How Early Experiences Shape Brain Architecture

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Acknowledgements

Core Concept #1

Early experience builds brain architecture.

Three Core Concepts in Early Development

Early experience builds brain architecture

- Genes are the blueprint but experience is like the carpenter
- Together, they establish a weak or sturdy foundation
The Ability to Change Brains Decreases Over Time

Normal Brain Plasticity Influenced by Experience
Phylogenetic “Effort” Required to Enhance Neural Connections

Age (Years)

Birth 10 20 30 40 50 60

Preventive vs. Remediation

Rate of return to human capital investment

Programs targeting the earliest years

Preschool programs
K-12 interventions
Job training

Age

Source: Heckman (2007)

Reflection

• How does the idea that early experience builds brain architecture relevant to your work?
• Why is this important? What are the implications for kids, parents, service providers, researchers and legislators?

Core concept #2

Caregiver-child interaction shapes brain circuitry.

Caregiver-child Interaction Shapes Brain Circuitry

Serve & Return interaction shapes brain circuitry

• Children serve
• Caregivers return their serves
• This back and forth is key to wiring the brain
• Works best within a trusting relationship
• Occurs inside and outside the home
Reflection

• Think of an example of serve and return interaction.
• Think of a child who experiences plenty of Serve & Return.
• Think of a child who does not.

Core Concept #3

Toxic stress derails healthy brain development.

Toxic Stress Can Derail Healthy Brain Development

Toxic stress derails healthy development

• When we are stressed, our bodies activate physiological responses.
• Short lived stress can promote growth.
• Toxic stress can weaken the architecture of the developing brain.

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.

Barriers to Educational Achievement Emerge Early

Developmental Status of Maltreated Children

As adversity increases so does risk

Executive Functioning

- EF is an important group of skills that children need to succeed
- Include inhibitory control, working memory and cognitive flexibility
- EF skills are built over time
- EF skills are linked to important outcomes
- Critical factors that shape children’s EF skills include relationships, activities and places
- Toxic stress can negatively impact EF skills development

Reflection

- Do you serve families who experience toxic stress? What does toxic stress look like for them?
- In your experience, how does adversity and toxic stress impact development?

Keys to Healthy Development

A balanced approach to emotional, social, cognitive, and language development, starting in the earliest years of life.

Supportive relationships and positive learning experiences that begin with parents but are strengthened by others outside the home.

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

SNAP Lab Research

- Specific effects of toxic stress
- Brain plasticity

The HPA Axis

- Hypothalamic-pituitary-adrenal axis
- Part of the neuroendocrine system
- Involved in stress regulation and other bodily processes (digestion, immune system, mood)
- Cortisol plays an important role
Low Cortisol in Foster Children

- Is associated with neglect (i.e. the failure of Serve & Return)
- The same pattern of cortisol activity has been observed in other studies of foster children and in internationally adopted children
- Important: Low cortisol levels are NOT the result of physical or sexual abuse

Neglect

Reflection

- Does it surprise you that kids in foster care showed an atypical pattern of cortisol levels?
- Is it surprising that those patterns normalized after six months of treatment?
- What are the implications?
Brain Activity Shows Neural Response to Corrective Feedback

Children with Toxic Stress: No Response to Corrective Feedback

Source: Bruce, McDermott, Fisher, & Fox (2009)

800 Milliseconds
Correct answer
Community Control Group
EEG electrical activity
Gap = greater brain activity to feedback when wrong
Correct answer
Regular Foster Care Group
EEG activity (μV)
NO GAP!

Children with Toxic Stress: No Response to Corrective Feedback

Source: Bruce, McDermott, Fisher, & Fox (2009)

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Correct answer
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Intervention & Brain Plasticity

Preintervention
Post Intervention

The Good News
Some Toxic stress effects can be overcome with systematic and well-timed family based interventions

Reflection
• Based on your experience working with kids and families, what do you think of these findings?
In Conclusion

- Early experience shapes brain architecture
- Especially, early caregiver-child interaction
- Toxic stress can derail brain development
- But these effects can be overcome by well timed, family based intervention.

Online Resources

- Harvard Center on the Developing Child
  – http://developingchild.harvard.edu/
- Stress Neurobiology and Prevention Lab
  – http://pages.uoregon.edu/snaplab/SNAP/Welcom e.html

Thank You

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