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Keynote Address: Post-Institutionalized Children Become Teenagers: Early Deprivation And The Developing Teen Brain

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POST-INSTITUTIONALIZED
CHILDREN BECOME TEENAGERS:
*EARLY DEPRIVATION AND THE
DEVELOPING TEEN BRAIN*

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University of Minnesota

Plan for the Talk



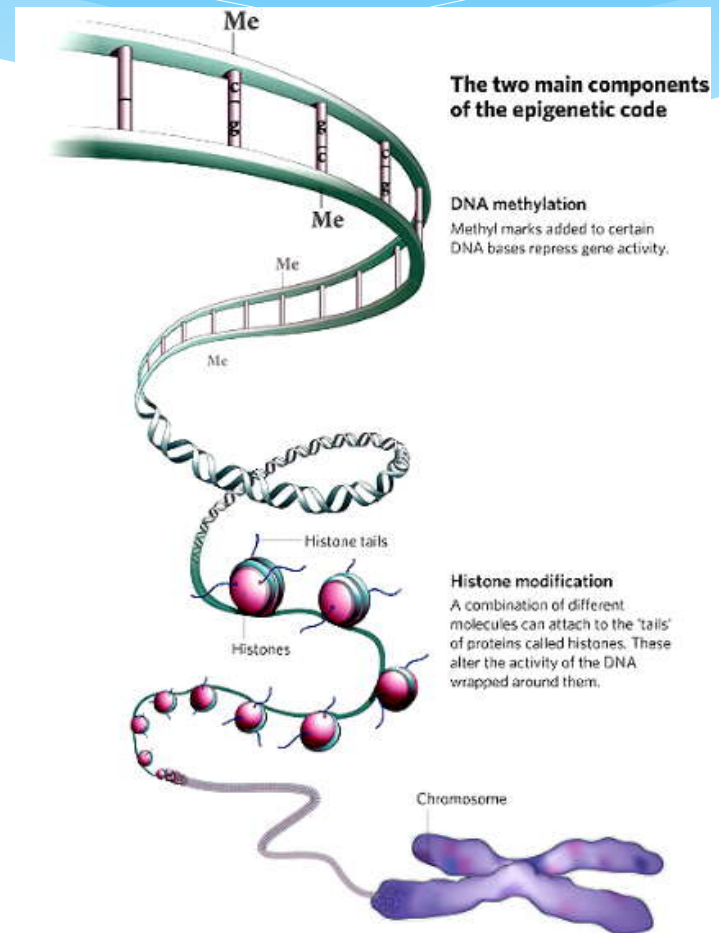
- * How Does Experience Affect Brain Development?
- * Sequelae of Early Institutional Rearing in Neurobehavioral Functioning of Post-institutionalized (PI) Children Prior to Puberty
- * Normative Changes in Neurobehavioral Development in Adolescence
- * Behavioral and Emotional Problems of PI Adolescence
- * Emerging work on Puberty and Brain Development in PI Youth
- * Glass Half Empty and Half Full: Risk and Resilience



How Does Experience Affect Brain Development?

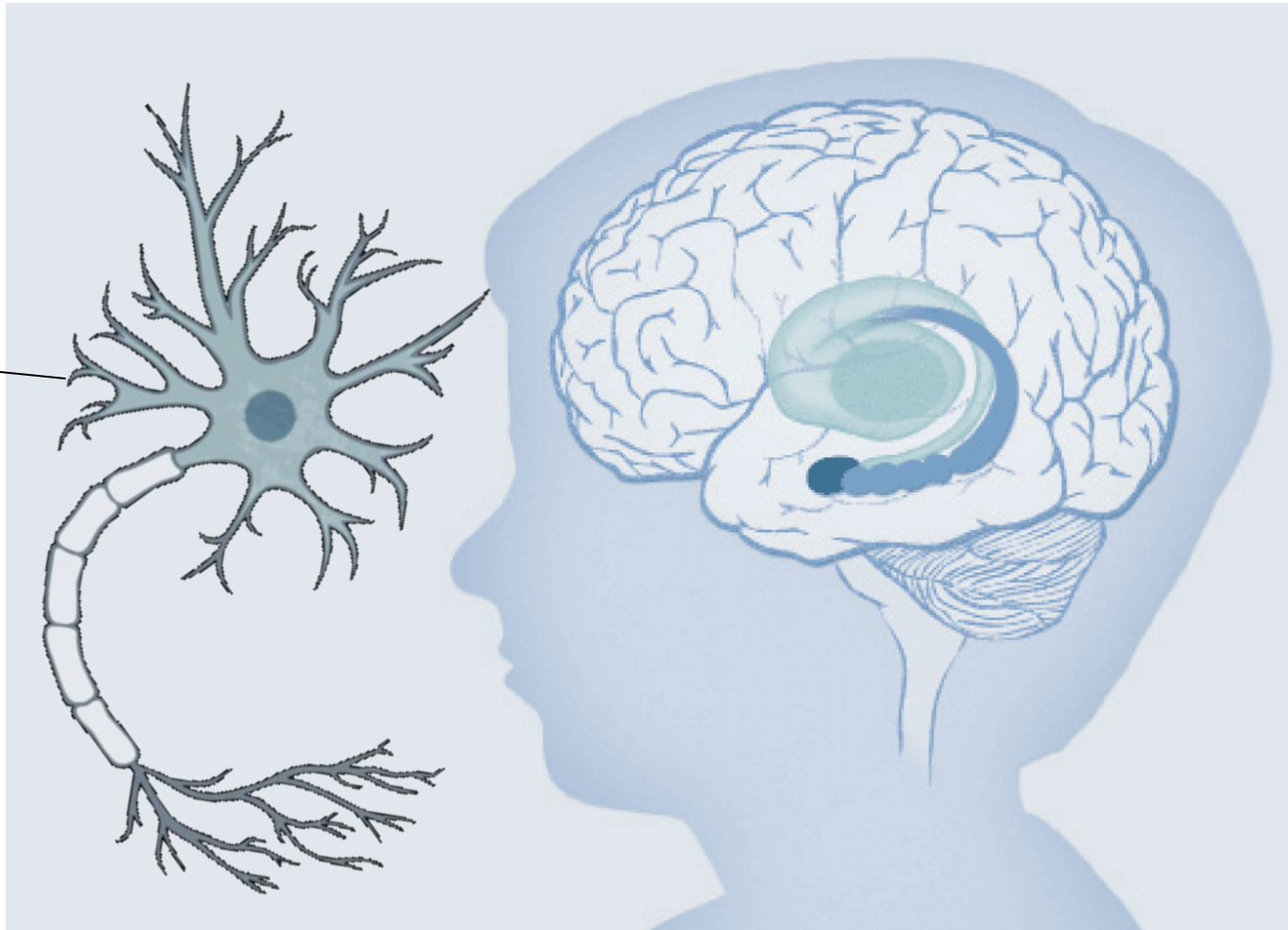
Building Healthy Brain Architecture – The Ingredients

