

# From Cells to Society and Return

Early Child Development:  
An Important Social determinant  
of Health.



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Fraser Mustard

1927 - 2011

“All Children deserve the right of full participation in community life”

Dr Dan Offord

“Investing in expectant mothers and their young children is a powerful equalizer and a key tool for economic and social stability.”

Dr Fraser Mustard



World Health  
Organization



Commission on  
Social Determinants of Health

# Closing the gap in a generation

Health equity through action on  
the social determinants of health



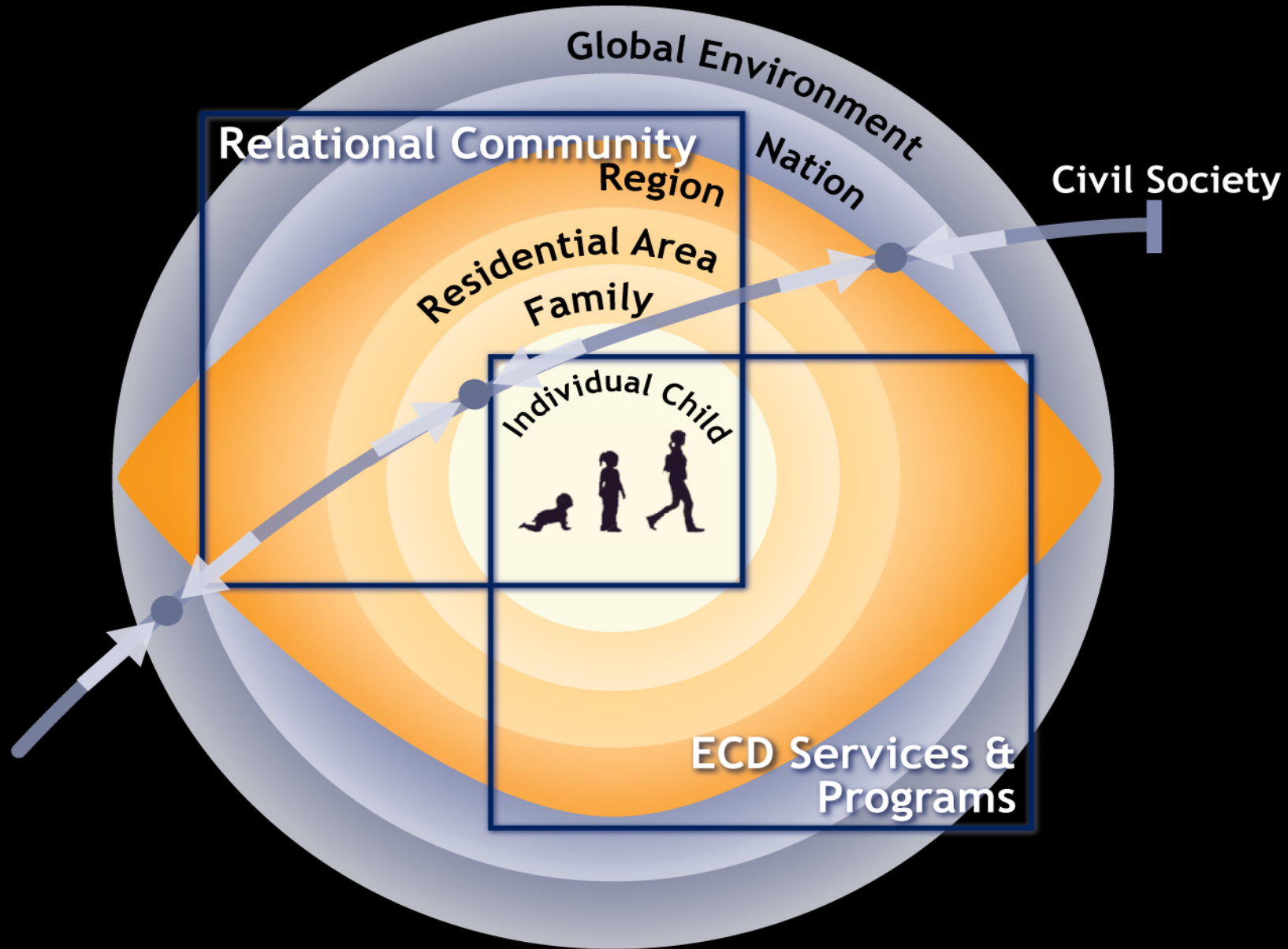
“Poor social  
policies, unfair  
economics and  
bad politics are  
killing people on  
a grand scale.”

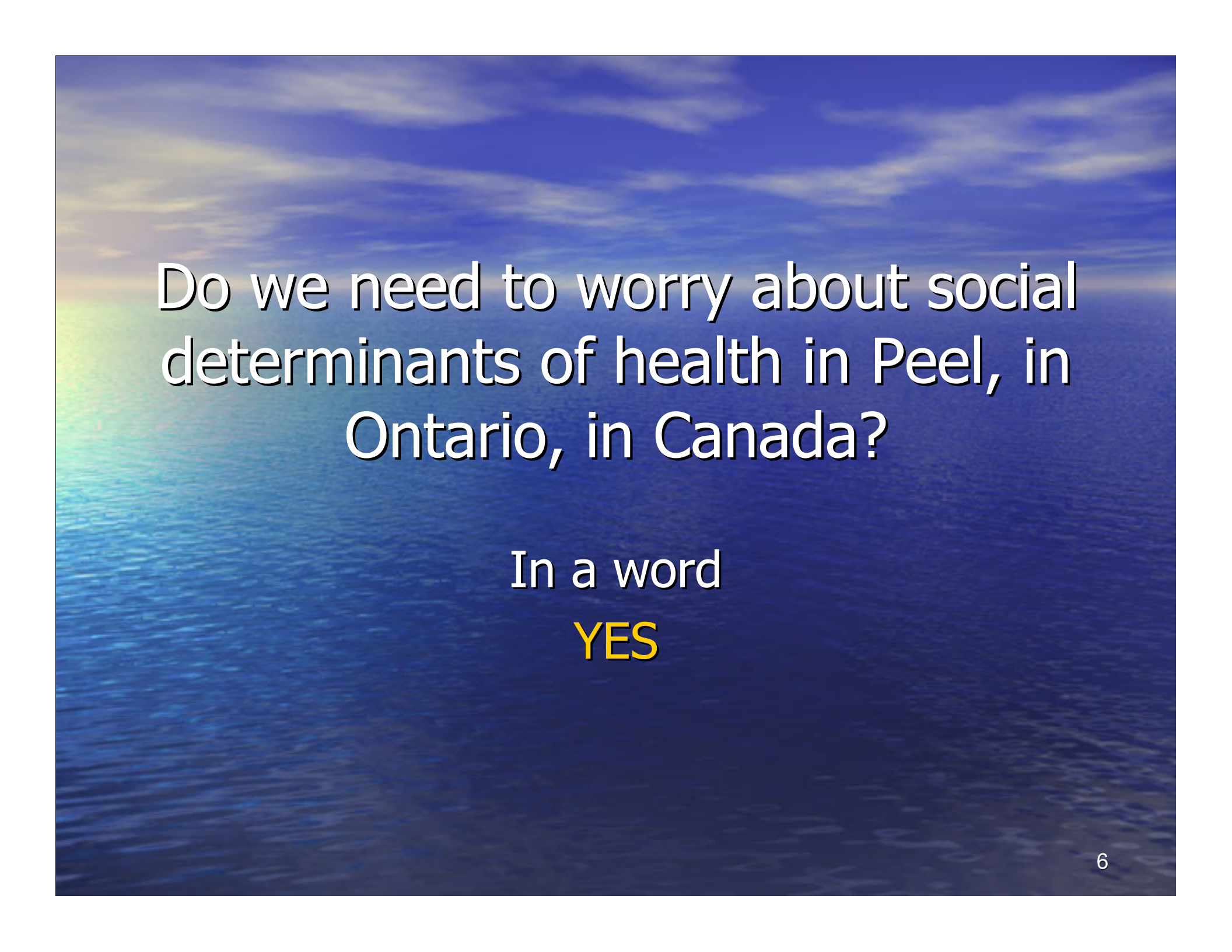
Sir Michael Marmot

# Families **OR** Society



# Which Environments Matter?





Do we need to worry about social determinants of health in Peel, in Ontario, in Canada?

In a word

**YES**

# SickKids Patients

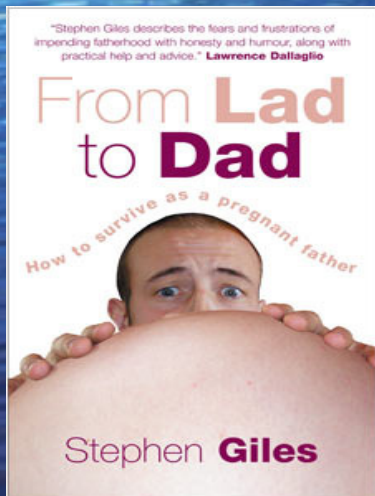
Children **from high poverty neighbourhoods:**

- **56%** of admissions
- **1.6 days** extra length of stay: 7.6 vs 6.0 days
- 2.0 vs 1.5 Resource Intensity Weighting
- **60%** of missed clinic visits
- **64%** of unplanned readmissions (8-28 days)
- **65%** of deaths

In Utero and during lactation **maternal experience** has a major influence on baby



Dad's behaviour  $\Rightarrow$  Influence Mom  
 $\Rightarrow$  Influence baby



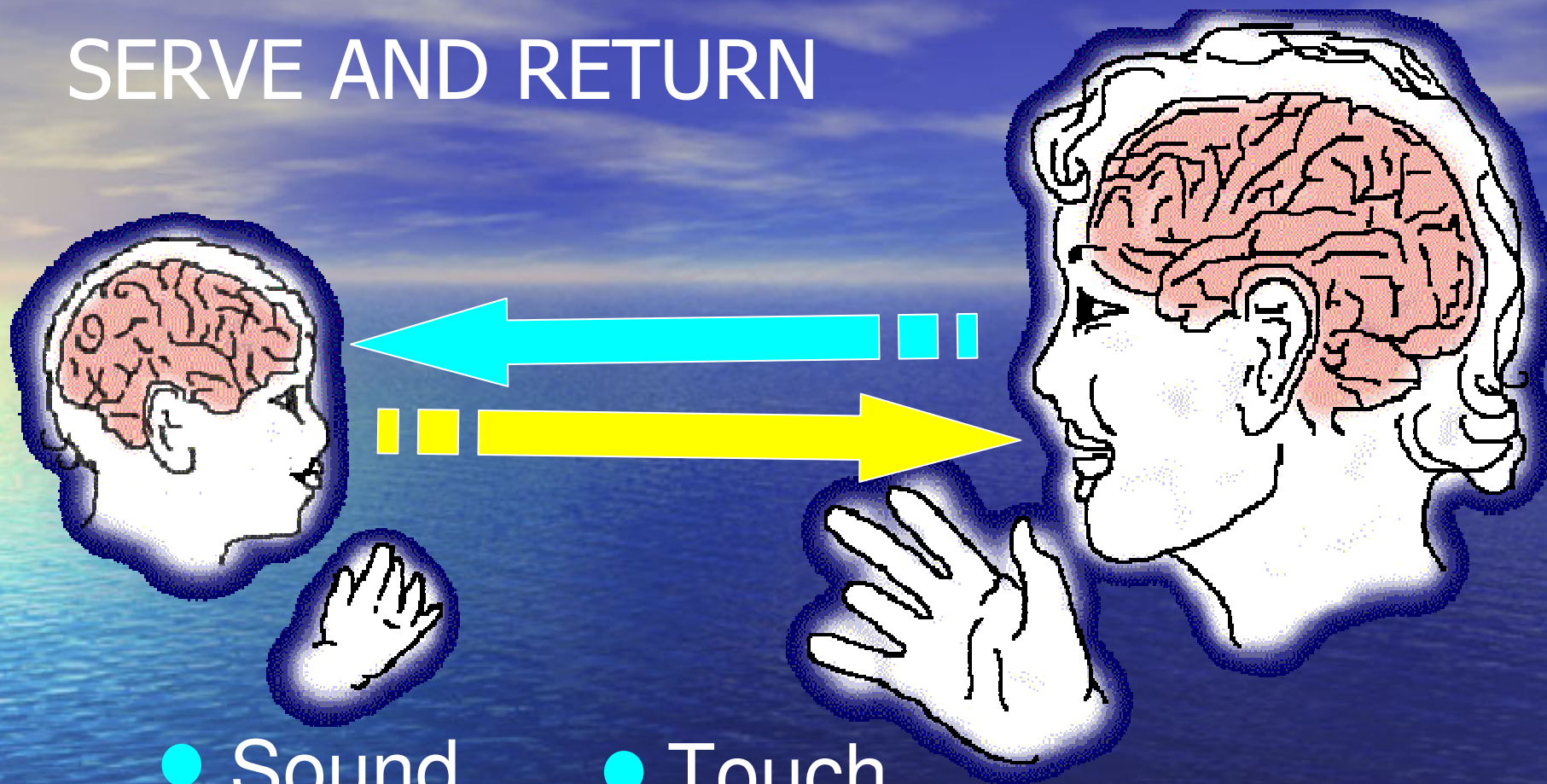




**BREASTFEEDING**

It Rocks!

