NATIONAL SCIENTIFIC COUNCIL ON THE DEVELOPING CHILD

The Science of Early Brain Development: A Foundation for the Success of Our Children and the State Economy

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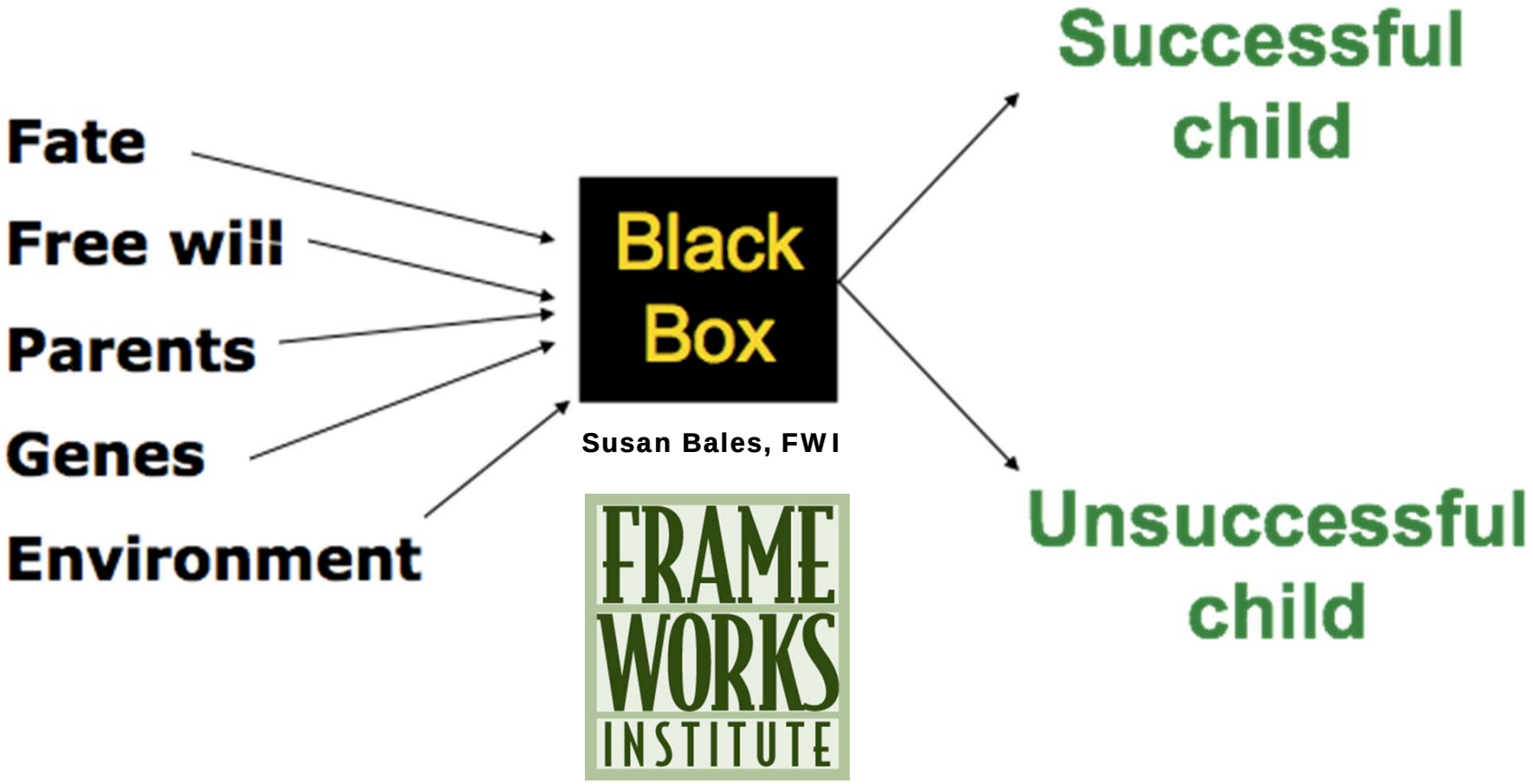
A First Fundamental

"A baby alone does not exist."

D.W. Winnicott, 1965

What the Public Has Thought Regarding Child Development



But it has changed……

The Core Story

#1 - Child development is the foundation of prosperous communities

#2 - Brains are built over time, from the bottom up (skill begets skill)

#3 - Genes and experiences together build brains (serve and return relationships)

#4 - Cognitive, social and emotion development are inextricably intertwined

#5 - Toxic stress damages brain architecture

#6 - Resilience is not an internal character strength, but rather is built through combined impact of genes and experiences of a child

#7 - For many functions, the brain's capacity for change decreases over time (cost-effectiveness factor) - but not all functions are impacted equally

Policy Changes Based on the Neuroscience of Brain Development - What Can They Mean?

Reduce special needs populations; increase emotionally sound, learning-ready children with sound Executive Function

→

Invest Early

→

Major increase human capital via ready workforce

It's

Patriotic

Experience Shapes Brain Architecture by Over-Production Followed by Pruning Through Childhood

birth

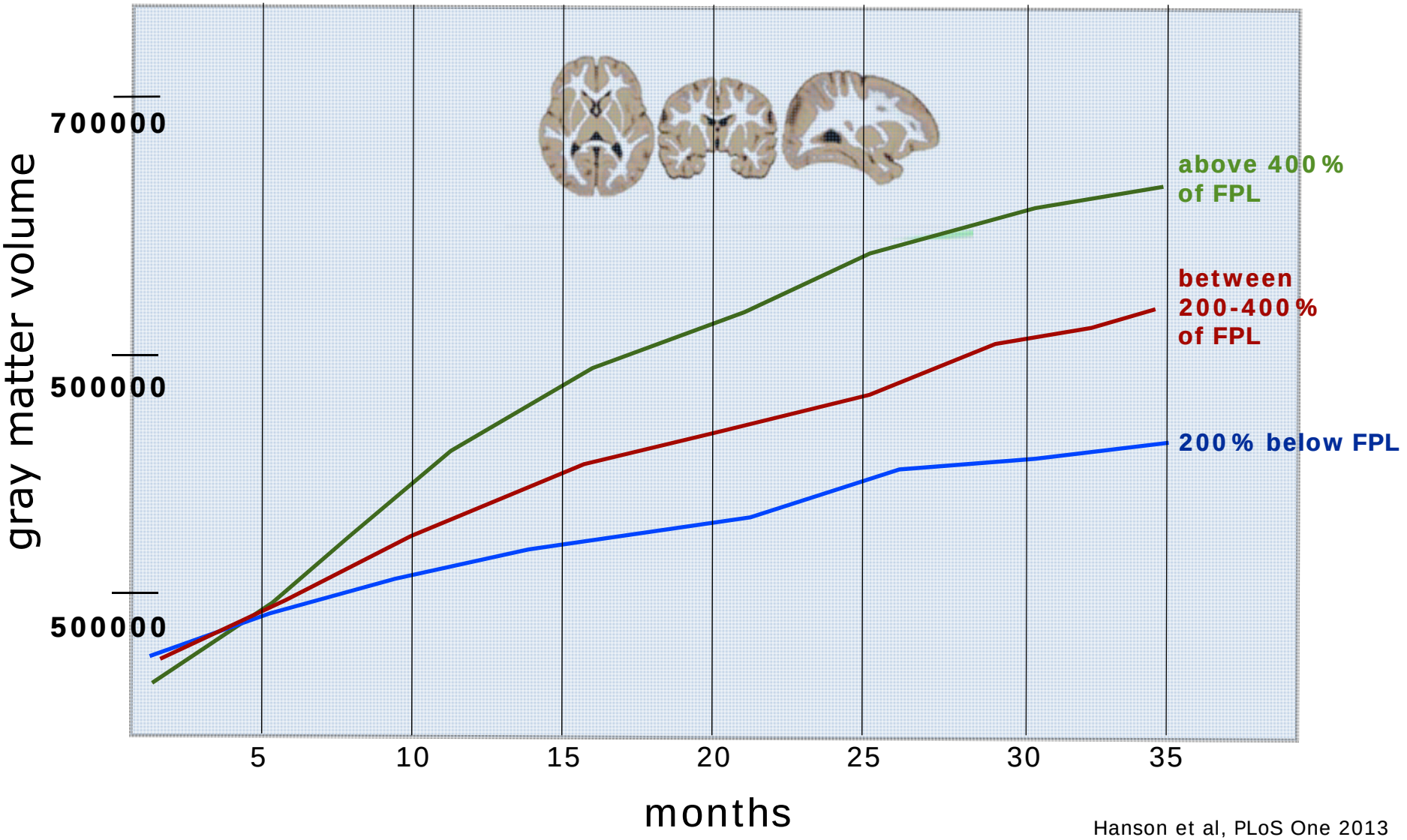
Take Home Reminder

- Development is not a blank slate (i.e. children are not sponges; the brain is built through experiences)