- * Takes more than having the right genes
- * Takes the right, supportive experiences
- * In fact, we now know that experience literally writes on our genes, determining how well our genes work

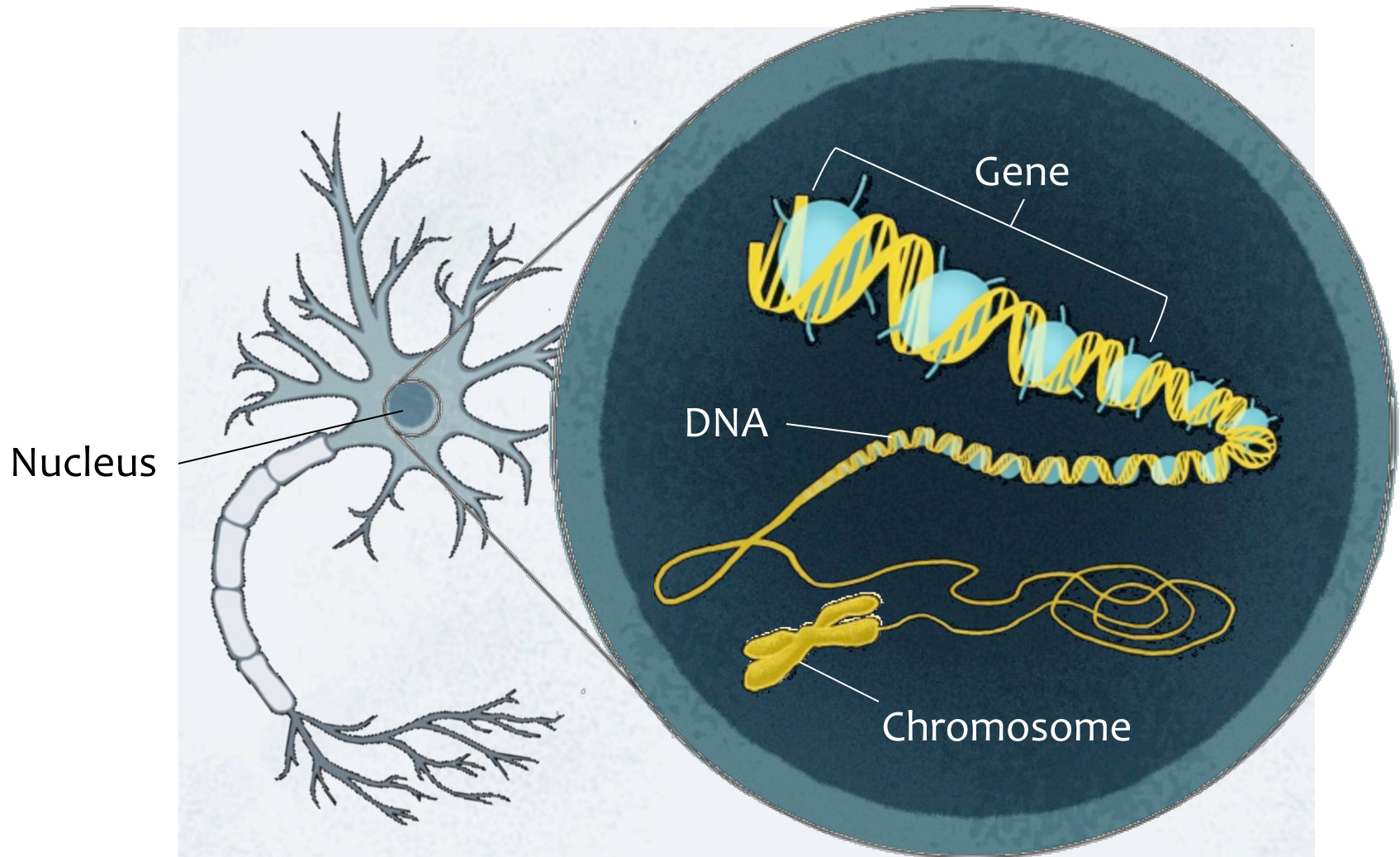