# SERVE AND RETURN



- Sound
- Vision
- Smell

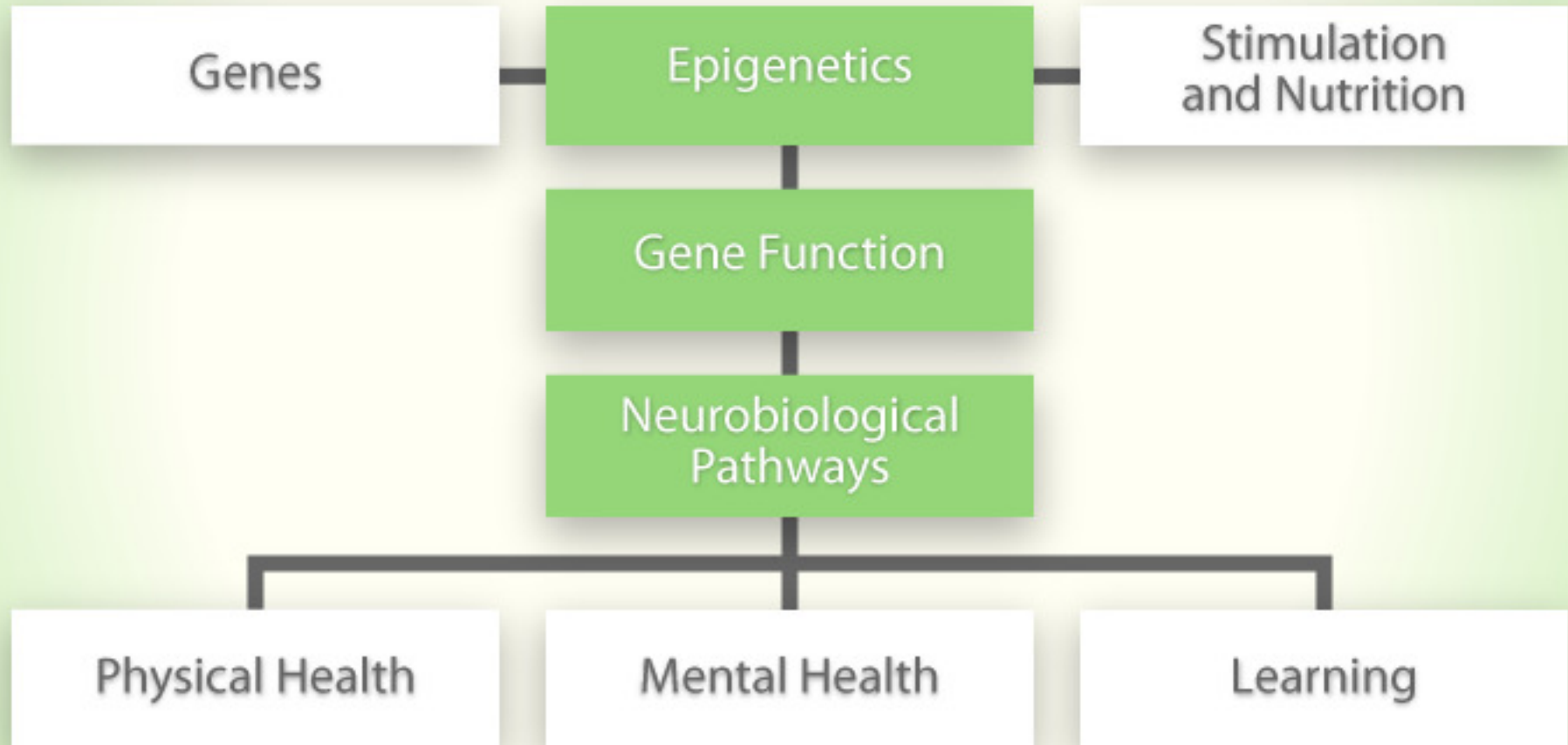
- Touch
- Proprioception
- Taste

# Experience-Based Brain Development

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**Nature**

**Nurture**



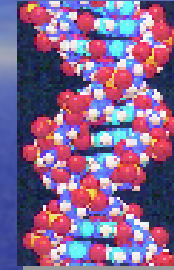
National Scientific Council on the Developing Child (2010). Early Experiences Can Alter Gene Expression and Affect Long-Term Development: Working Paper No. 10. Retrieved from [www.developingchild.harvard.edu](http://www.developingchild.harvard.edu) September 28, 2010.

# Gene Transcription: Maternal Behavior in the Rat (Meaney M, Szyf M et al, 2004-08)



Low parental  
licking and  
grooming

Pregnancy



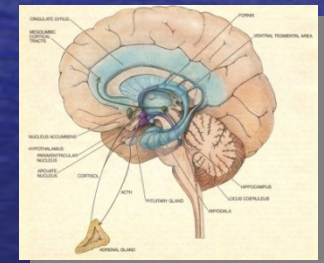
DNA methylation  
at GR promoter

↓ Epigenetic  
expression of  
GR

Relegation to  
subordinate roles

Behavioral  
inhibition

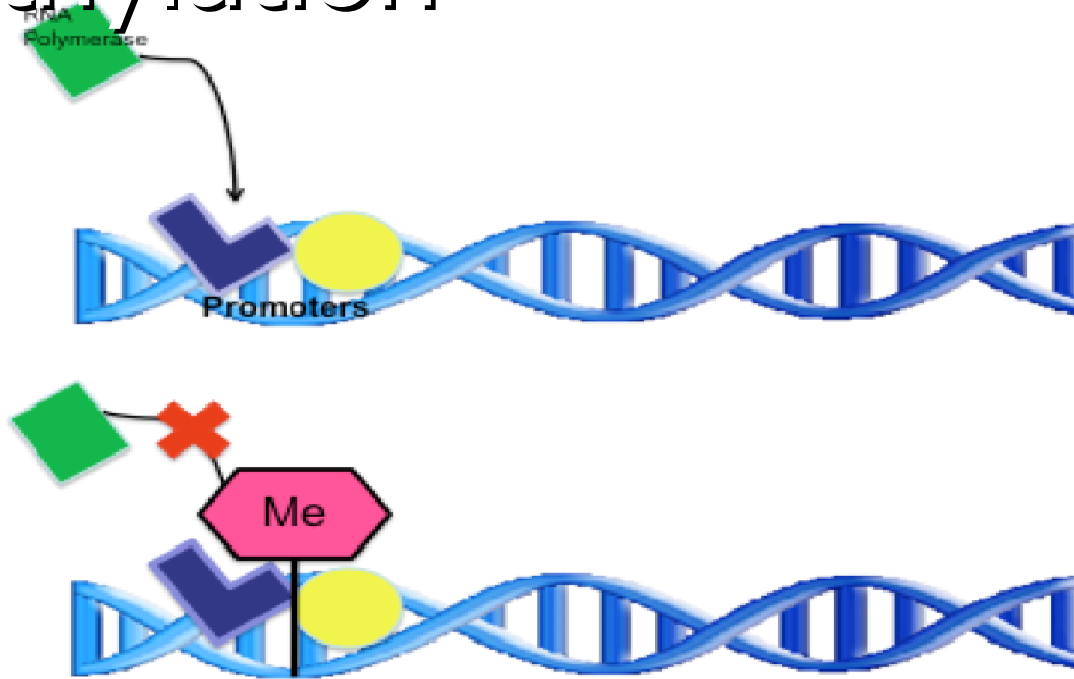
Upregulation  
of HPA axis  
reactivity



# Epigenetics

Is any process that can alter gene activity without changing the DNA sequence.

## Methylation



# Serotonin Transporter Gene Experience in Early Life - Depression

03-089

Depression  
Risk

Age 26



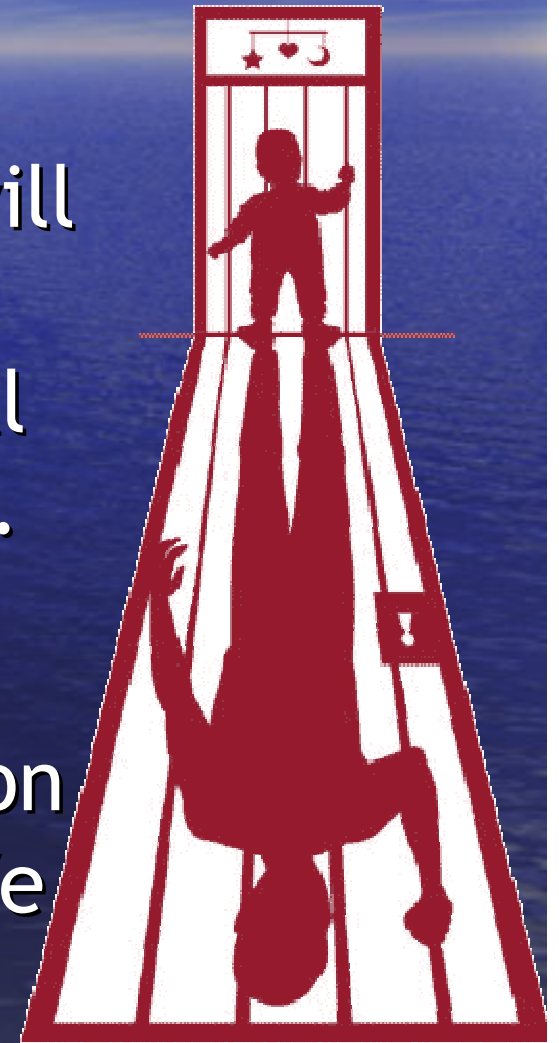
Early Childhood

A. Caspi, Science, 18 July 2003, Vol 301, <sup>14</sup>

# Cradle to Prison Pipeline

The burden of mental health problems and early criminality will be driven by the level of vulnerability in social-emotional development in the early years.