- Skill begets skill (a strong foundation increases odds for positive outcomes)

Interaction as Serve and Return

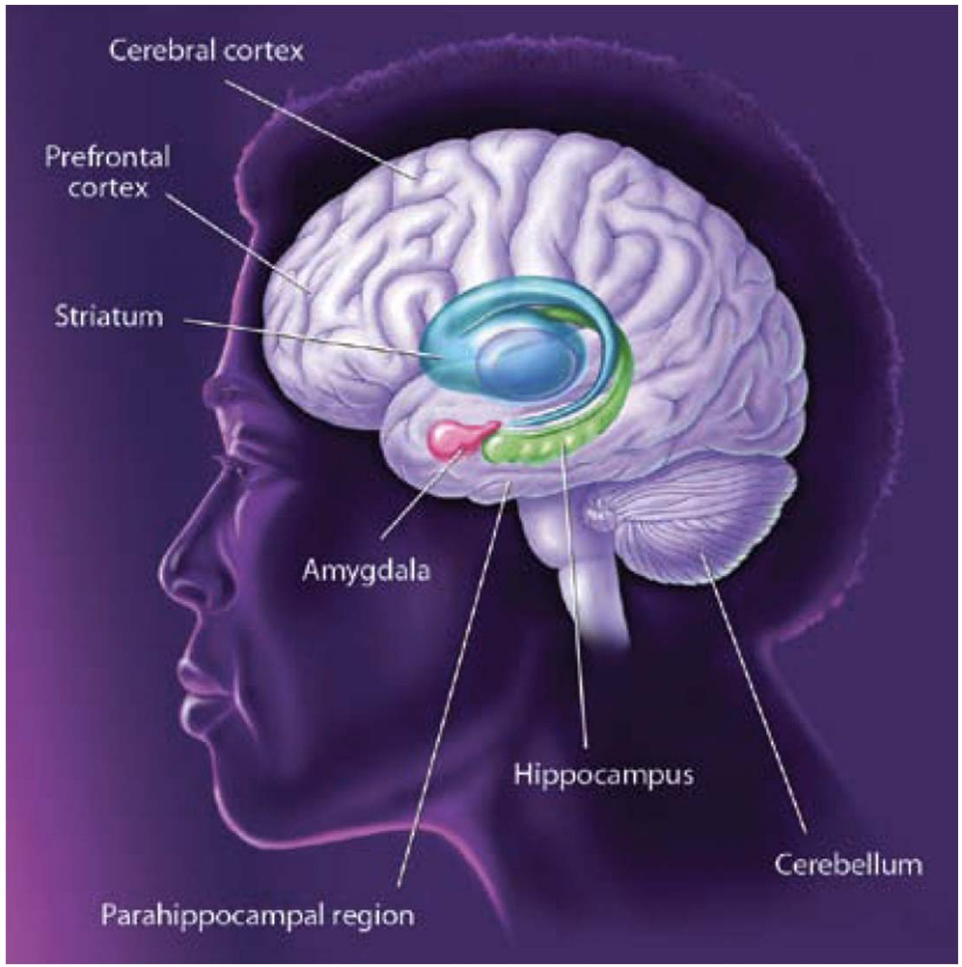
Brain Growth and Poverty



Hanson et al, PLoS One 2013

Social-Emotional and Cognitive Skill Building are Interconnected!

Fear / Anxiety Circuits



Learning / Memory Circuits

Executive Function – Our Air Traffic Control System (Top-down)

You Develop Control Over:

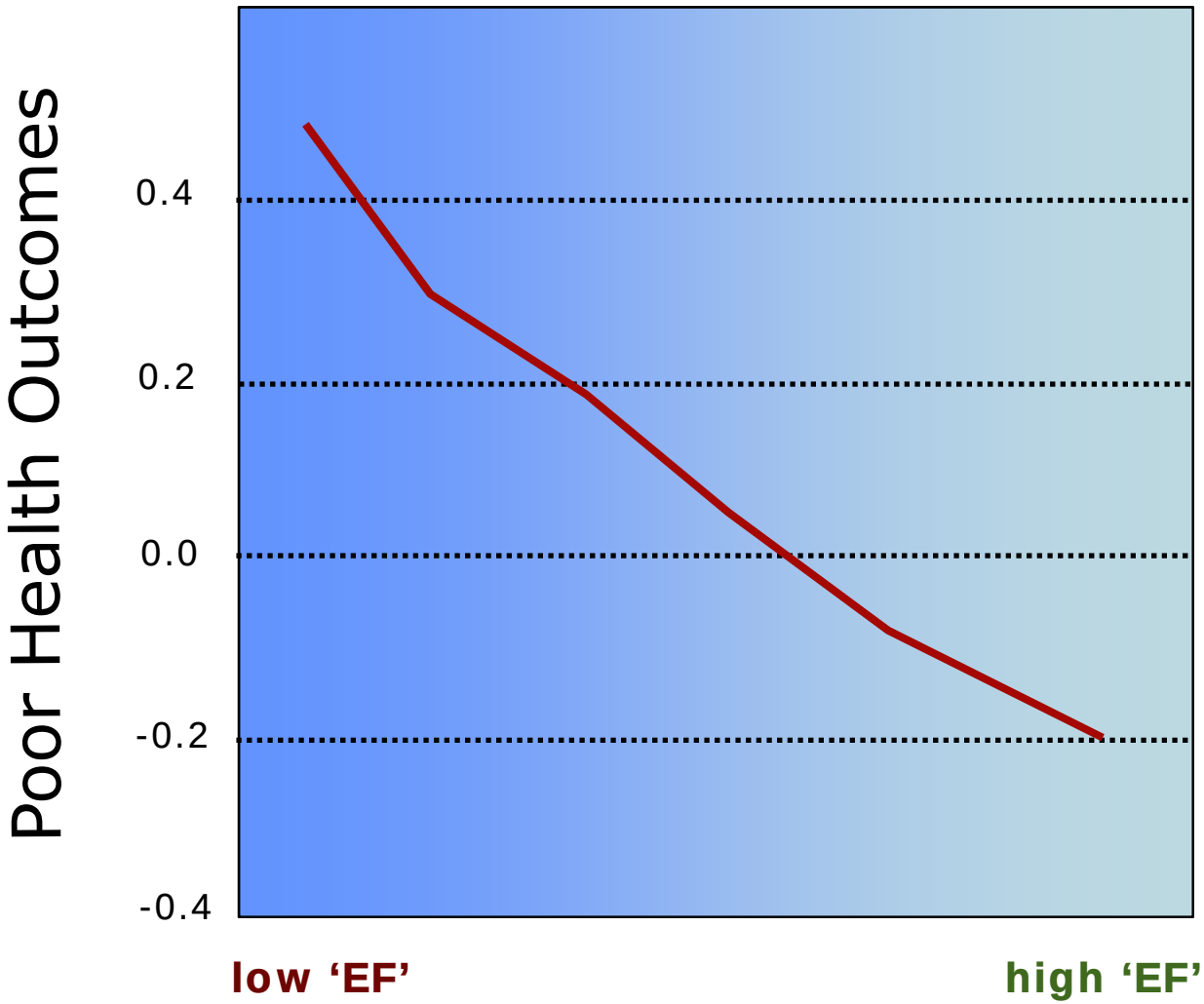
- Attention
- Working memory representations
- Long-term memory
- Emotions
- Actions

How Do We Test Executive Function?