How Early Experiences Alter Gene Expression and Shape Development

Neuron



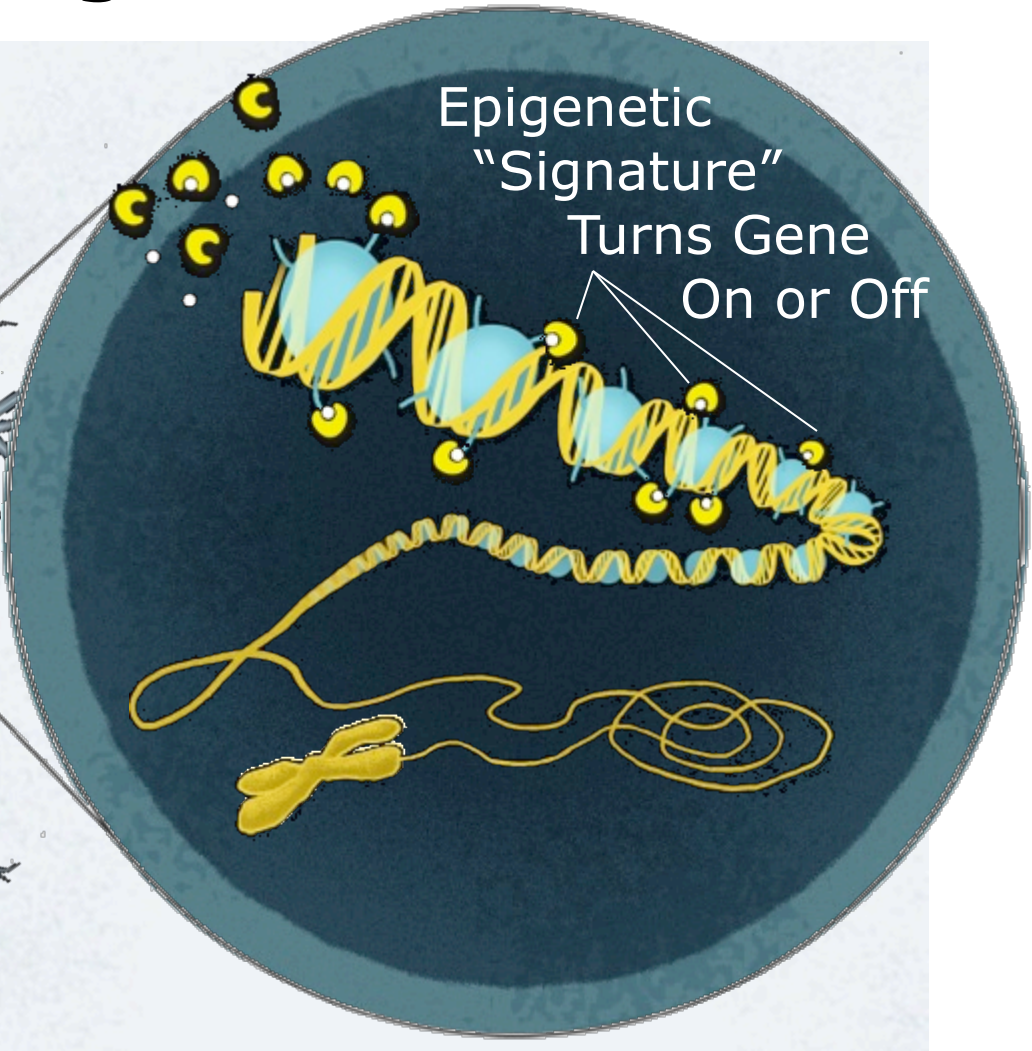
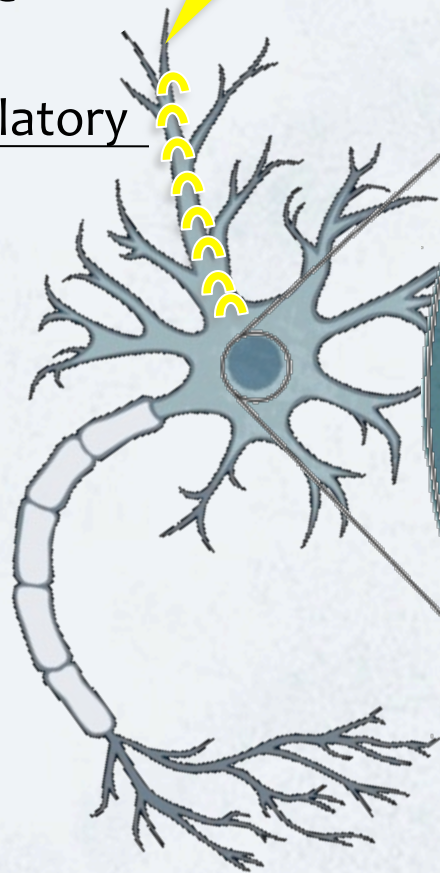
Genes Carry Instructions that Tell Our Bodies How to Work