Thus, our strategy should focus on reducing vulnerability early in life



# Life Course Problems Related to Early Life

2<sup>nd</sup>  
Decade

- School Failure
- Teen Pregnancy
- Criminality

3<sup>rd</sup>/4<sup>th</sup>  
Decade

- Obesity
- Elevated Blood Pressure
- Depression

5<sup>th</sup>/6<sup>th</sup>  
Decade

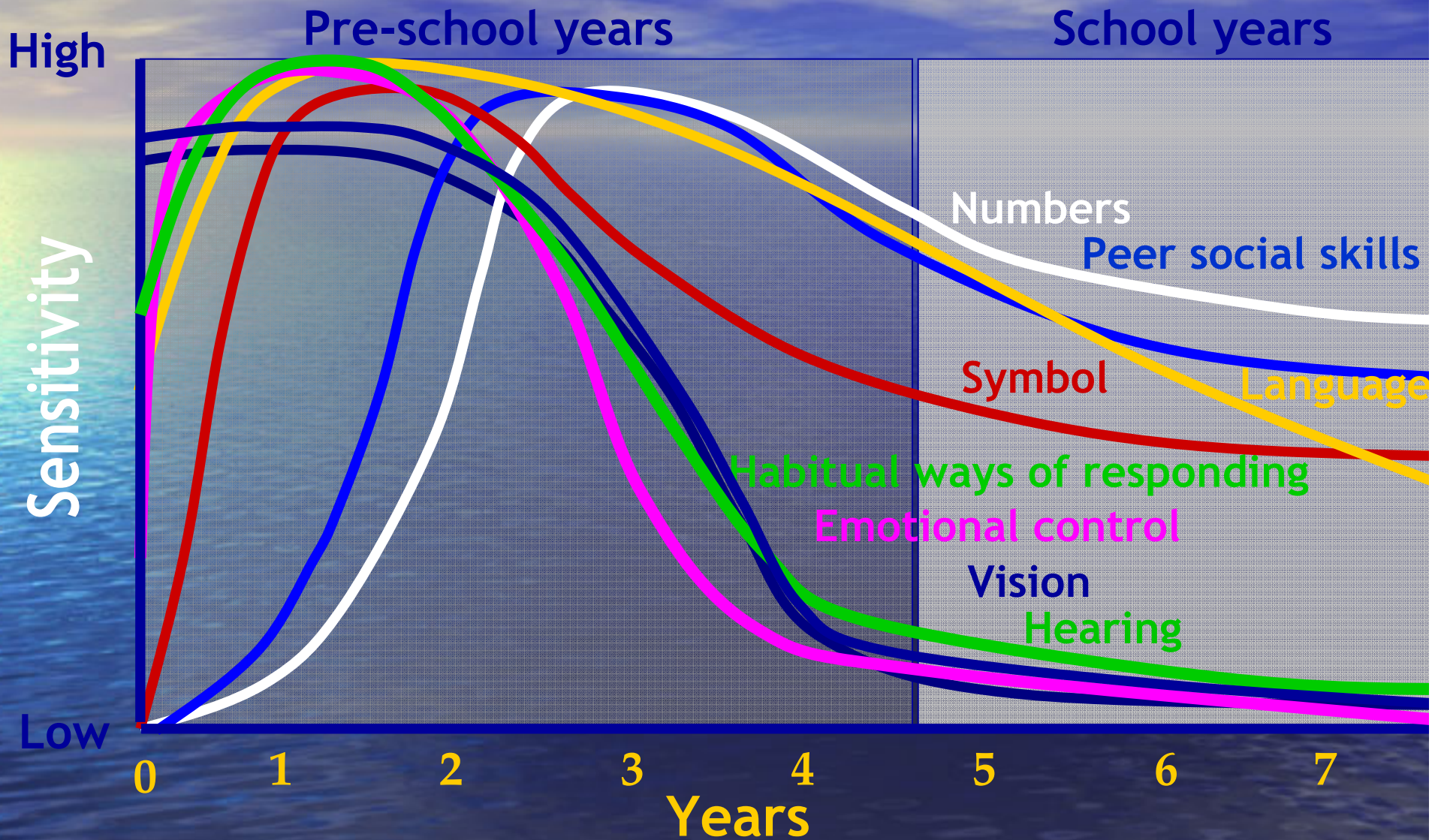
- Coronary Heart Disease
- Diabetes

Old Age

- Premature Aging
- Memory Loss



# Sensitive Periods in Early Brain Development



Graph developed by Council for Early Child Development (ref: Nash, 1997; *Early Years Study*, 1999; Shonkoff, 2000.)

# How Important are Social Risk Factors??

*Gain in Life Expectancy from eliminating:*

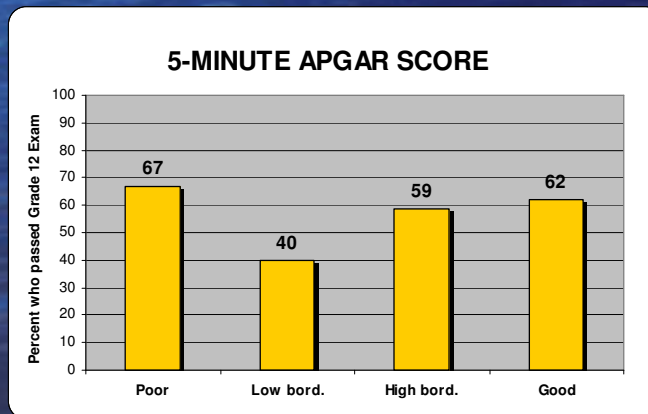
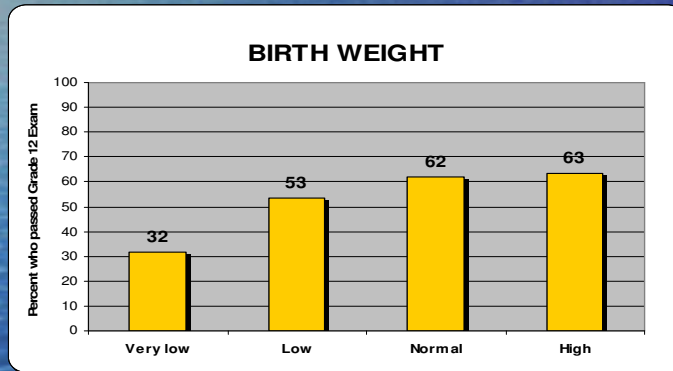
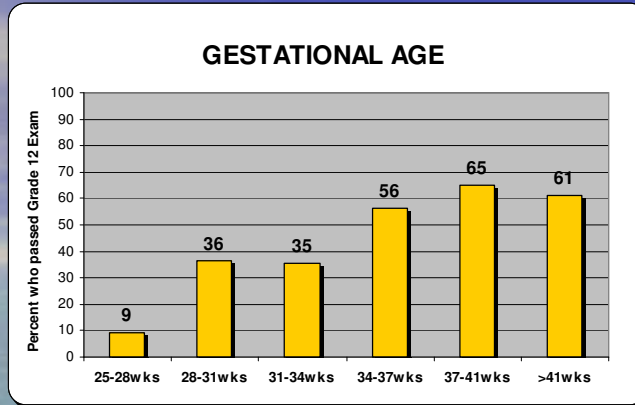
- *Cancer = 3-4 years*
- *Heart Disease = 3 years*

Eliminate (effects of)

- Social Risk Factors = 10 years

# Passing Score - 12<sup>th</sup> Grade Exam

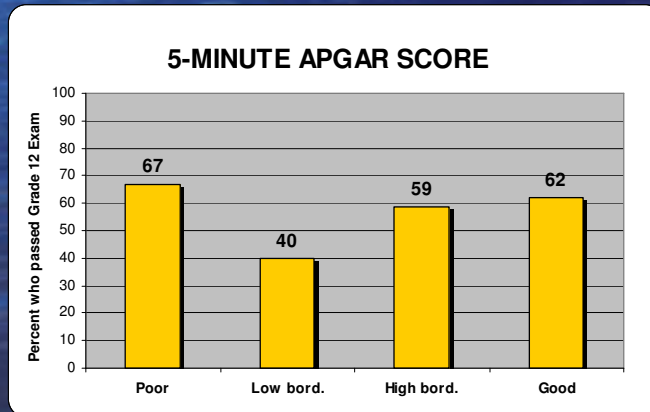
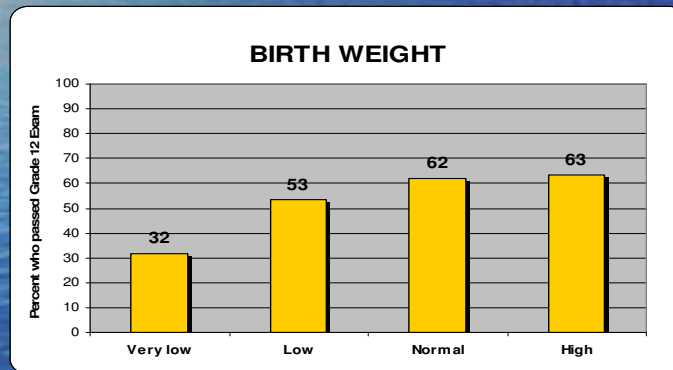
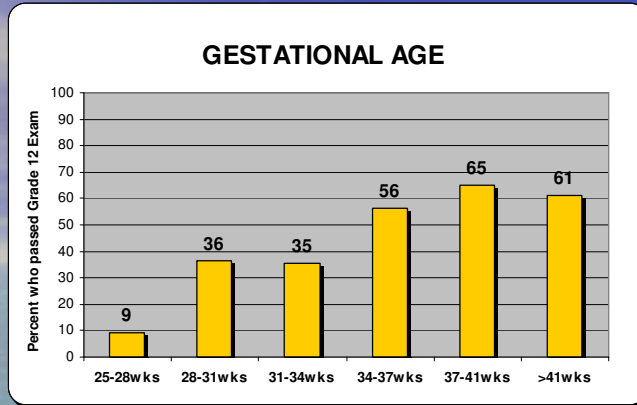
## Biomedical Predictors



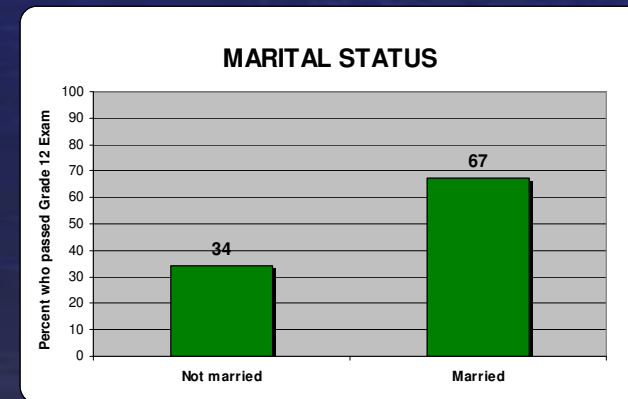
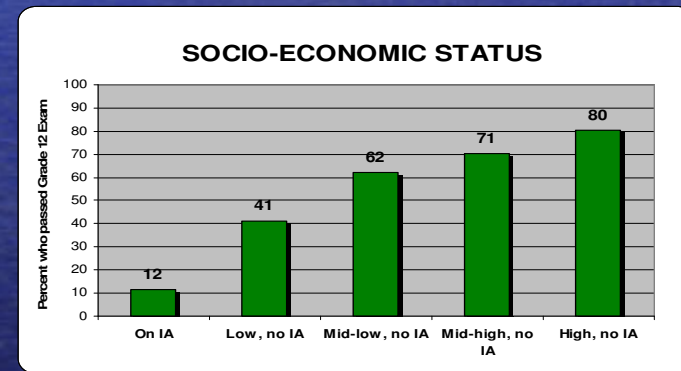
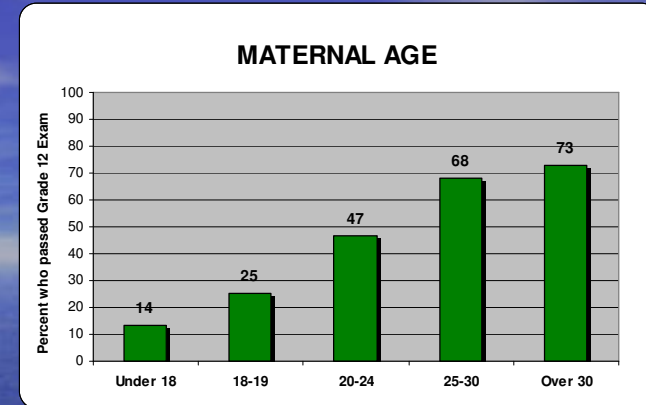
## Social Predictors

# Passing Score - 12<sup>th</sup> Grade Exam

## Biomedical Predictors



## Social Predictors



# The Long Reach of Early Childhood

- The longer children lived in poverty, the higher the measured stress load and lower score on working memory tests
- A plausible contributor to the income-achievement gap is working memory impairment in lower-income adults caused by stress-related damage to the brain during childhood”

Evans and Schamberg PNAS 2009



# Canada



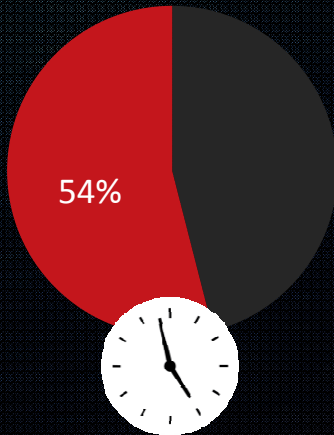
Young women in the labour force



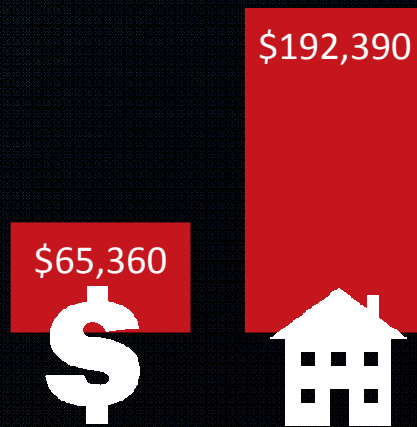
Median household income  
*(adjusted for inflation)*



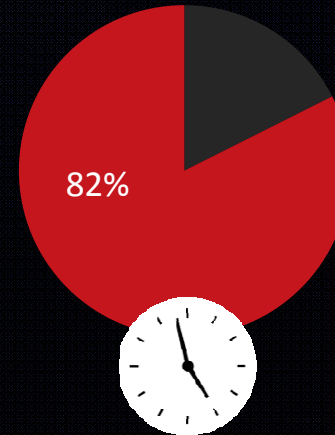
Average cost of housing  
*(adjusted for inflation)*