Early Executive Function Disruption = Long Term, Expensive Problems

Early Executive Function Disruption - Long Term Impact

The Dunedin Study



Moffitt et al PNAS 2011

Early Executive Function Disruption - Long Term Impact

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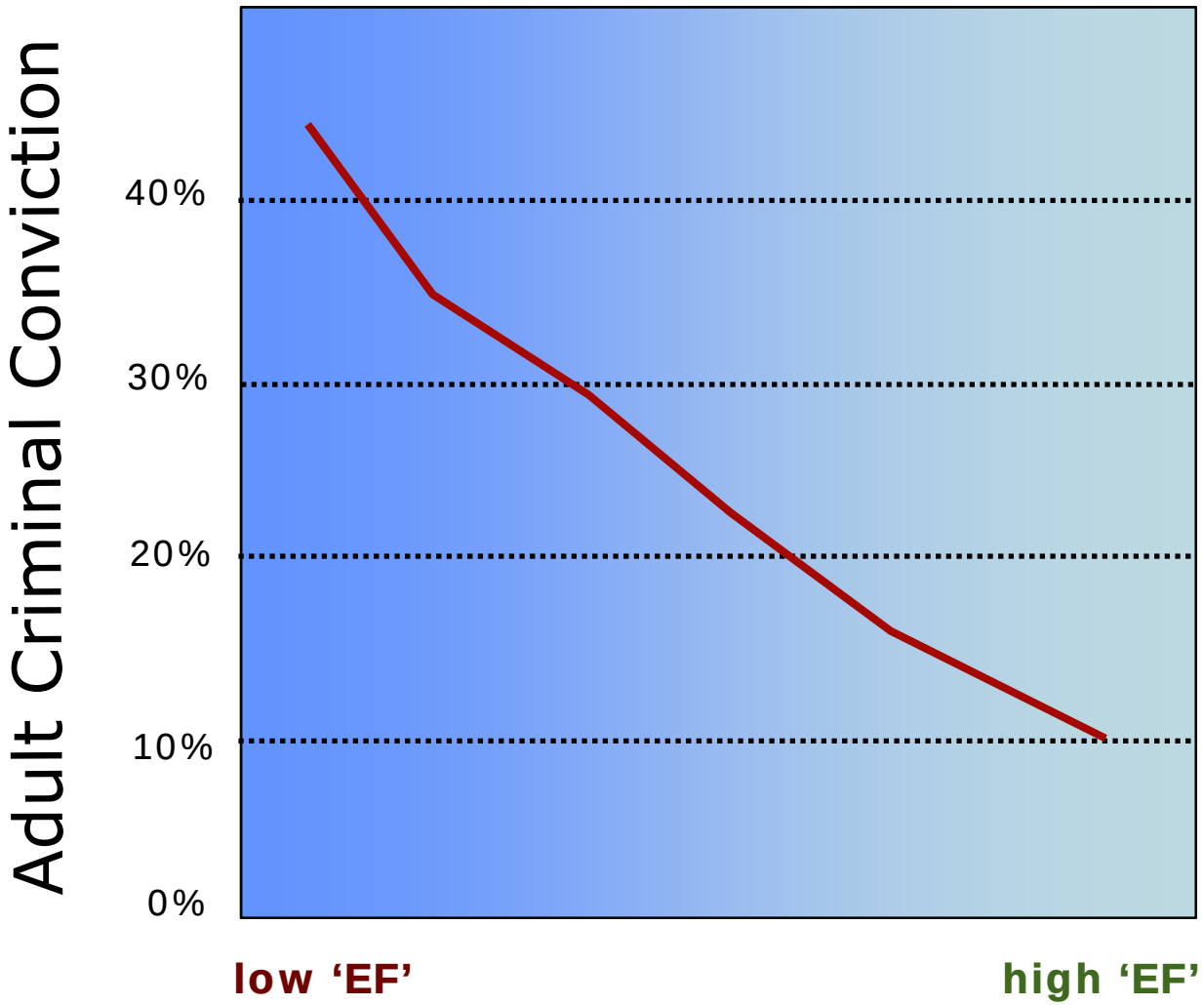

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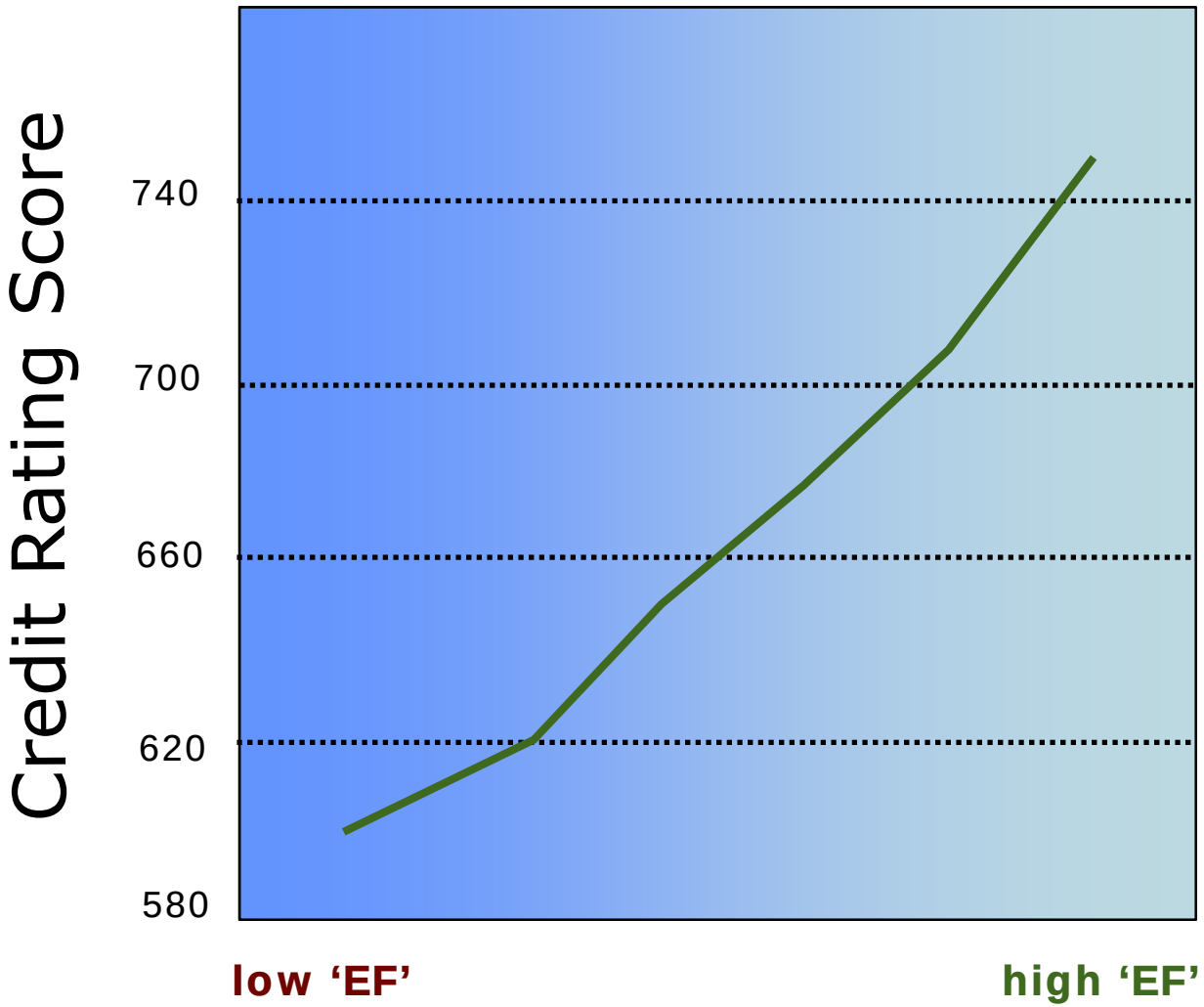