Early Experiences Leave Lasting Chemical "Signatures" on Genes

External Experience

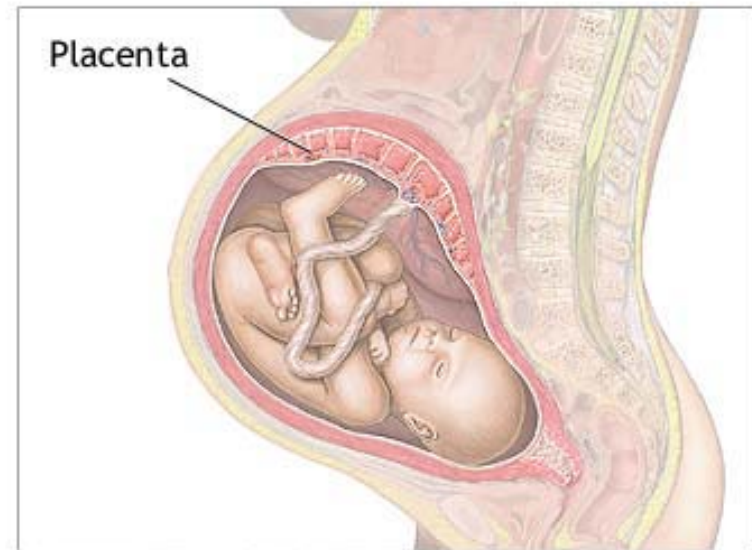
Gene Regulatory Proteins



Epigenetic "Signature" Turns Gene On or Off

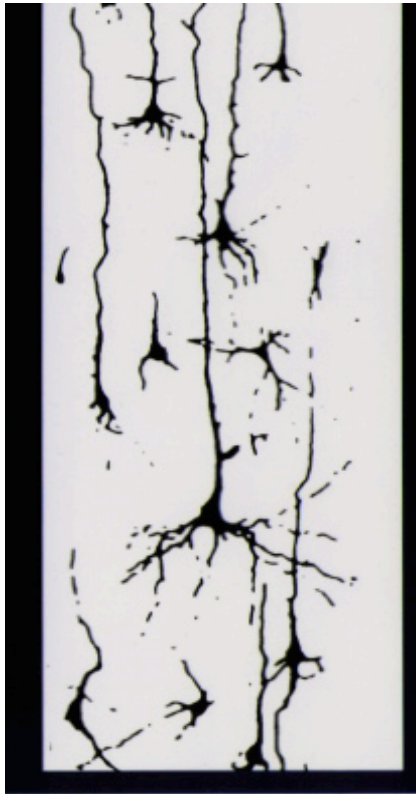
Prenatal Conditions

- * Maternal Conditions
 - * Malnutrition
 - * Infections
 - * Severe & Chronic Stress
 - * Drug and Alcohol Use
- * Fetal Conditions
 - * Low Birth Weight
 - * Early Delivery
 - * FAS/FAE



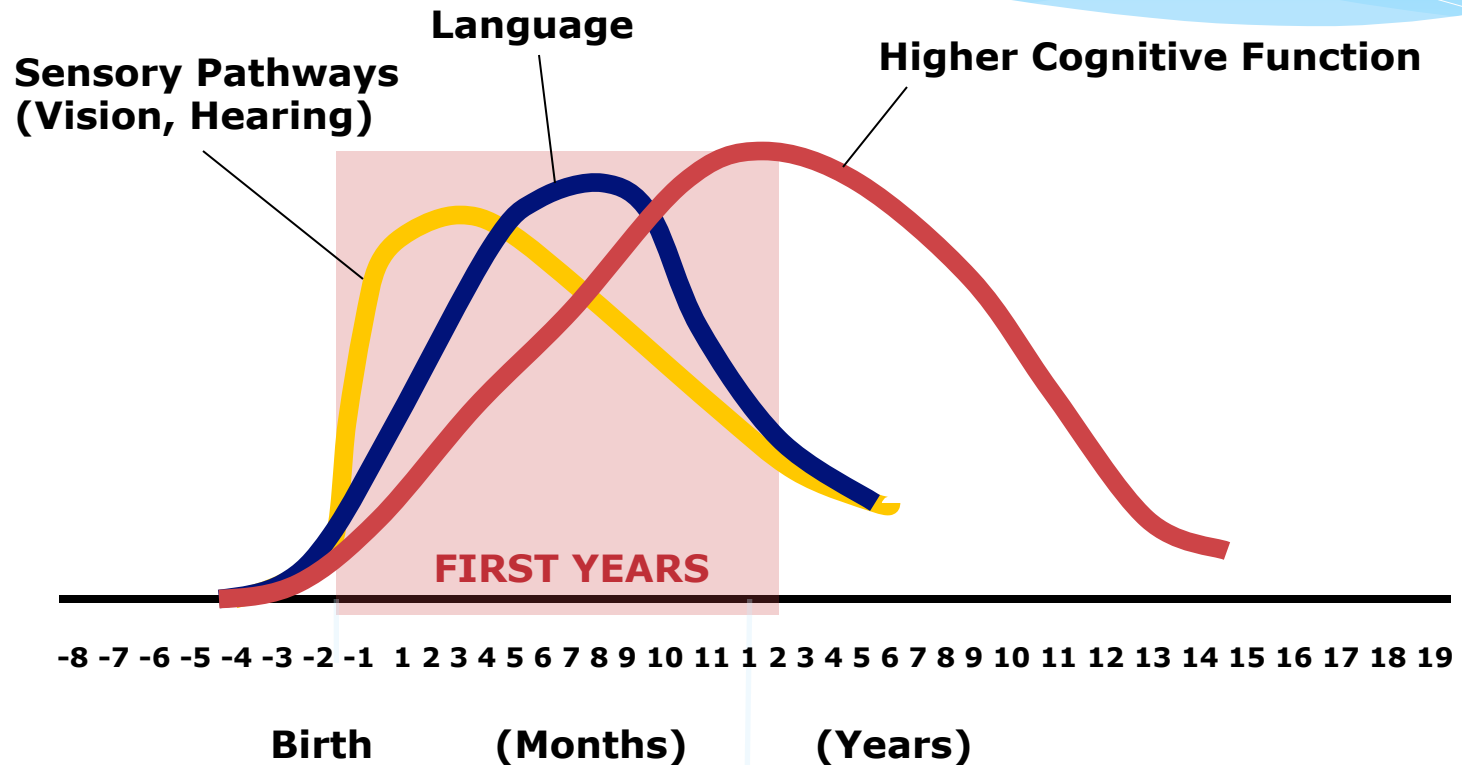
Experience Shapes Brain Architecture by Over-Production Followed by Pruning

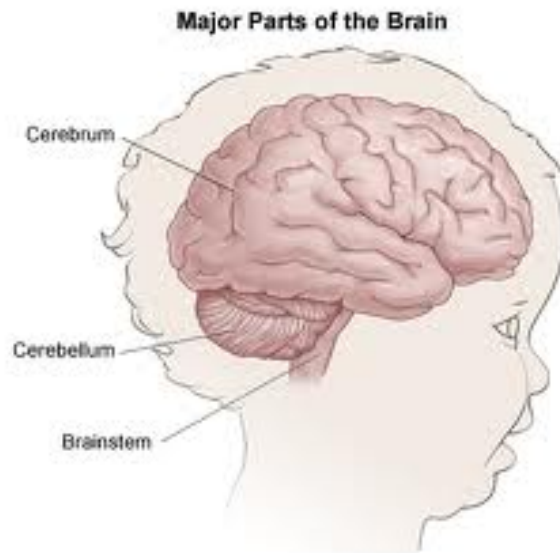
(700 synapses formed per second in the early years)



birth

Neural Circuits are Wired in a Bottom-Up Sequence





Stimulation is Needed
In Order for the Brain
To Develop



Human Infant is Unable to Provide
Itself Adequate Stimulation
for Normal Brain Development