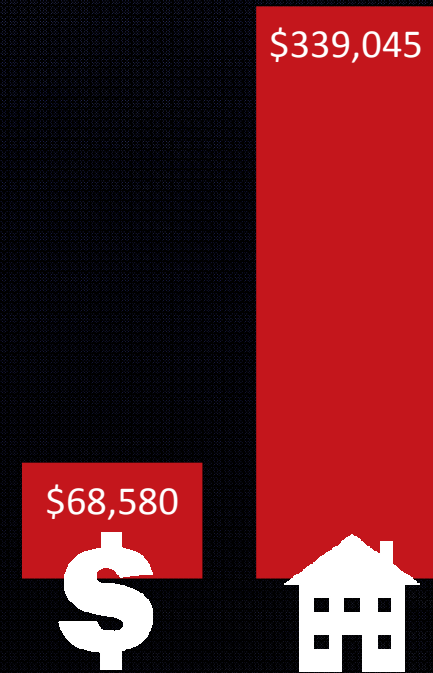
1976



1976-1980



2009



2005-2009

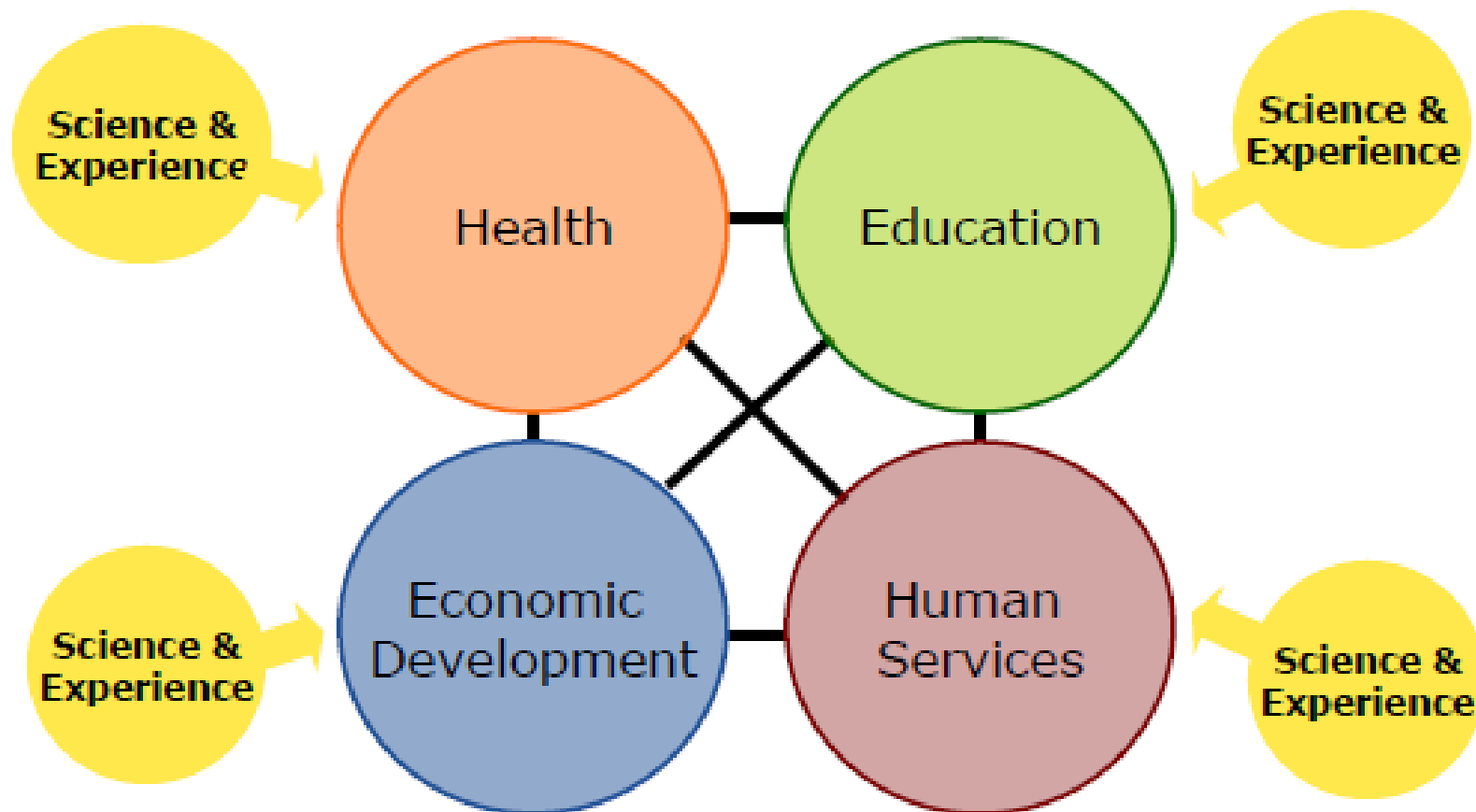
2010

# The Foundation of a Successful Society is Built in Early Childhood

Healthy development in the early years provides the building blocks for educational achievement, economic productivity, responsible citizenship, lifelong health, strong communities, and successful parenting of the next generation.

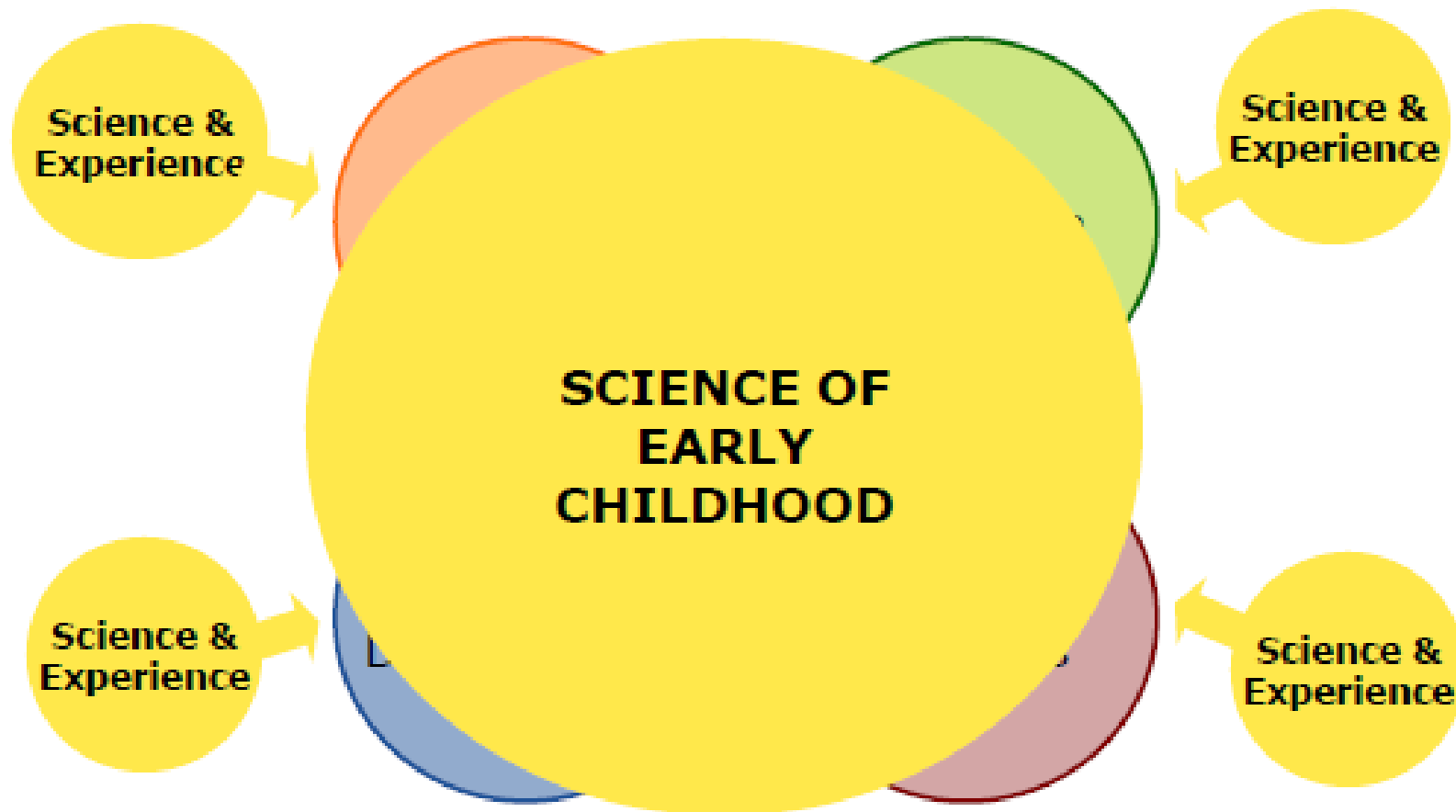
Advances in neuroscience, molecular biology, genomics, and the behavioral and social sciences could be leveraged to catalyze innovative policies and practices across sectors.