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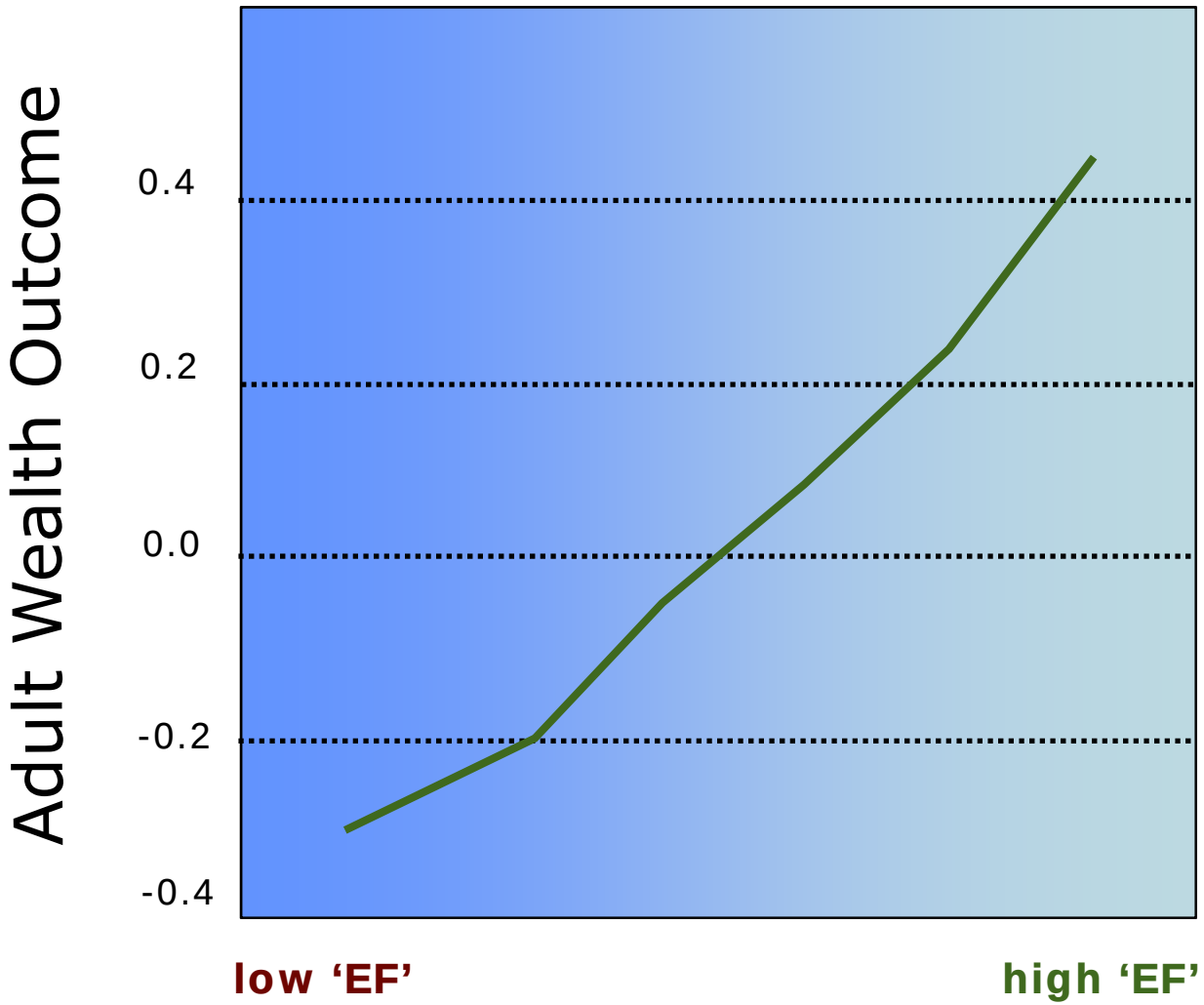

Moffitt et al PNAS 2011

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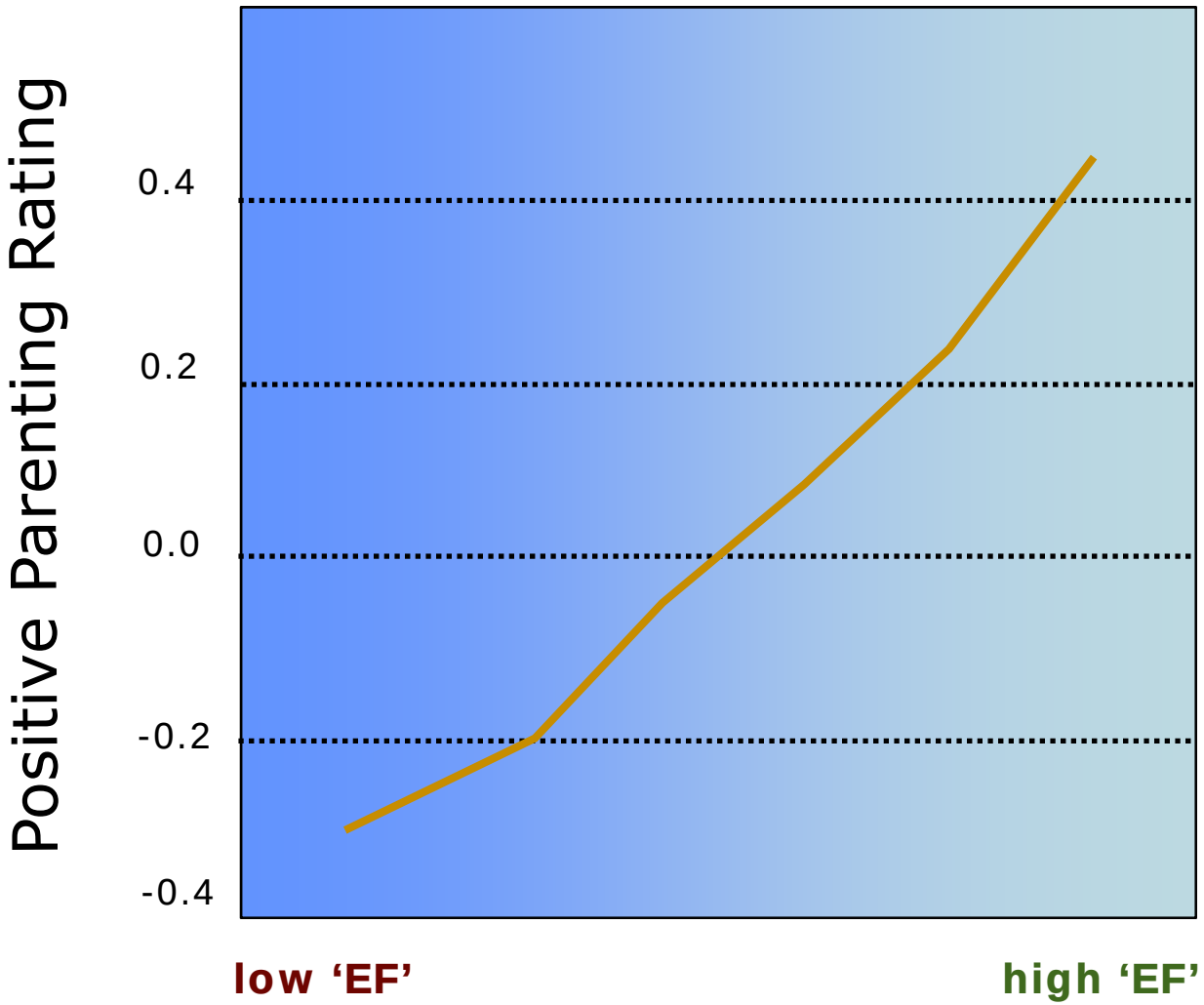