The Brain Develops in the Context of Relationships





Tremendous Capacity for Change: Development in First Year Post-Adoption

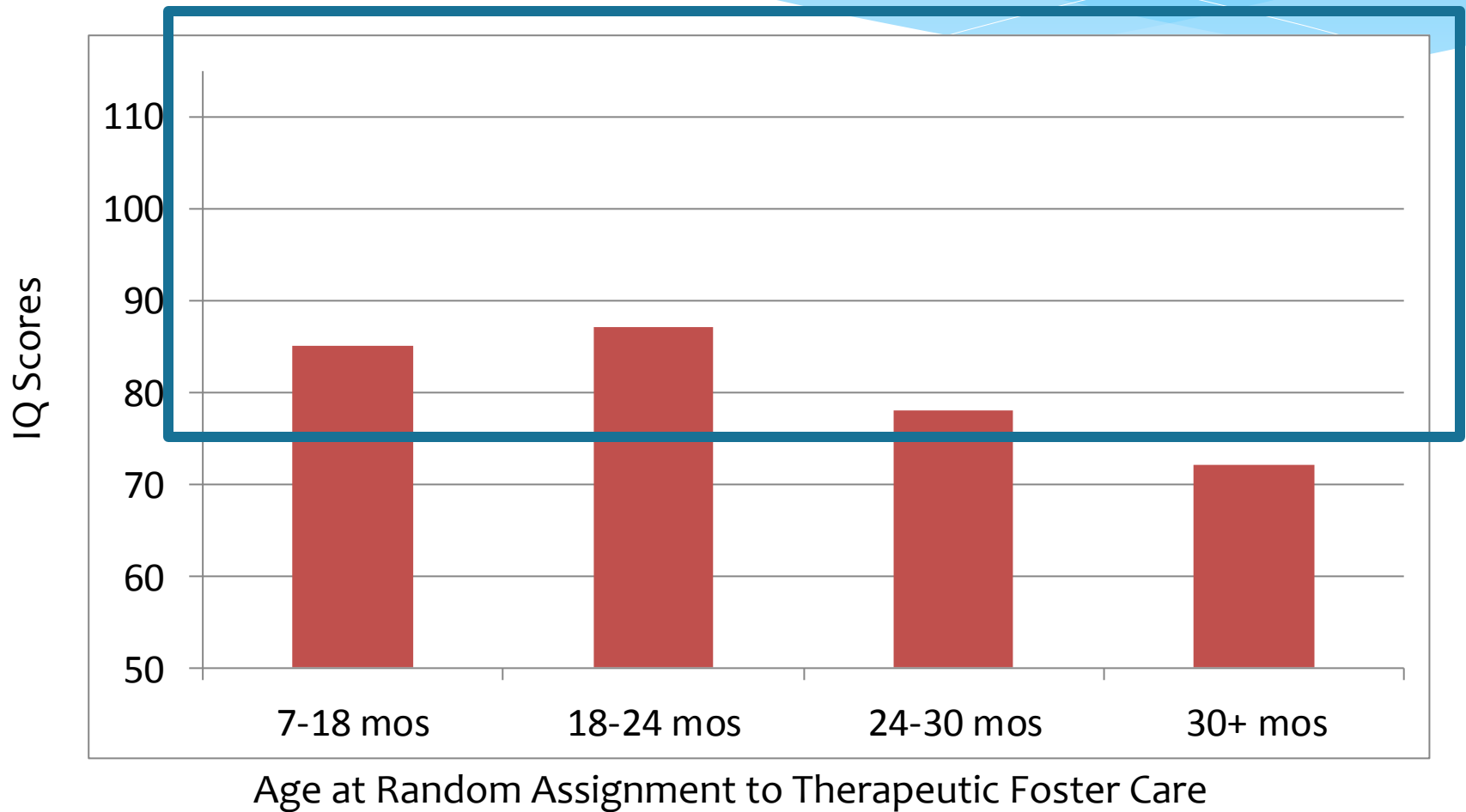
- * Physical Growth: Rapid
- * Motor Development: Rapid
- * Language Development: Rapid
- * Social Development: Rapid
- * Most Children Are Within Normal Ranges of Development by 2 Years Post Adoption




Bucharest Early Intervention Project: Nelson et al.

Science, 2008

IQ at 54 mos





Impact of Early Institutional Rearing on Neurobehavioral Functioning of Post-institutionalized (PI) Children Prior to Puberty

Social Cognitive Skills Underlying Social Competence

Emotional Responses: Anger and Fear

Risk Taking and Sensitivity to Rewarding Stimuli

Social Competence

- * Parents Tell Us that PI children often struggle with being as socially competent as their peers
- * Building Blocks of Social Competence
 - * Reading and Understanding Emotions
 - * Perspective Taking
 - * Understanding and Appropriately Negotiating Social Boundaries and Intimacy Rules
 - * Ability to Regulate Emotions and Behaviors

Reading and Understanding Emotions

- * Long developmental progression to full adult competency; adults also differ in their emotion skills
- * Several years after adoption, around age 5, children adopted from institutions in Russia/Eastern Europe have difficulty identifying emotions in static pictures of faces and in mapping the emotion to the context. (Fries & Pollak, 2004)
- * But there is some evidence that reading peak emotional expressions may be spared or recoverable (McDermott).
- * Parent Report at age 8 (Gunnar et al), PI children are poorer at
 - * (1) interpreting peers emotions and behavior
 - * (2) being considerate of other's feelings

Perspective Taking (Theory of Mind or TOM)

- * With development children come to understand that other people have minds (thoughts, beliefs, perceptions) and that these may differ from their own.
- * TOM is at the very least delayed and for some PI children may be seriously impaired
- * For Good or ILL
 - * Basis for being good at deception
 - * Basis for being good at being socially cruel
 - * Important skill to avoid being deceived and manipulated
 - * Important skill to have in order to respond appropriately to others who are different from ourselves.