# Multiple Sources of Knowledge Currently Inform Practice in Poorly Connected Sectors

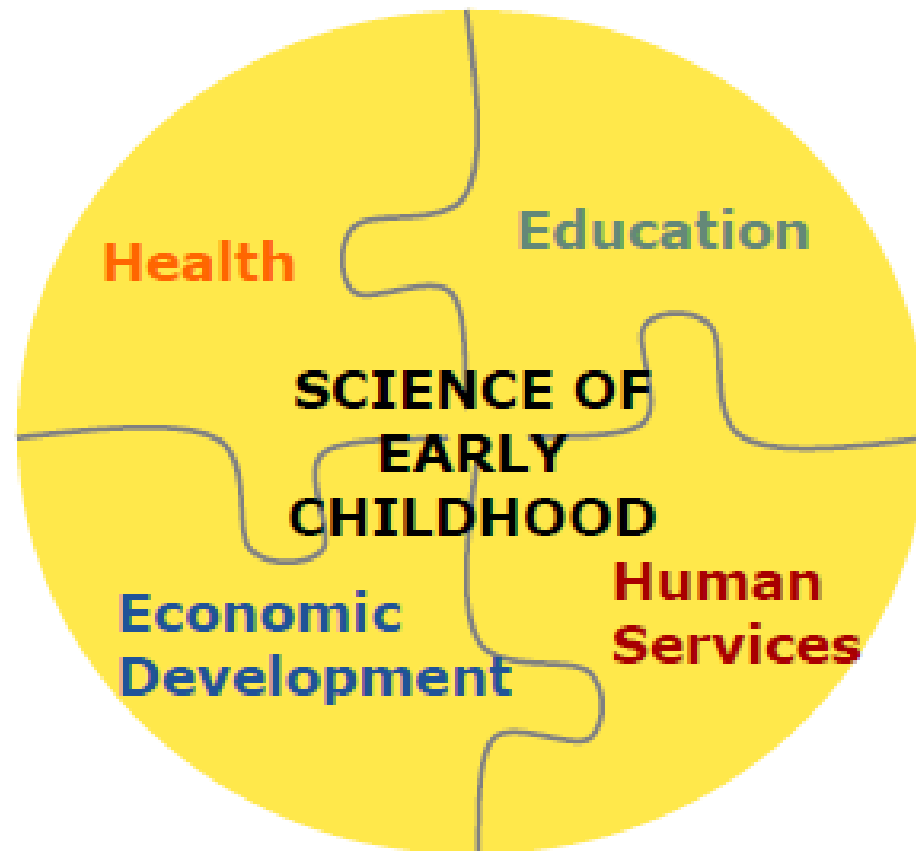




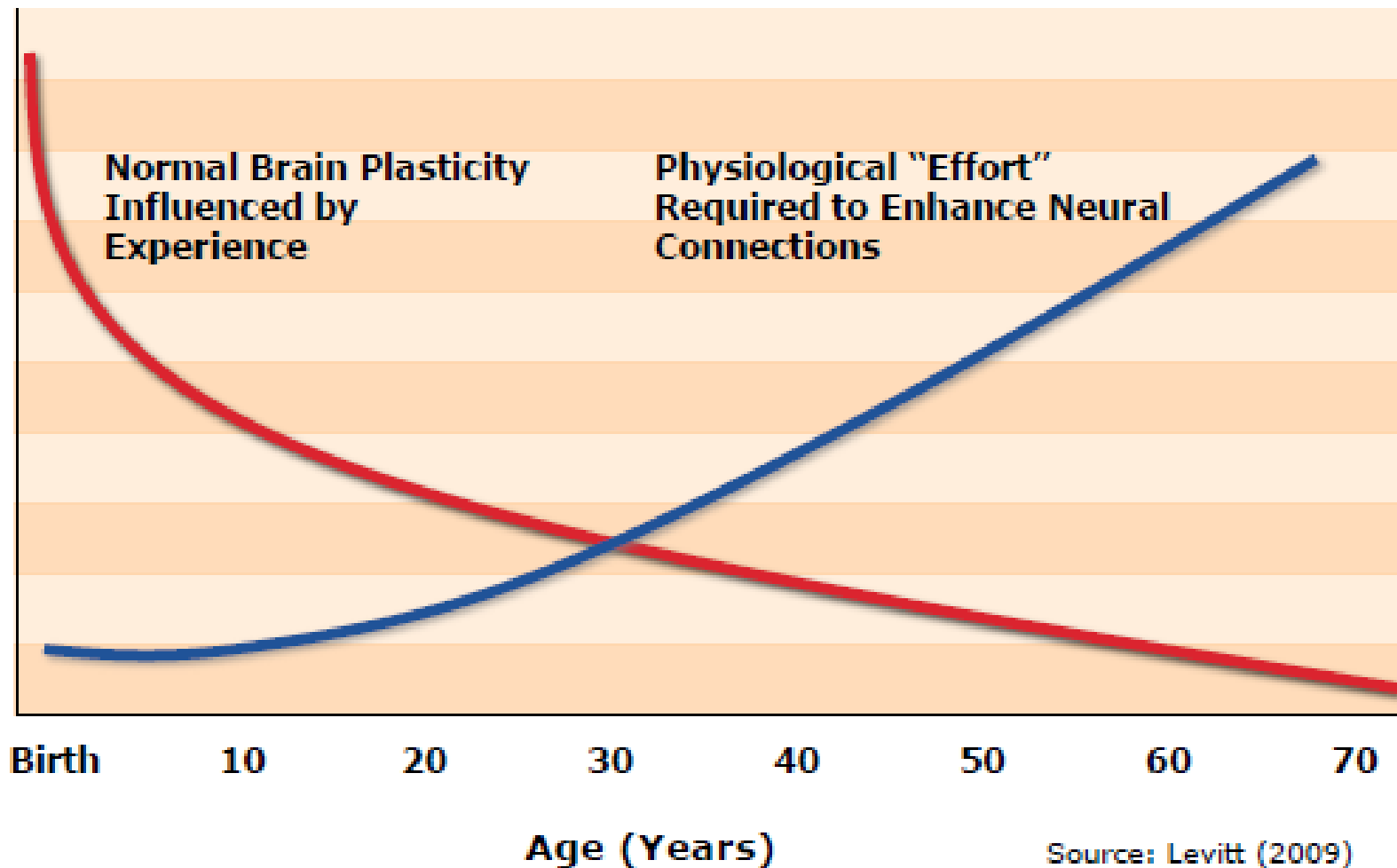
# An Integrated Science of Early Childhood Development Could Drive More Productive Investments Across Sectors



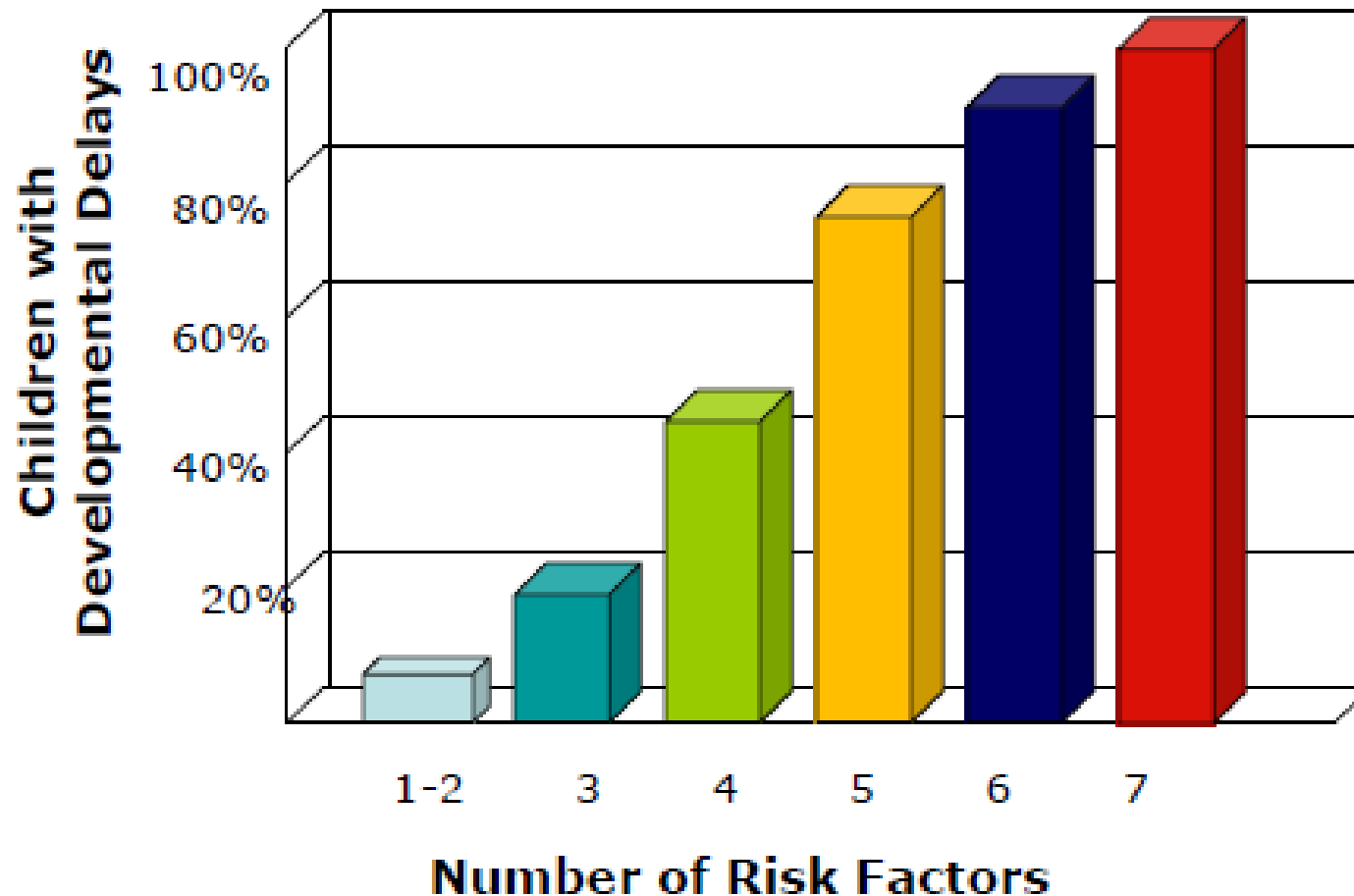
# An Integrated Science of Early Childhood Development Could Drive More Productive Investments Across Sectors



# The Ability to Change Brains Decreases Over Time

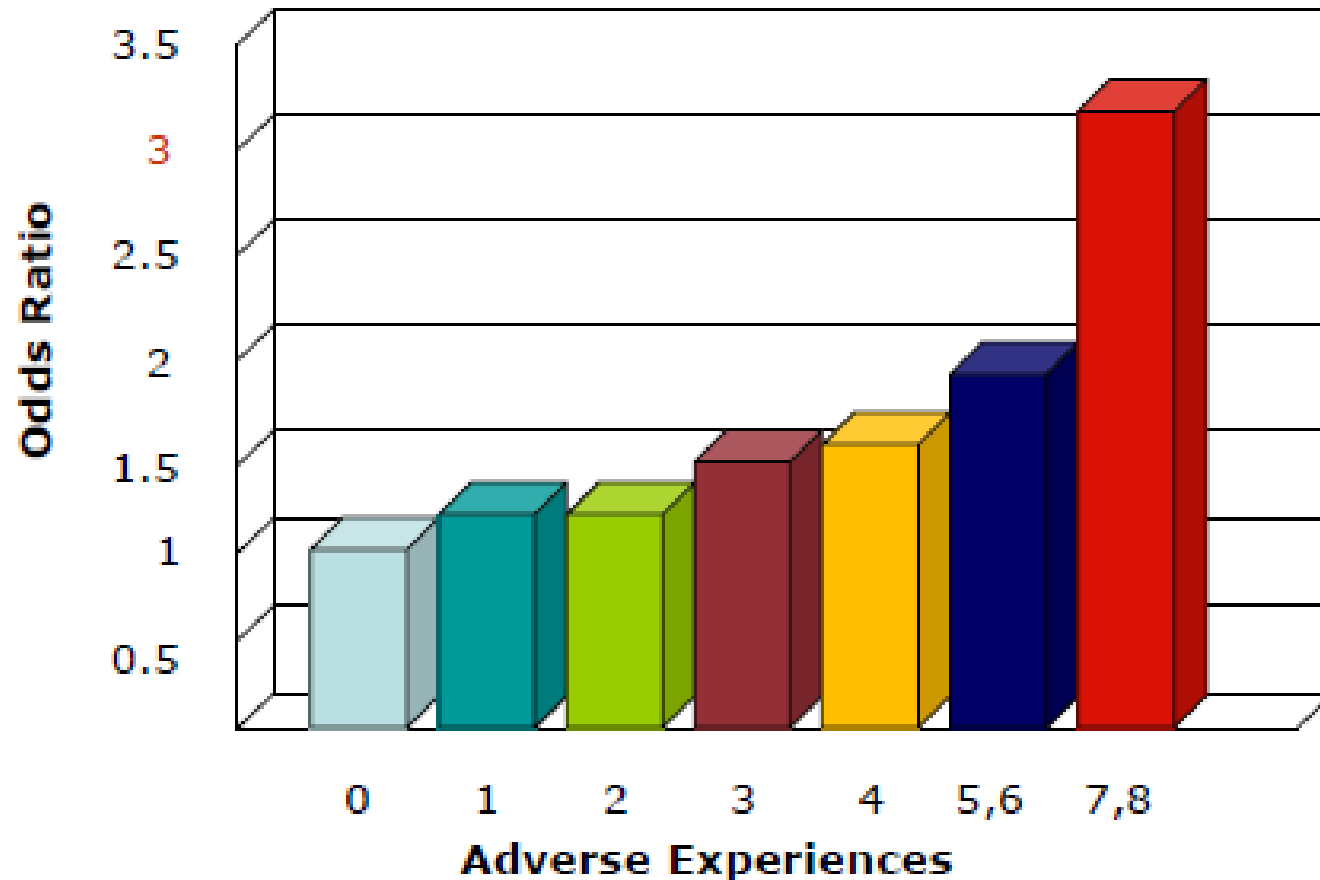


## Significant Adversity Impairs Development in the First Three Years



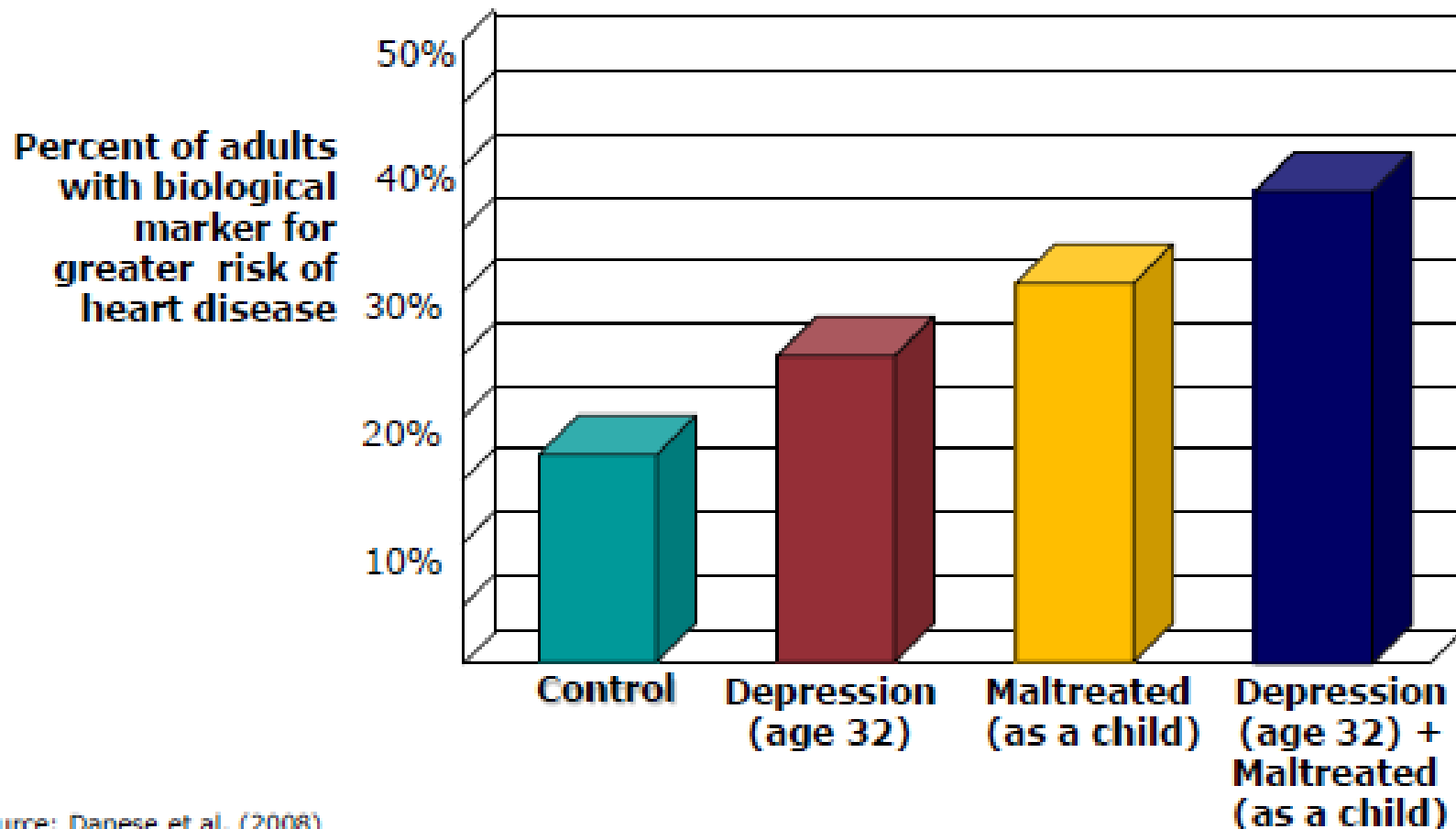
Source: Barth, et al. (2008)