Moffitt et al PNAS 2011

Three Levels of Stress

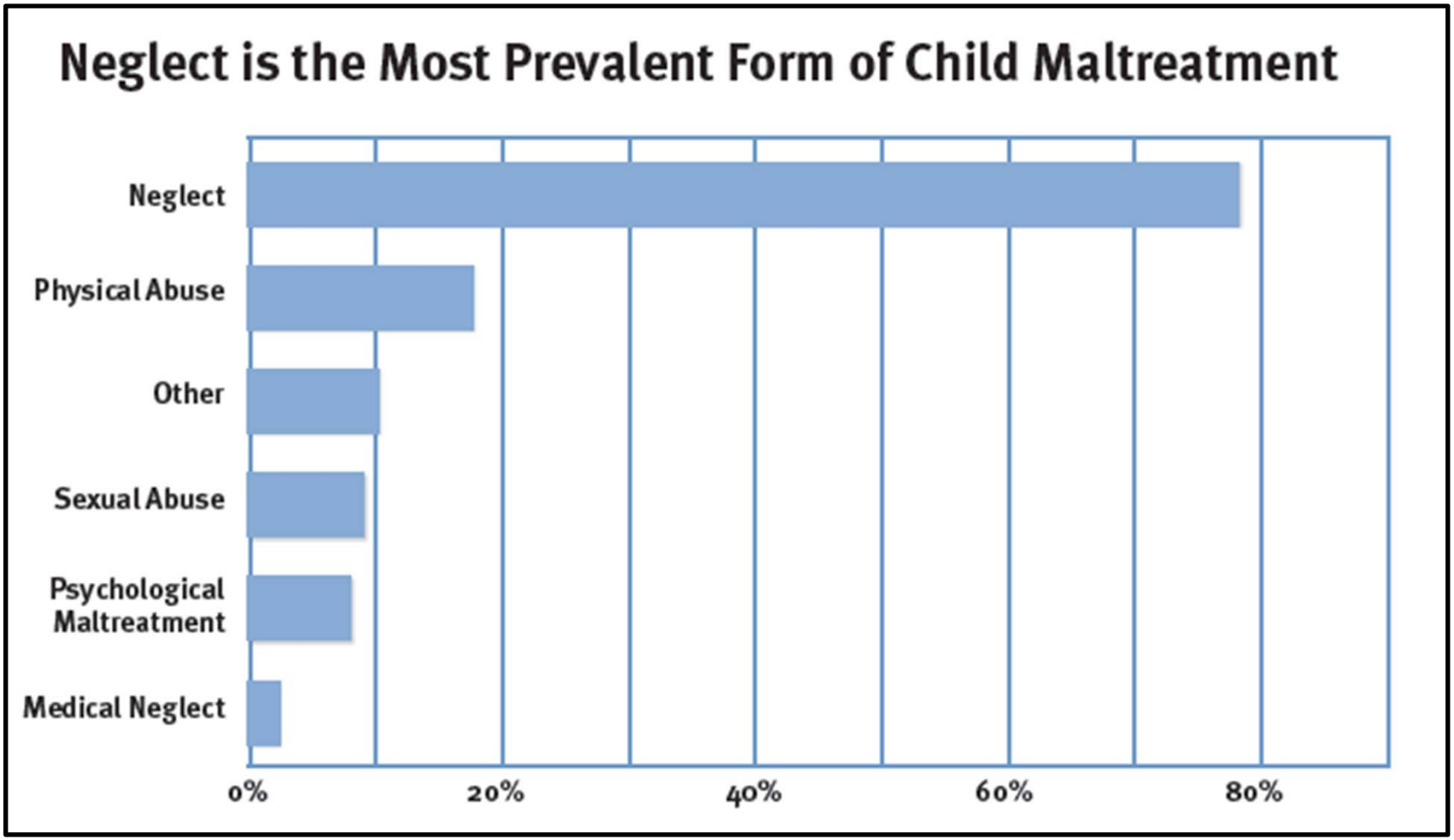
Positive
Brief increases in heart rate,
mild elevations in stress hormone levels.

Tolerable
Serious, temporary stress responses,
buffered by supportive relationships.

Toxic
Prolonged activation of stress response systems
in the absence of protective relationships.

We know that:

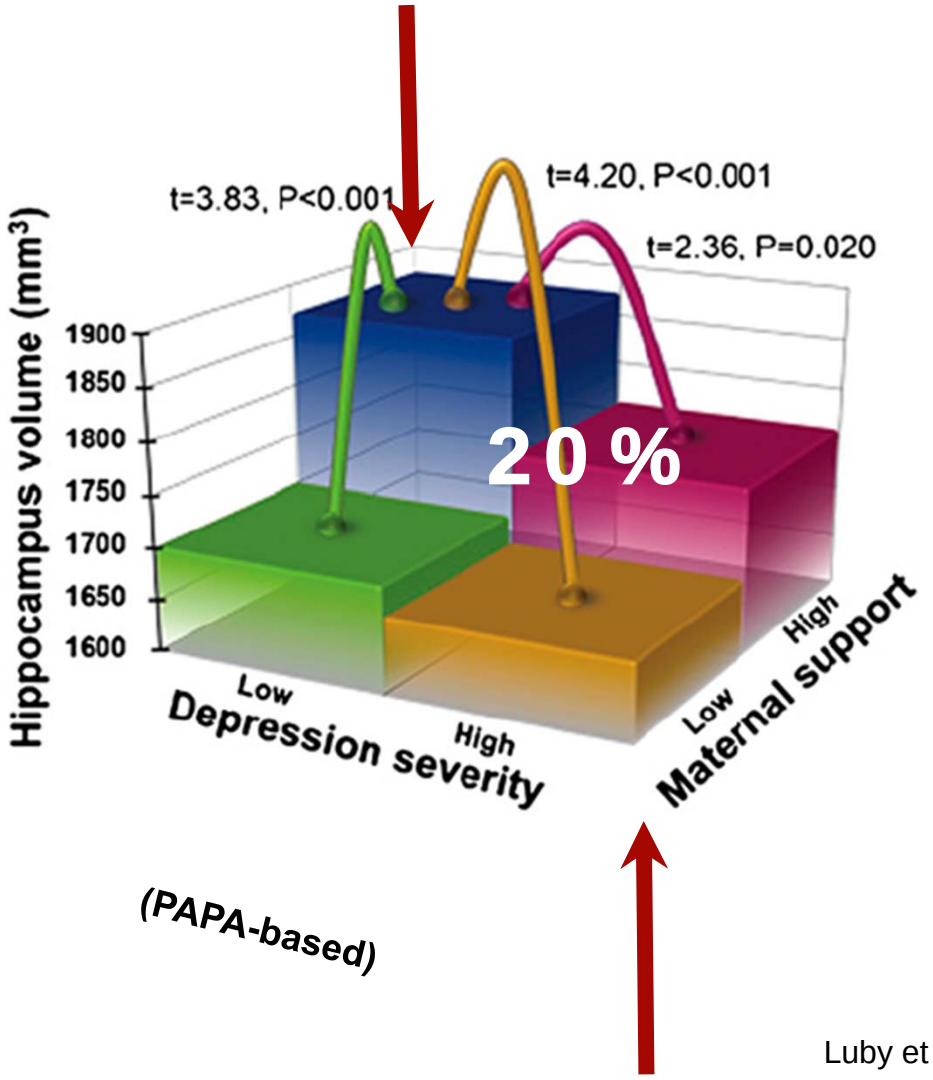
Early Adverse Experiences (ACEs) contribute directly to the risk for long-term physical and mental health.



