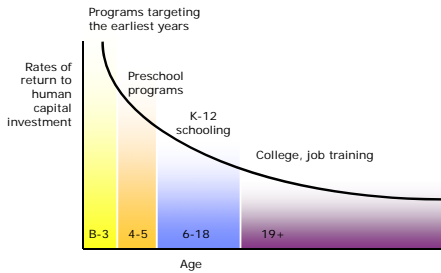
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### Preventive Intervention is More Efficient and Produces More Favorable Outcomes Than Later Remediation



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### Program Evaluation Research Helps Identify Effectiveness Factors



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### Program Evaluation Research Helps Identify Effectiveness Factors

Example # 1

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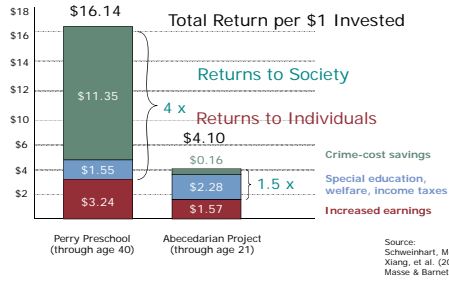
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### Cost/Benefit for Two Early Childhood Programs (Dollars returned for each dollar invested)



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### Program Evaluation Research Helps Identify Effectiveness Factors

#### Example # 2

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### Targeted Preventive Services Can Affect Outcomes for Vulnerable Families Expecting a First Child

Early, intensive support by a skilled home visitor can produce significant benefits.

**Effectiveness factors for home visiting include:**

- More highly trained visitors = larger effects.
- No evidence that 1-3 visits have any impact.
- Engaging and maintaining participation of families is a key challenge.
- Some successful programs specifically target populations at high risk with focused curricula.

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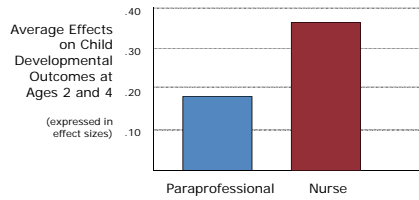
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### Highly Trained Professionals Improve Home Visiting Outcomes



Source: Olds, et al. (2004)

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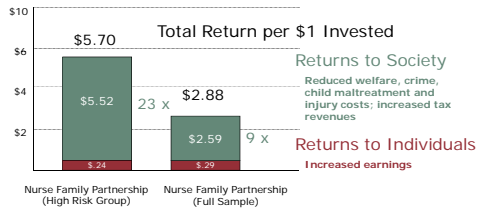
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### Cost/Benefit Data on Nurse Family Partnership (Dollars returned for each dollar invested)



Source: Karoly et al. (2005)

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### New Hope Project in Milwaukee - A Make Work Pay Program

- Child care subsidies
- Health care subsidies
- Case managers with low loads
- Full time employment above poverty level or community work @ minimum wage ( $\geq 30$  hr)

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### 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.

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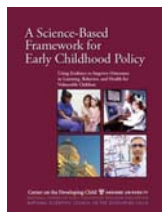
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<http://www.developingchild.net>  
<http://www.developingchild.harvard.edu>

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