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



Source: Dong, et al. (2004)

# Biological “Memories” Link Maltreatment in Childhood to Greater Risk of Adult Heart Disease



Source: Danese et al. (2008)

# Three Levels of Stress Response

## 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.

## **Early Life Experiences Are Built Into Our Bodies (For Better or For Worse)**

Stable and supportive relationships, language-rich environments, and mutually responsive, “serve and return” interactions with adults promote healthy brain architecture and adaptive regulatory systems.

Excessive or prolonged activation of stress response systems and reduced availability of the buffering protection of supportive relationships can weaken brain architecture and disrupt the development of other organ systems.

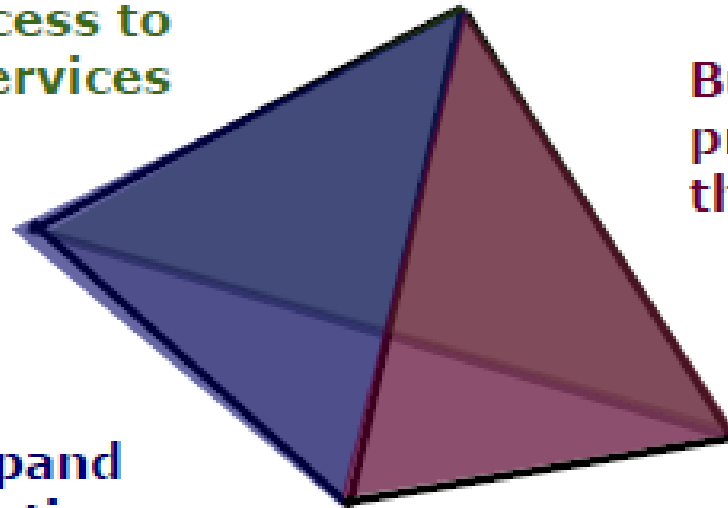


# Building the Future of Early Childhood Policy and Practice Requires Three Strategies

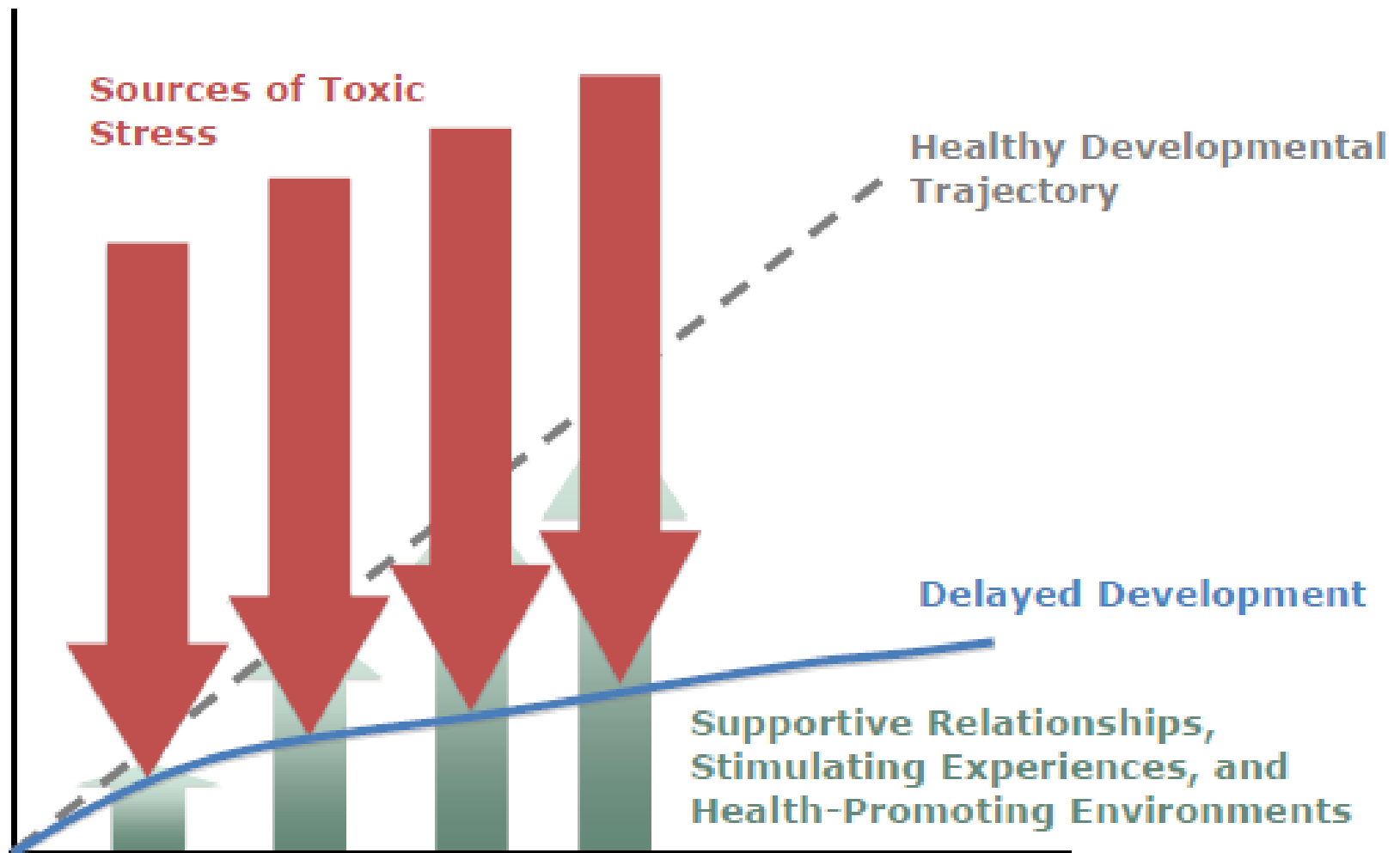
Enhance  
quality and  
access to  
services