Understanding and Appropriately Negotiating Social Boundaries and Intimacy Rules

- * Indiscriminate Friendliness: Responding to friendly or neutral strangers as if they were “intimates”.
- * Neither completely indiscriminate nor really “friendly”
- * Likely serves a role in getting child’s social needs met while in the institution
- * Decreases rapidly for many children once placed in a family
- * Does not resolve for a substantial number

Indiscriminate Friendliness

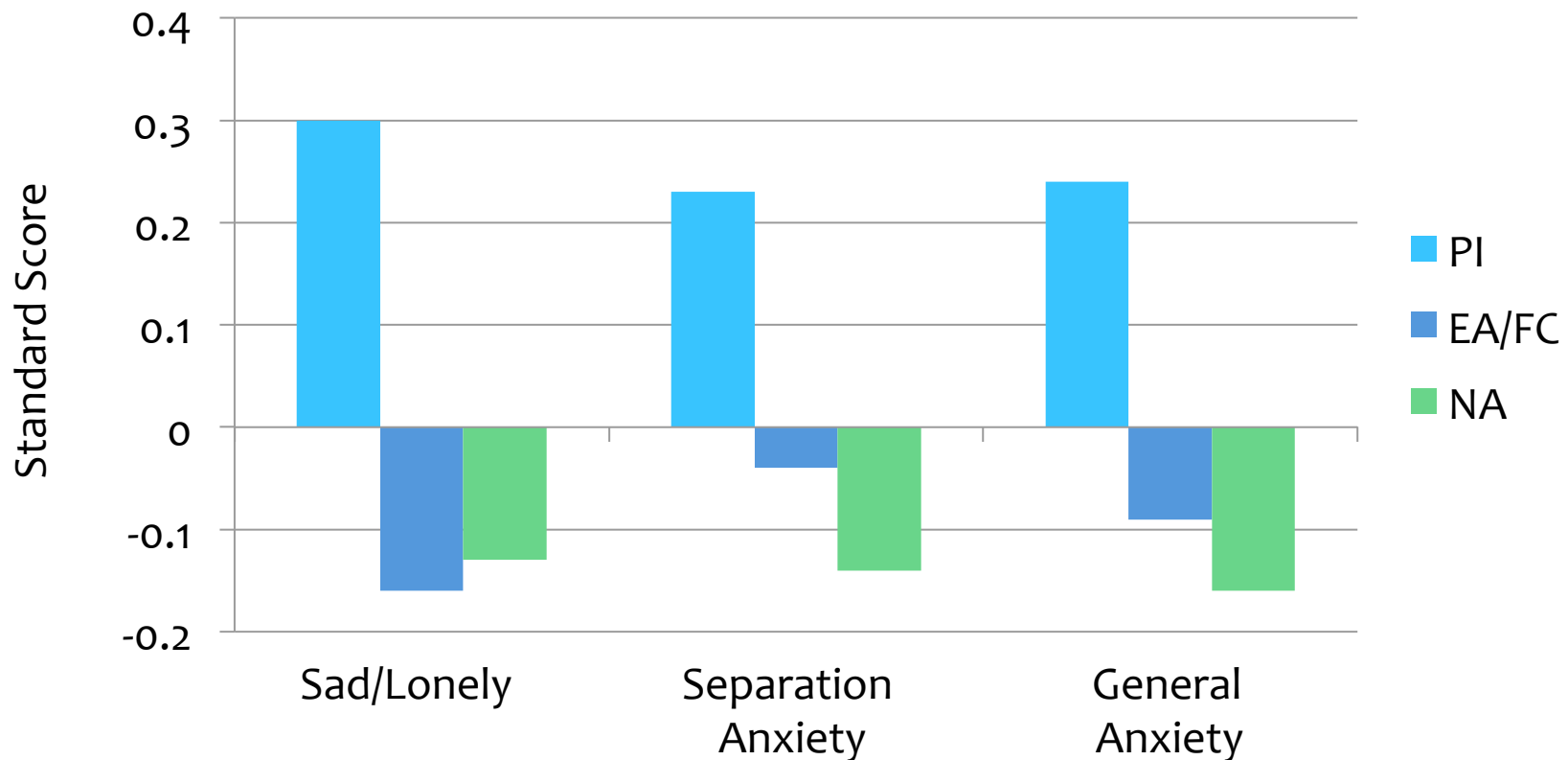
- * Not a reflection of a poor attachment relationship to the adoptive parent.
- * Associated with problems in cognitive inhibitory control (i.e., like playing red light/green light or Simon Says)
- * Disinhibited Social Approach might be a better term
- * Not just about being more sociable. More about violating boundaries or engaging in social behavior that is inappropriate for the context
- * Indiscriminate Friendliness changes in form with development, but has been reported among adolescent PI children. (Asking inappropriately intrusive questions, sharing too much private information, pestering teachers/peers)

Emotions

Anger and Fear

- * Anger and Aggression
 - * In childhood, PI children are not more aggressive nor do they have more conduct problems than children reared in their birth families
 - * They do have more problems with controlling “meltdowns”. -----
Emotion Regulation
- * In childhood, PI children report more fear/anxiety than do birth children and children adopted from overseas foster care