U.S. Dept. Health and Human Services, 2010

Powerful Impact of ACEs on Brain Architecture

Positive or Adverse Childhood Experiences – Impact on Brain Architecture

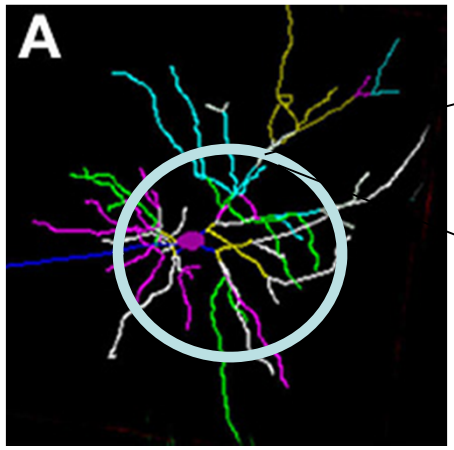


Luby et al, Proc. Nat. Acad. Sci. (2012)

Toxic Stress Damages Brain Architecture

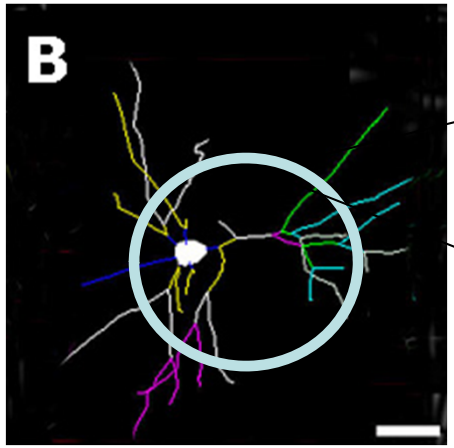
Prefrontal Cortex and Hippocampus - EF Regions

Normal



Typical neuron—many connections

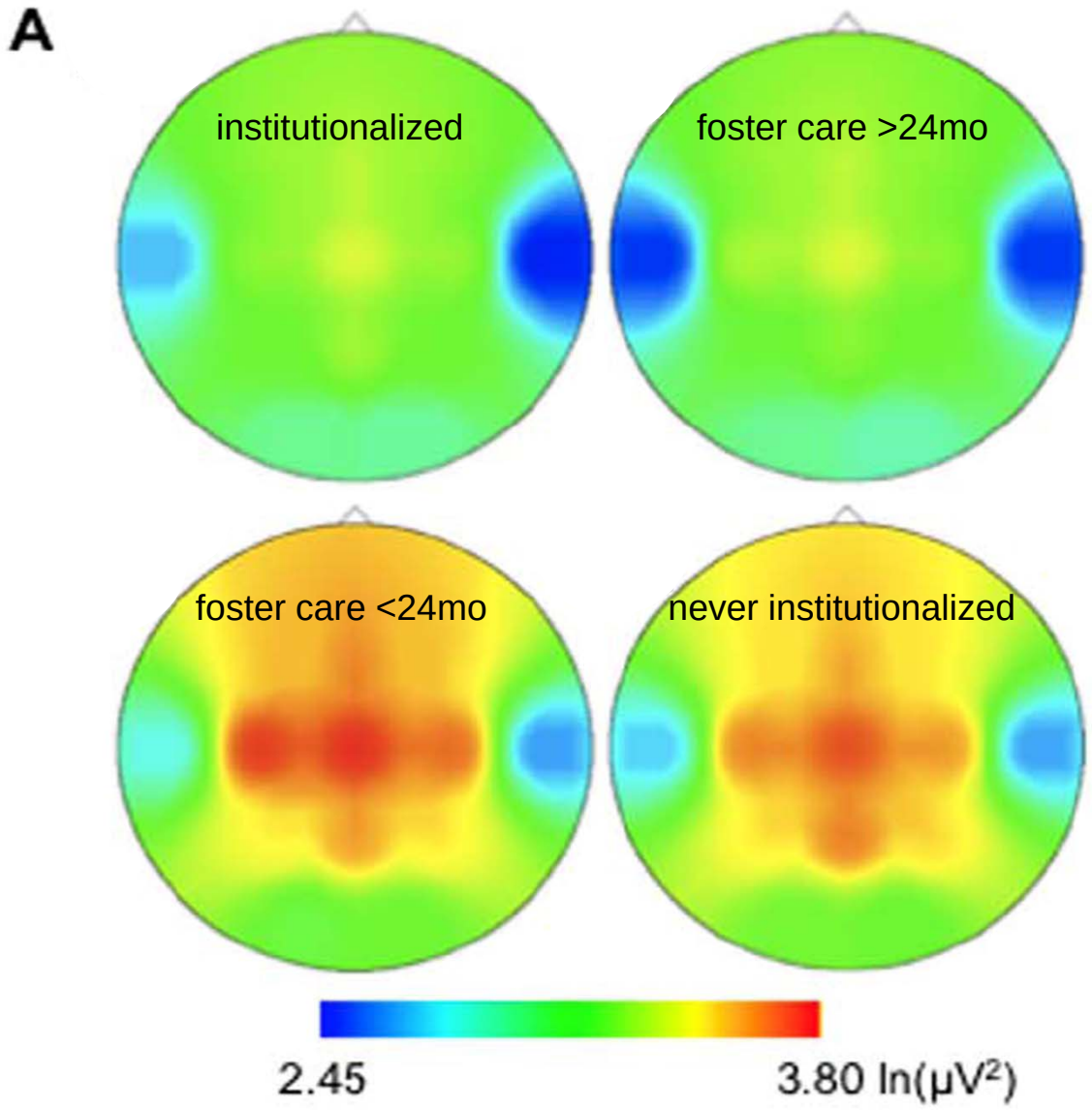
Toxic stress



Damaged neuron—fewer connections

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

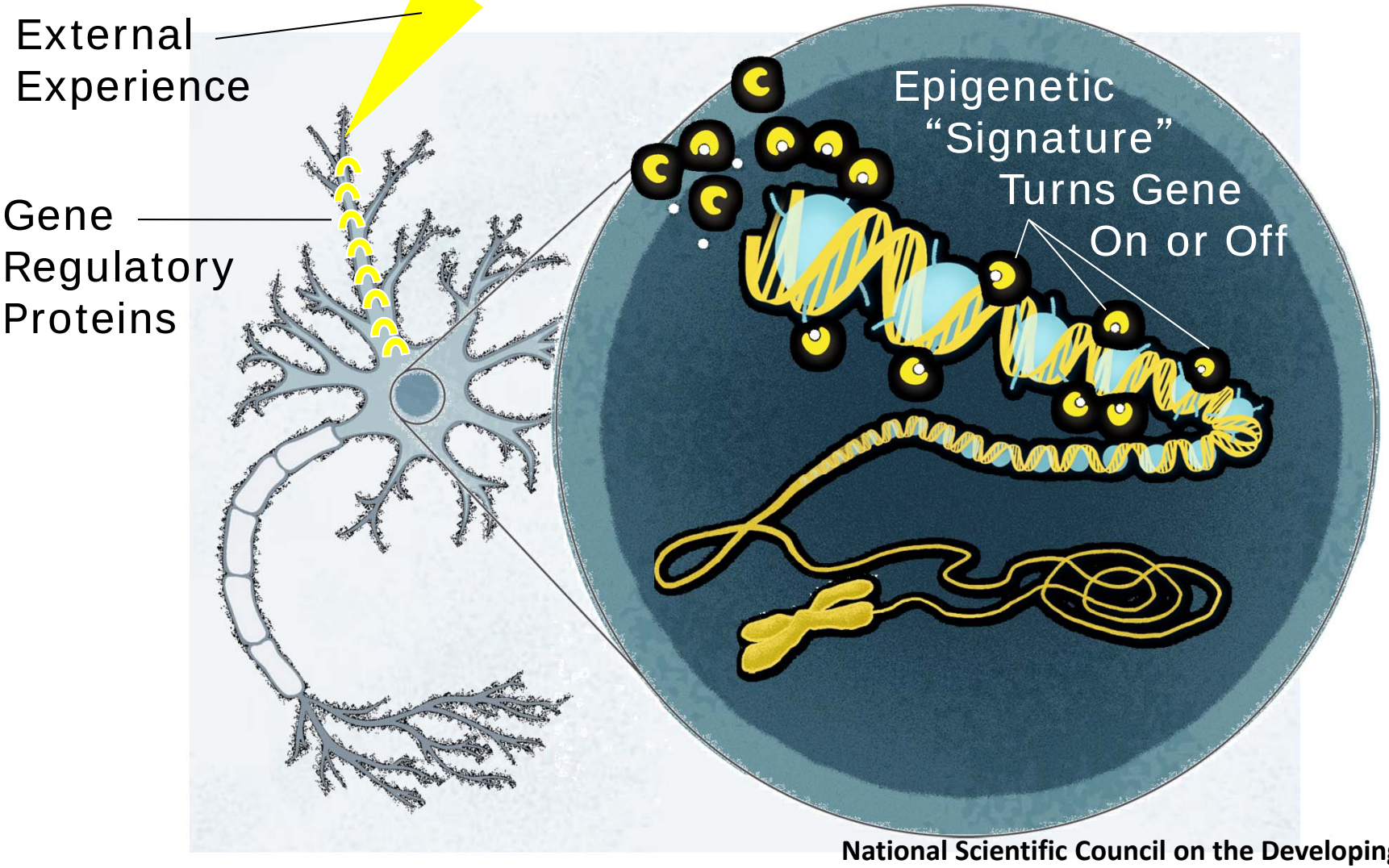
Extreme Neglect - BEIP Follow-up at 8 years - Absolute Alpha Power