Build, test, and  
promote new  
theories of change

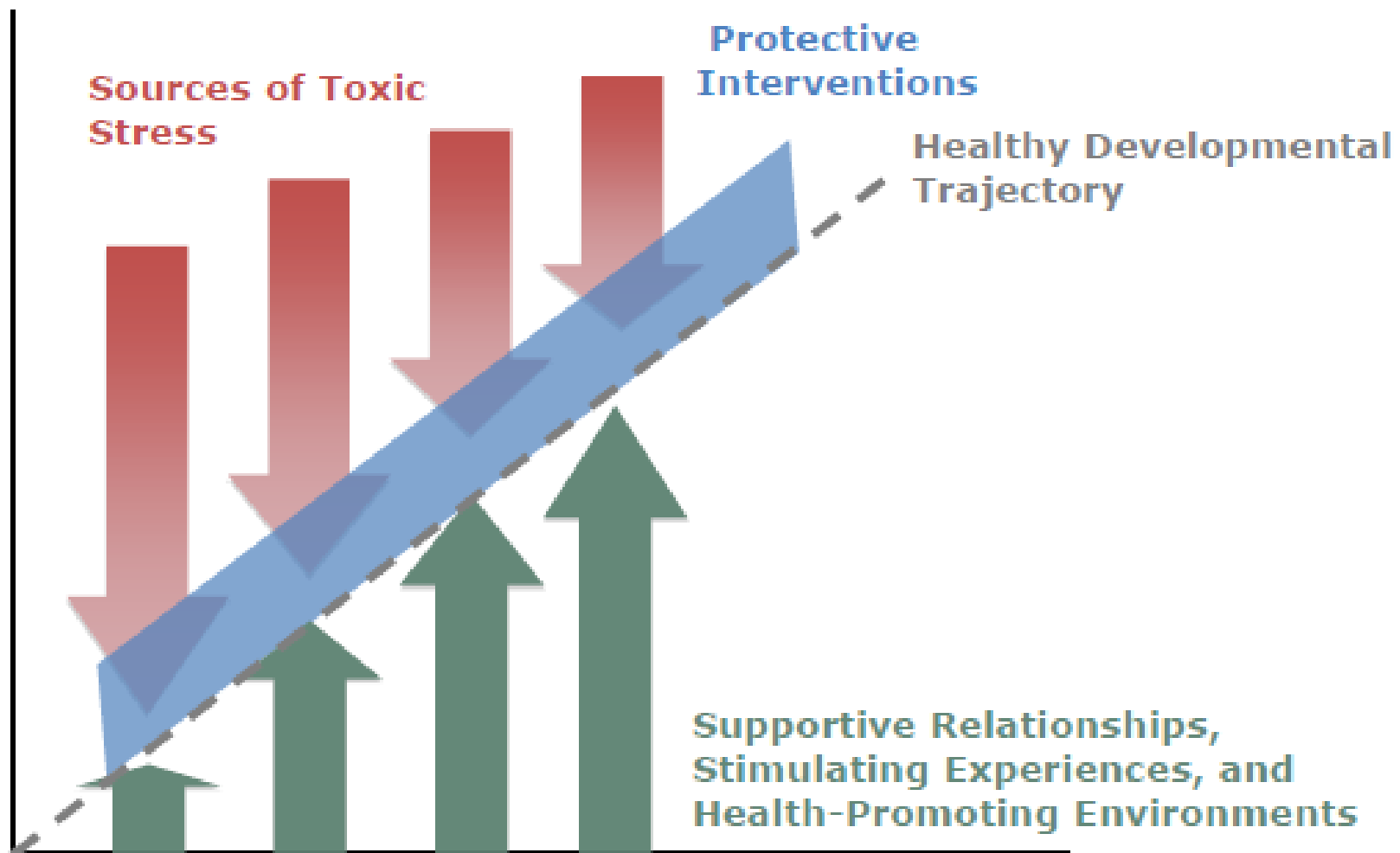
Expand  
effective  
models



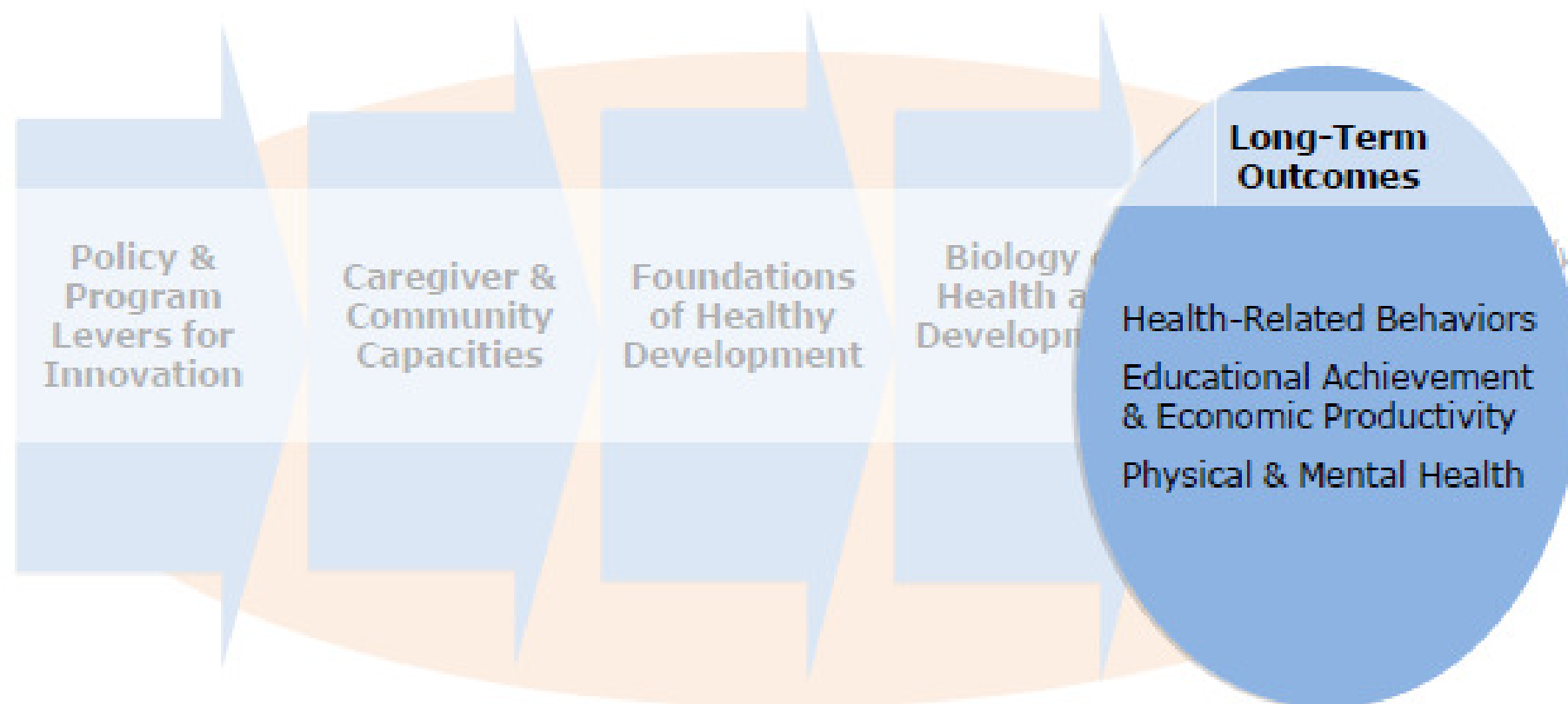
# Current Conceptual Framework for Early Childhood Policy and Practice



# Designing an Enhanced Framework that Balances Enrichment and Protection

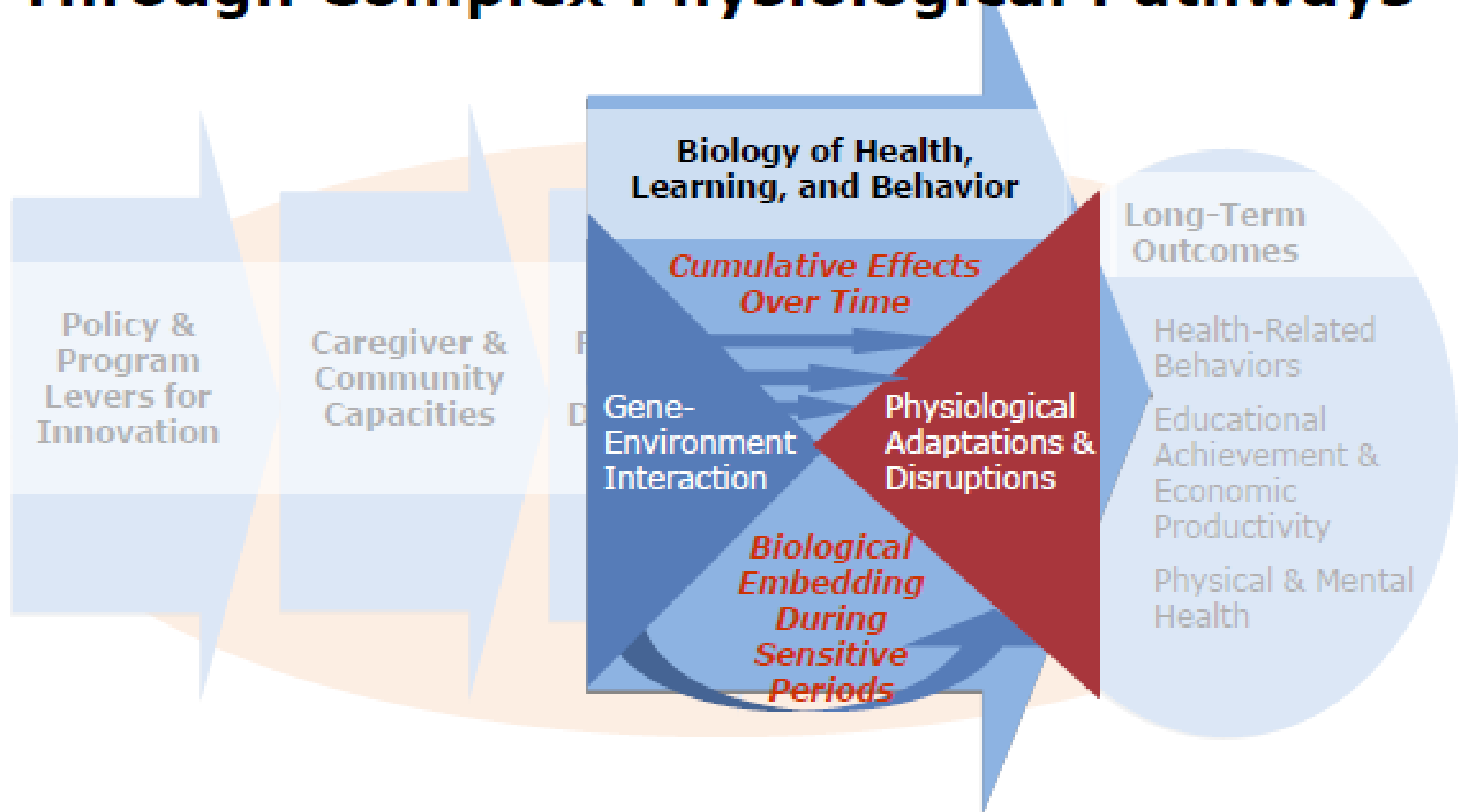


# Science Can Help Construct a Logic Model to Guide Effective Early Childhood Investments



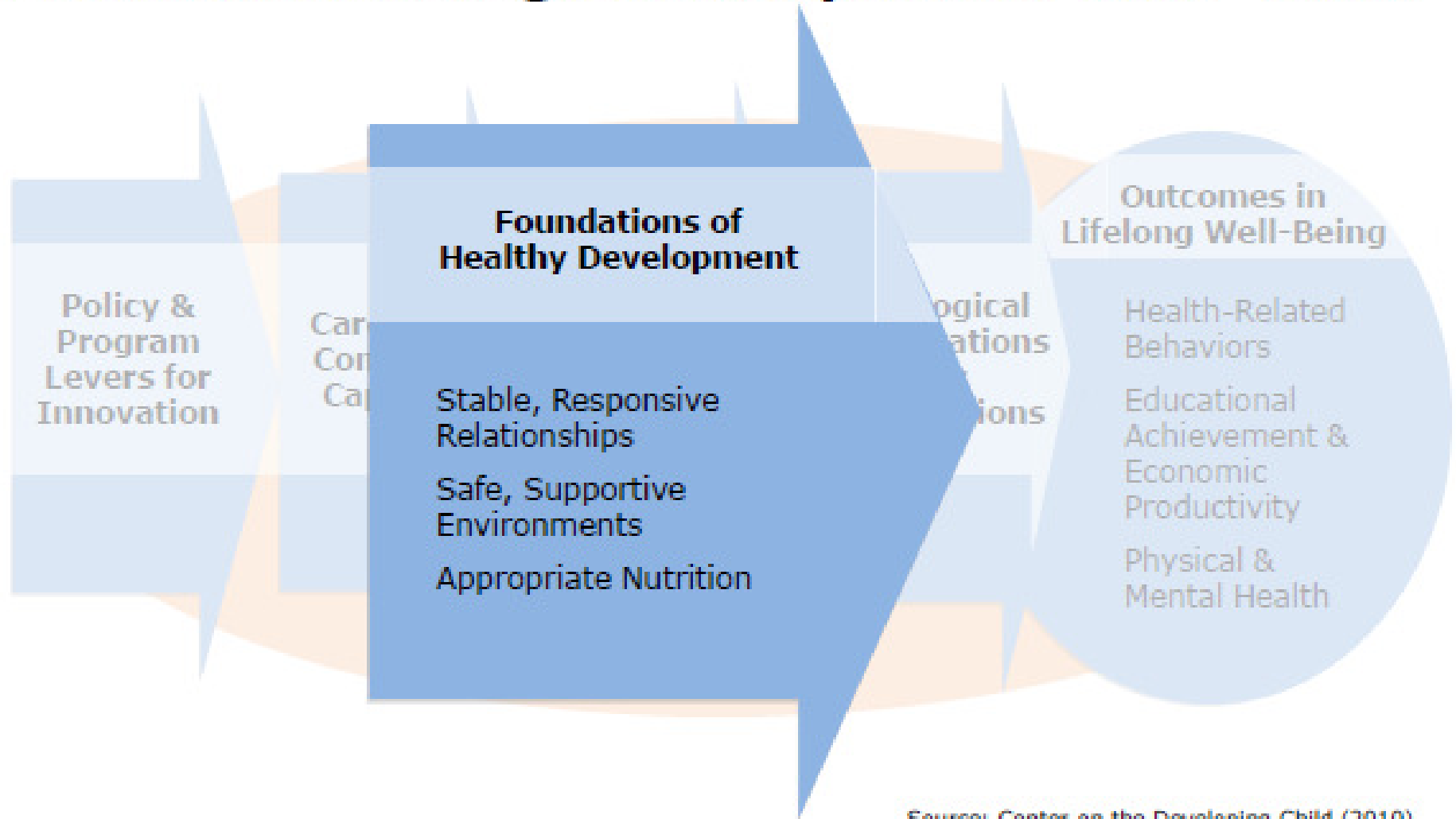
Source: Center on the Developing Child (2010)

# Early Experiences Are Built Into the Body Through Complex Physiological Pathways



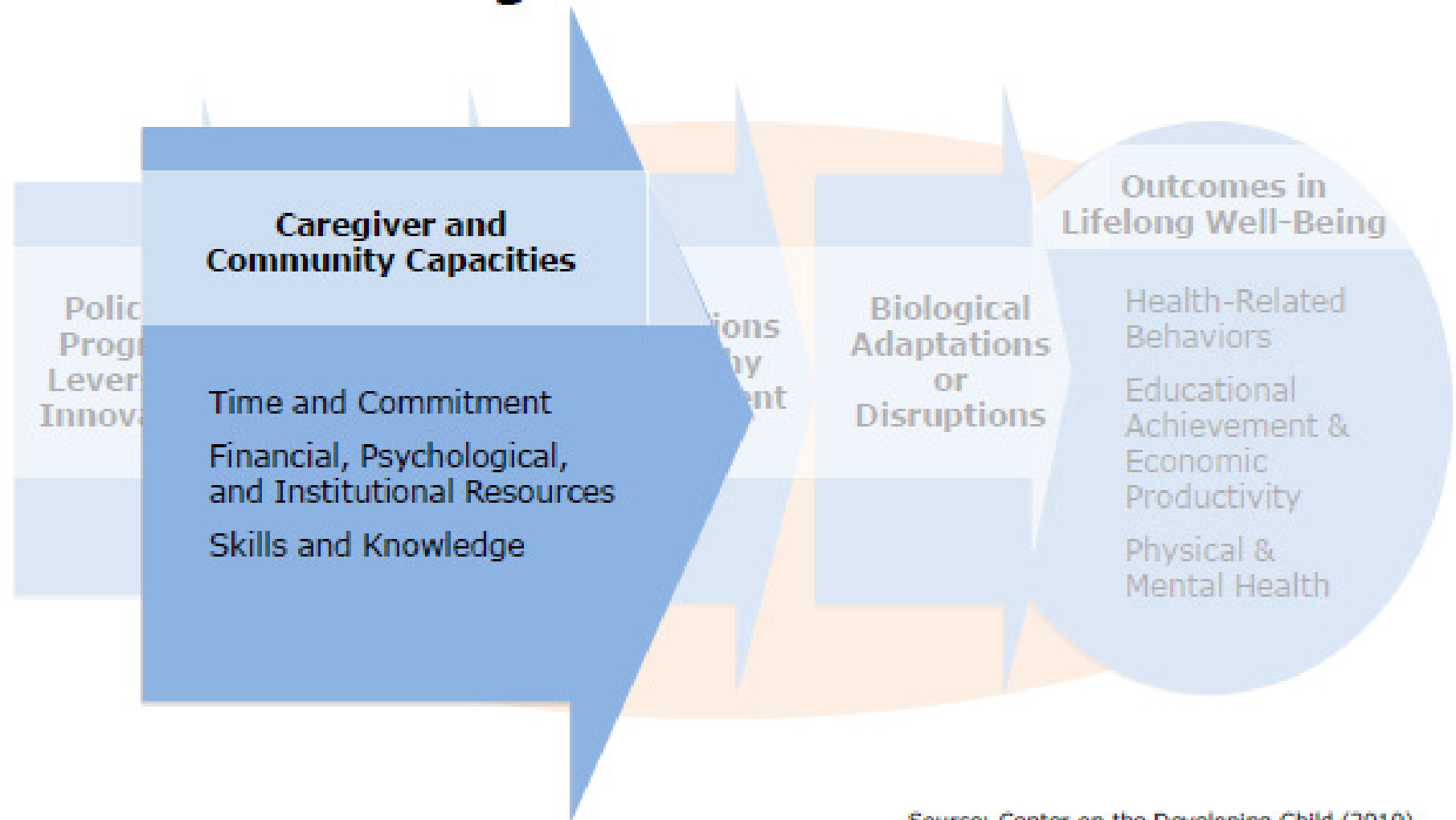
Source: Center on the Developing Child (2010)