Children's Self Reports of Sad and Anxious Feelings at Age 8 & 9

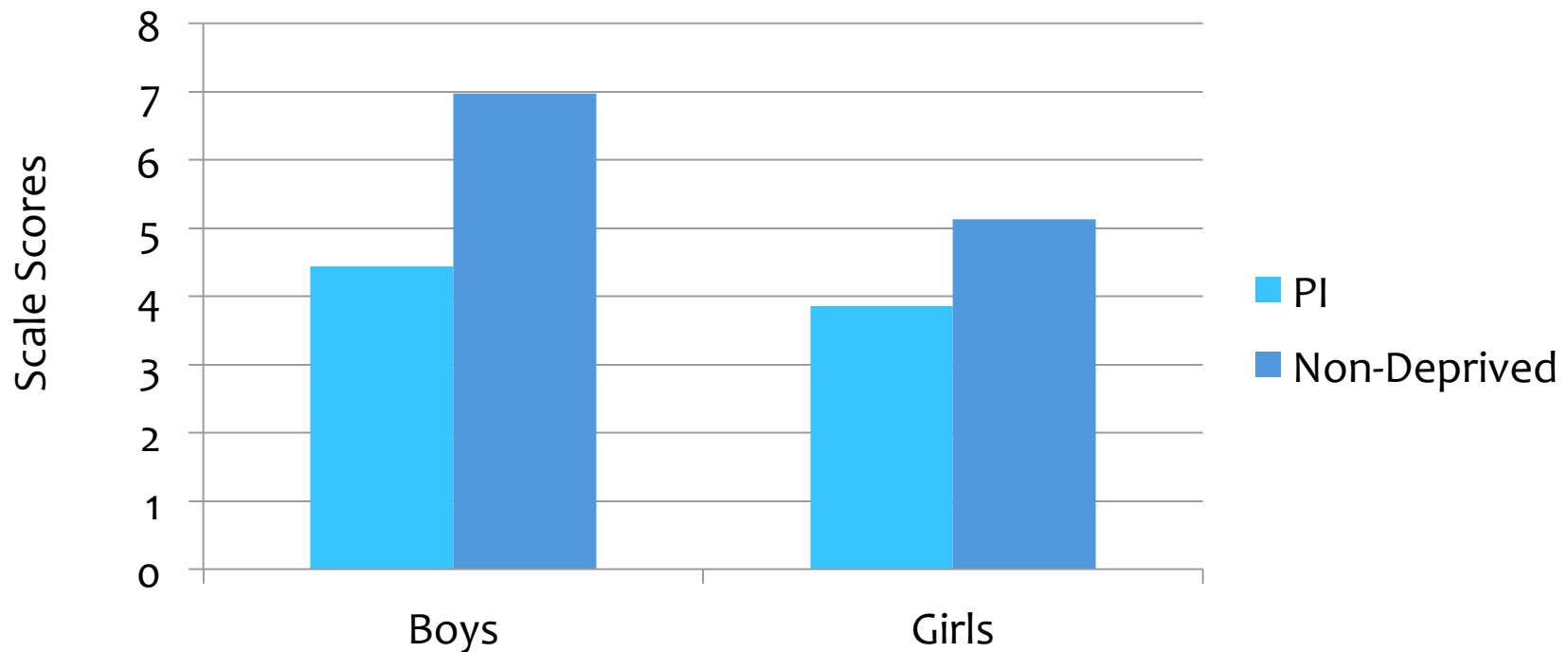


Risk Taking and Reward Seeking

- * Anxious children take fewer risks, but early deprivation may make it harder to judge risks.
- * Risk taking increases in adolescence
- * Where are PI children on Risk Taking Prior to Adolescence?
- * Two tasks: Children 12-13 years, all were pre/early puberty
 - * Self Report of Sensation Seeking
 - * BART Balloon Task

Thrill and Adventure Seeking and Social Disinhibition Combined

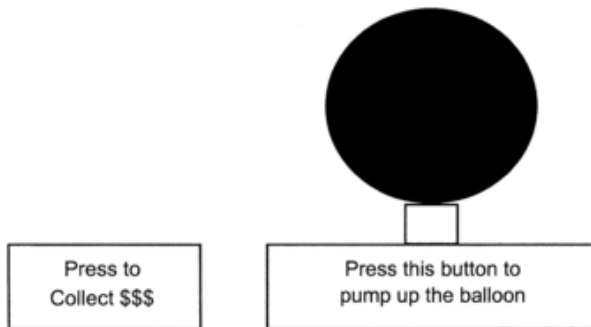
Prepubertal



Balloon Analogue Risk Task

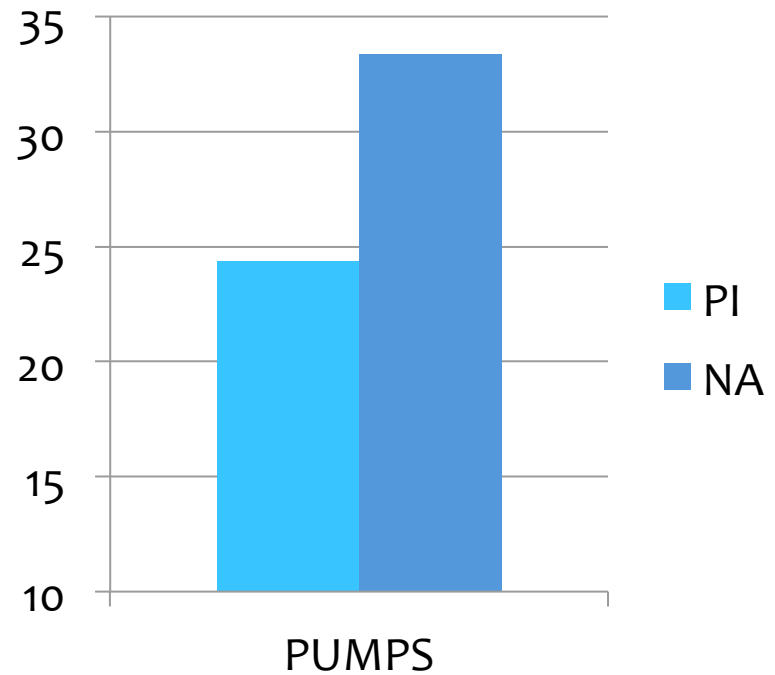
BART

PRE-Pubertal



Total Earned \$ 00.00

Last Balloon \$ 00.00



Summarize

- * PI children show remarkable recovery from early deprivation once placed in supportive families
- * Many do extremely well
- * Despite this, as a group they exhibit delays/deficits in
 - * Skills needed for being socially competent
 - * Regulating strong emotions
 - * More anxious
 - * Lower in risk taking