Vanderwert et al PLos One 5 (2010)

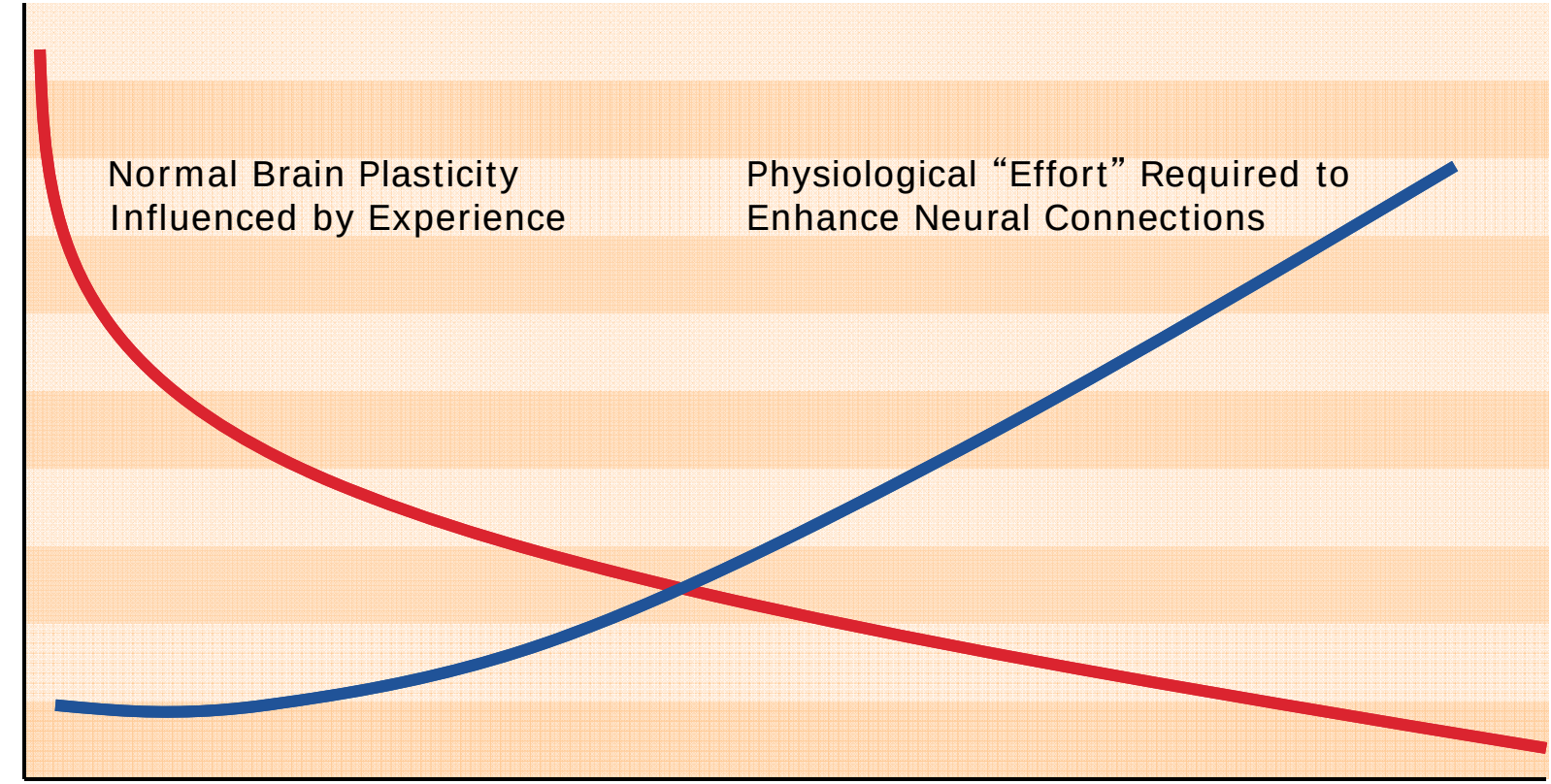
Why does toxic stress have such long-lasting impacts?

Early Experiences Leave Lasting Chemical "Signatures" on Genes



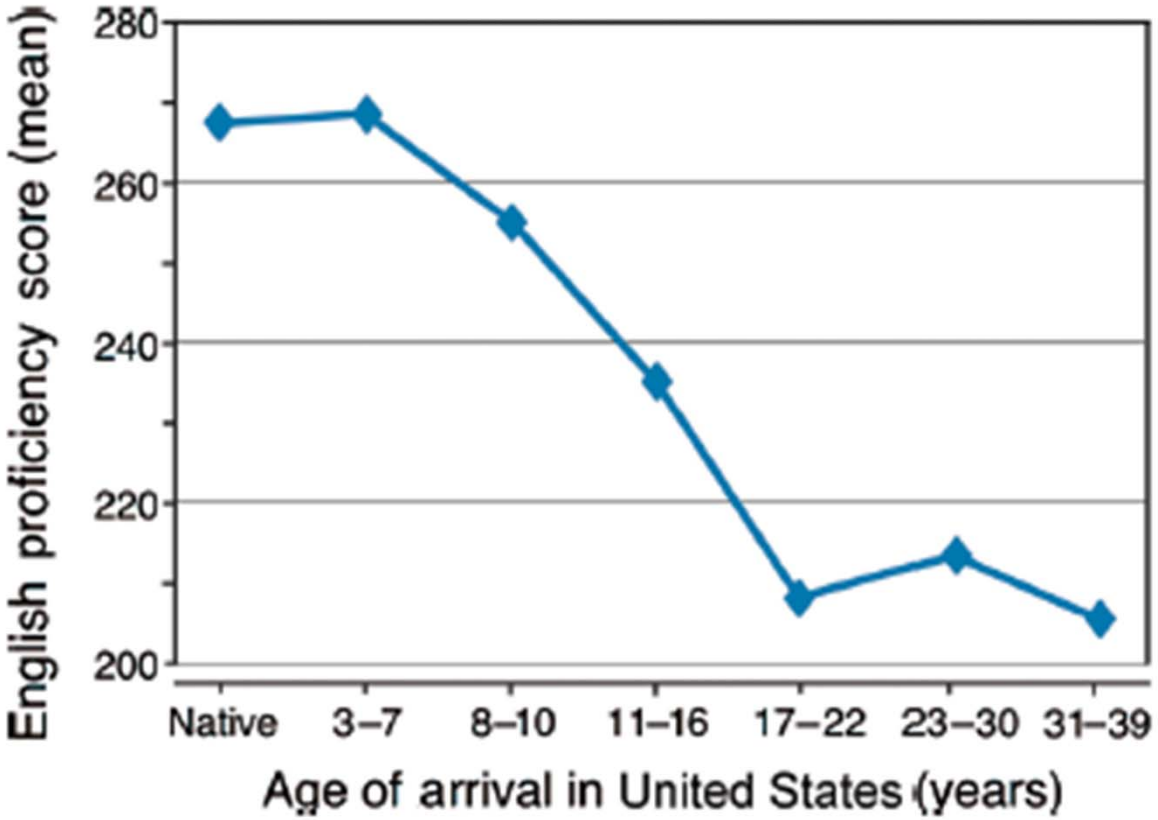
National Scientific Council on the Developing Child

The Ability to Change Brains of Children Decreases Over Time



Source: Levitt (2009)

Second Language Proficiency and Timing



Hertzman and Boyce, Ann. Rev. Public Health 31 (2010)

Classical Program Strategies That Do Work

- Plan from pregnancy, and look beyond education and health care.
- Invest in the development and retention of a skilled workforce in early childhood and public education.
- Make sure vulnerable children have access to stable, supportive relationships with adults—as early and as consistently as possible.