# The Foundations of Healthy Development Influence Biological Responses Over Time



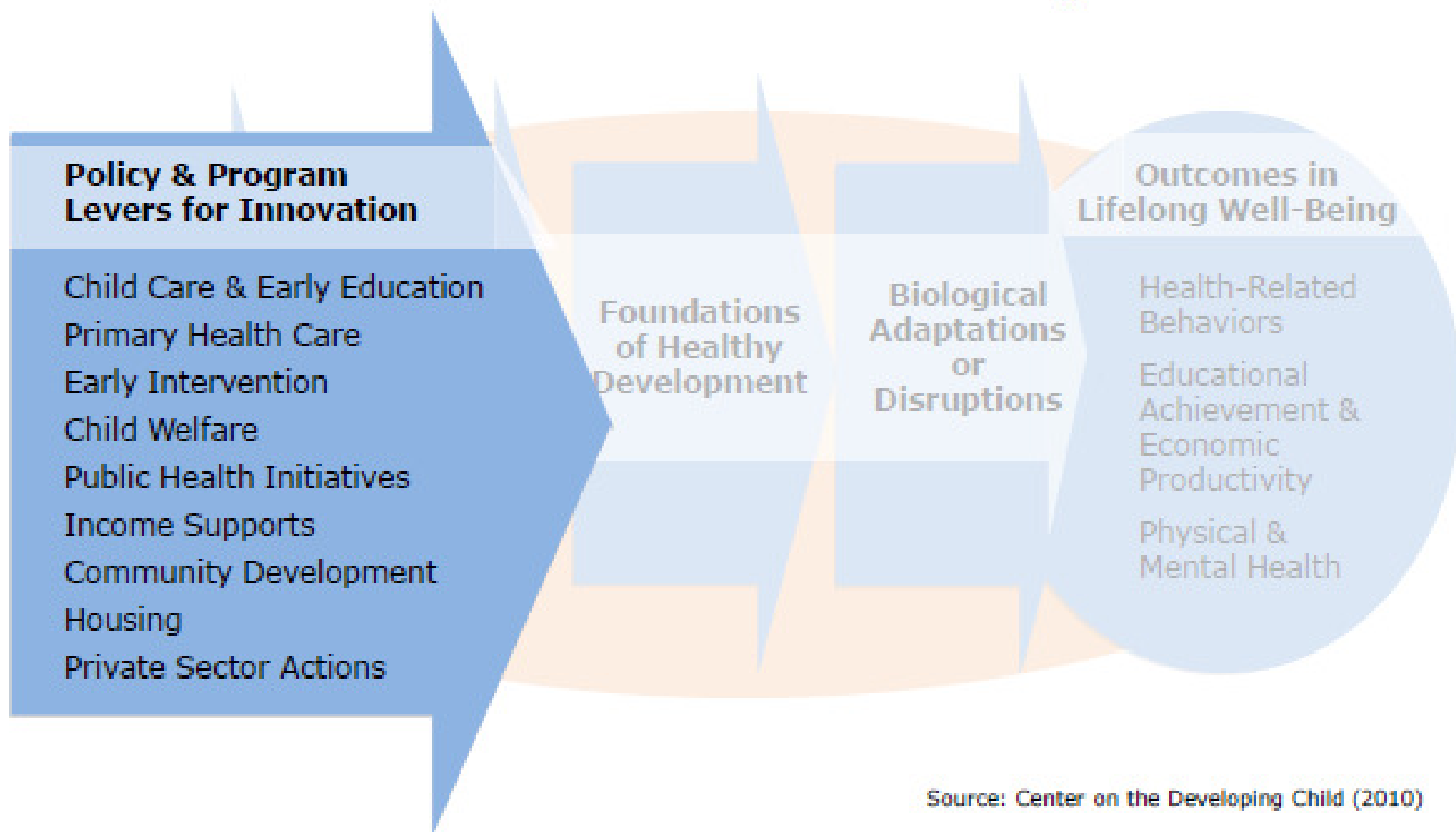
Source: Center on the Developing Child (2010)

# Caregiver and Community Capacities Affect the Strength of the Foundations



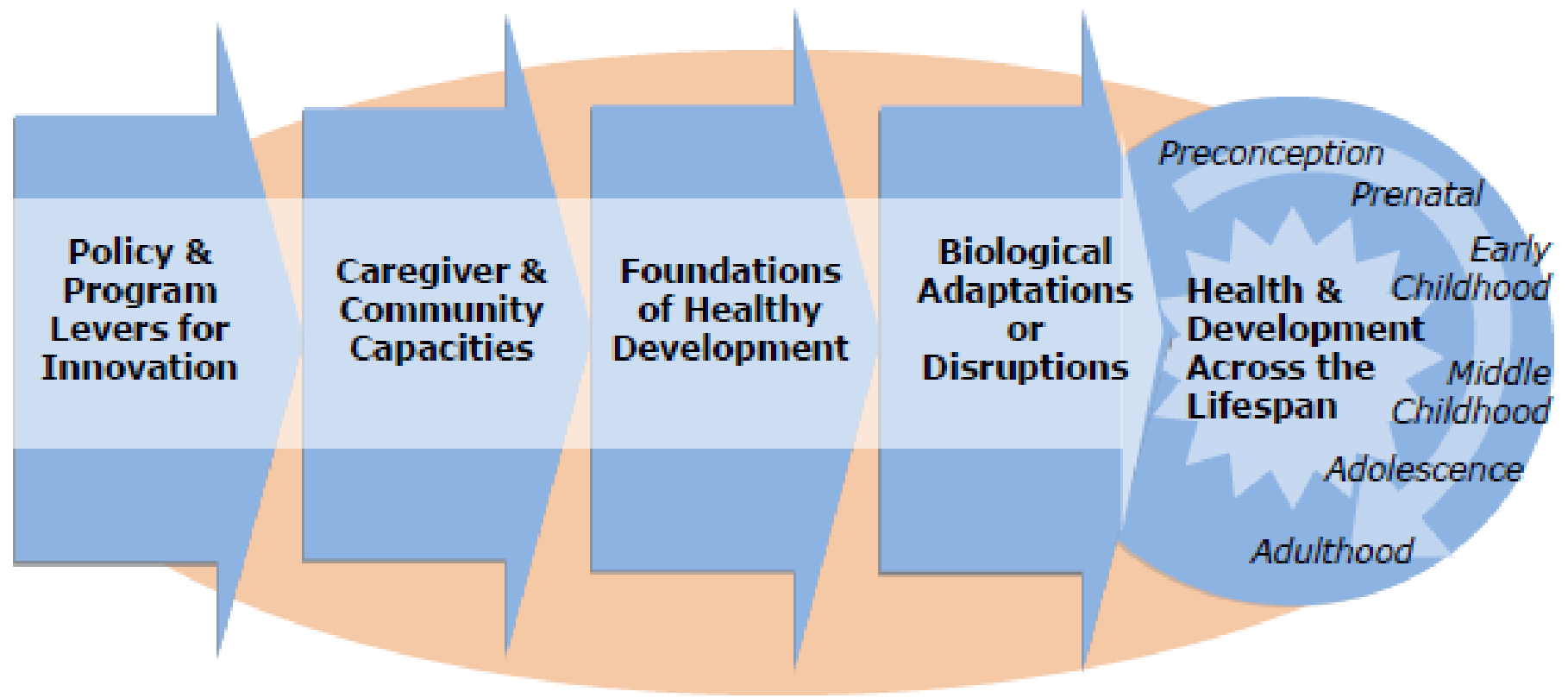
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# The Developmental Needs of Young Children Can Be Addressed Across Multiple Sectors





# Science Can Inform an Integrated Approach to Early Investment in Healthy Development

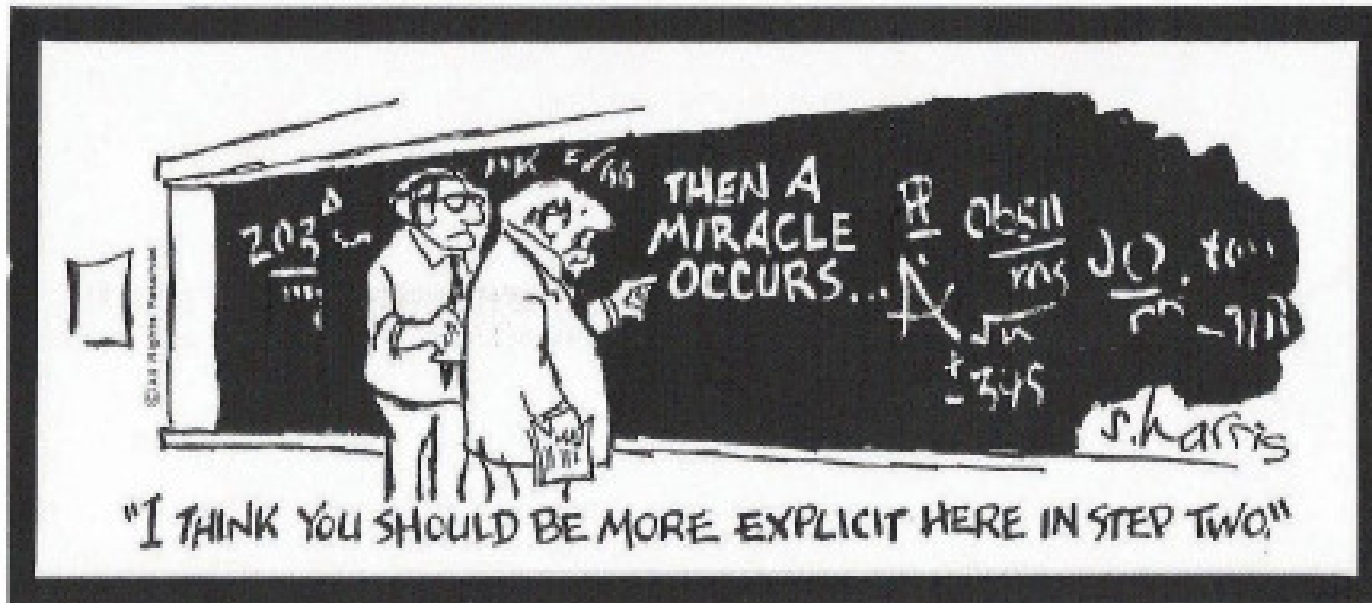


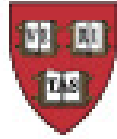
Source: Center on the Developing Child (2010)

# **The Biology of Adversity Suggests a Compelling New Theory of Change to Enhance Both Learning and Health**

Because excessive activation of the body's stress response systems can lead to long-term disruptions in brain architecture, immune status, metabolic regulation, and cardiovascular function ...

...better outcomes could be achieved by reducing the number and severity of adverse experiences and by strengthening relationships that protect young children from the harmful effects of toxic stress, above and beyond providing parenting education, rich learning experiences, and primary health care.





# Center on the Developing Child HARVARD UNIVERSITY



[www.developingchild.harvard.edu](http://www.developingchild.harvard.edu)