Executive Function Interventions

The Recipe of Programs that Work
(4-12 yr old in clinical studies)

- Computerized training (CogMed) for working memory
- Reasoning and speed training—domain-specific
- Aerobic exercise (high dose—40-70 min daily)
- Martial arts (inhibitory control, mindfulness)
- Curricula (Tools of the Mind—planning, inhibitory control)

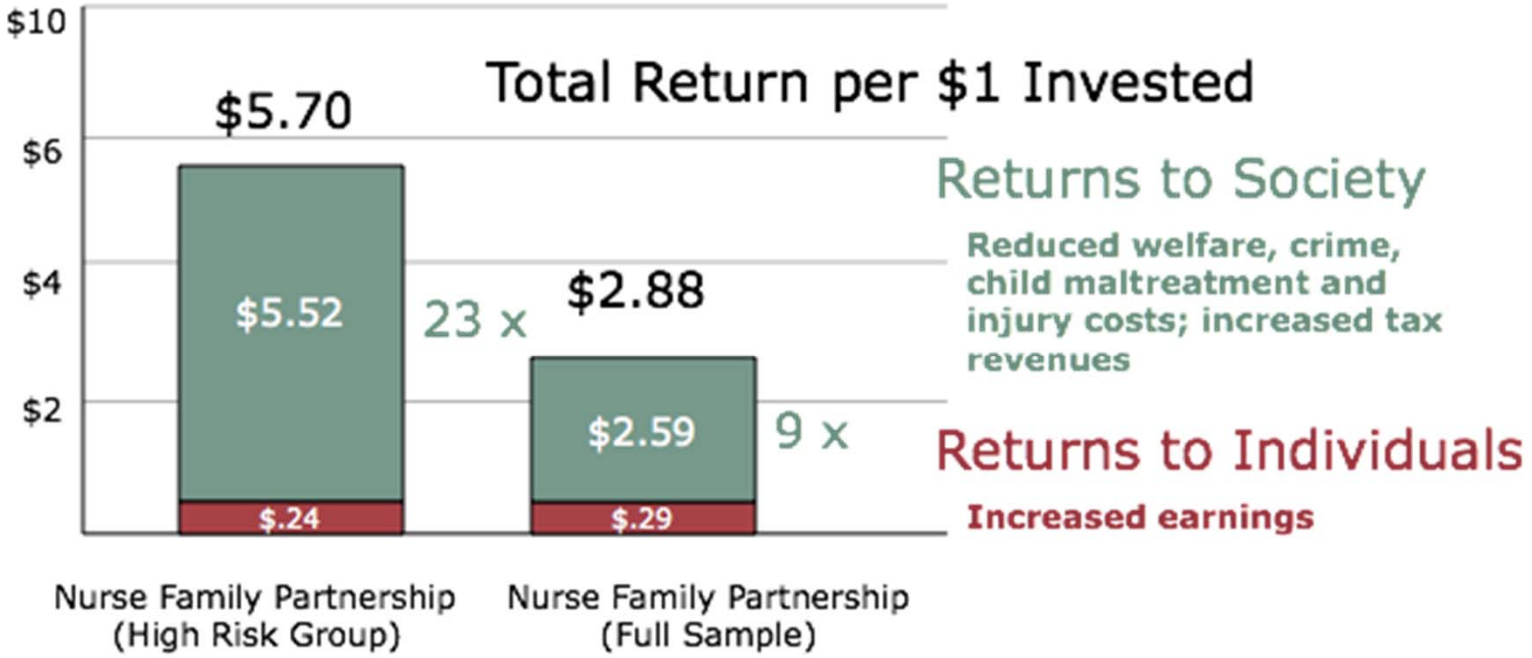
reviewed in Diamond and Lee, Science 333 (2011)

Remember Serve and Return?

Cost/Benefit Data on Nurse Family Partnership

(Dollars returned for each dollar invested)

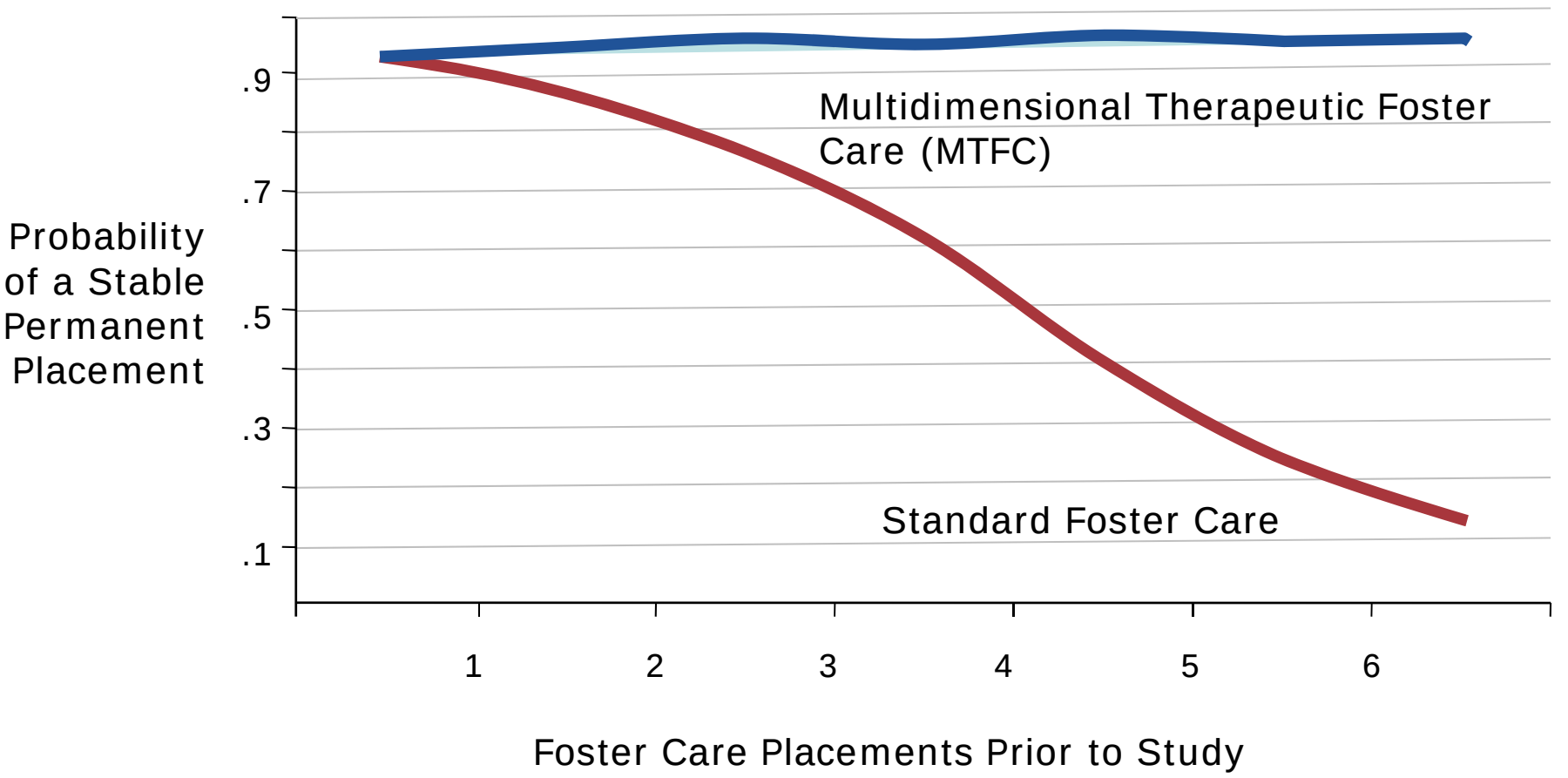
Karoly et al, 2005



Nurses > impact than Paraprofessionals

Olds et al JAMA Pediatrics, 2013

Placement Instability Breeds More Instability



Source: Fisher, Burraston, & Pears (2005)

Remember.....

Invest Early

Major increase human capital via ready workforce

It's

Patriotic

Thank You!

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www.CHLA.org/LevittLab

http://www.developingchild.harvard.edu