Teen Years

(It was the best of times; it was the worst of times)



Behavioral and Emotional Problems of PI Youth During Adolescence

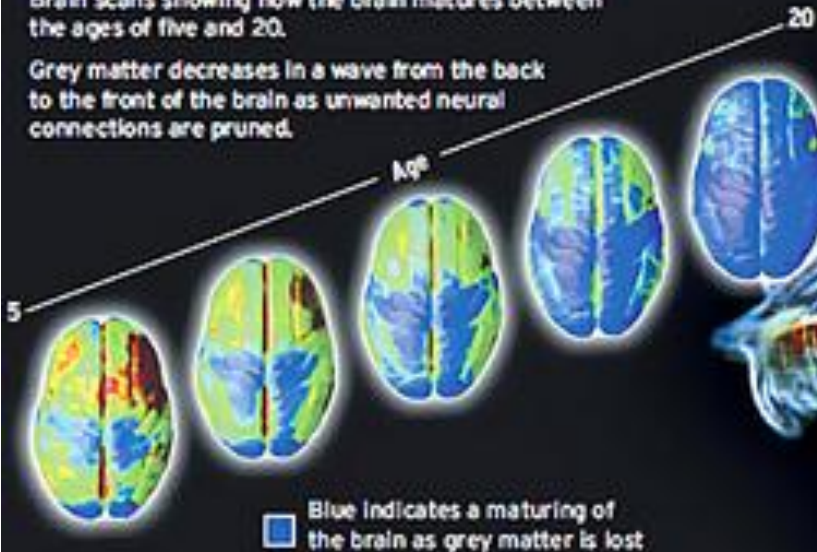
- * Complex time, especially for adopted youth because identity issues are particularly tricky to solve
- * Longitudinal Studies have shown that PI youth are particularly vulnerable (Rutter et al)
 - * Increase in depression, more so than other children
 - * Increase in conduct problems, more so than other children
 - * Emergence of emotional and conduct disorders in youth who had not shown them before the teen years
 - * Most vulnerable were the youth who had problems with TOM, Indiscriminate Friendliness, Lower IQ

Adolescent Brain Development

FROM HERE TO MATURITY

Brain scans showing how the brain matures between the ages of five and 20.

Grey matter decreases in a wave from the back to the front of the brain as unwanted neural connections are pruned.



Blue indicates a maturation of the brain as grey matter is lost.

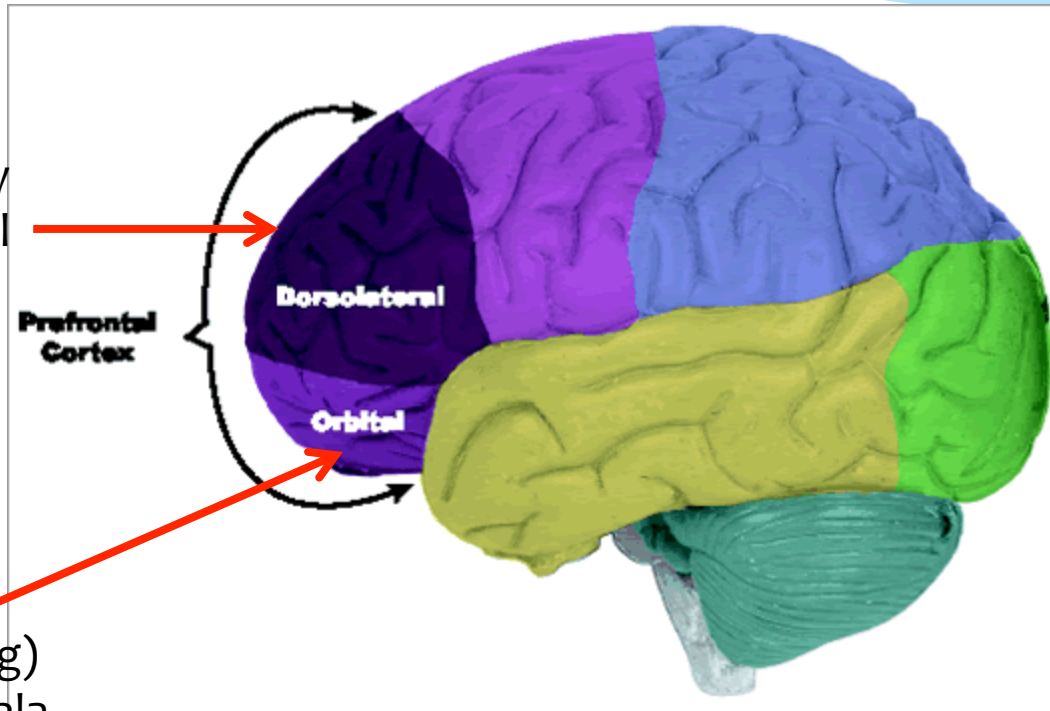
The Adolescent Years

- Greater capacity to learn and create
- Increased risk of damage from drugs and alcohol
- Increased risk of developing addiction
- Increased risk of mental illness
- Increased desire for risk taking
- Parts of brain that control impulses and emotions not yet mature



Decision Making and Self Control

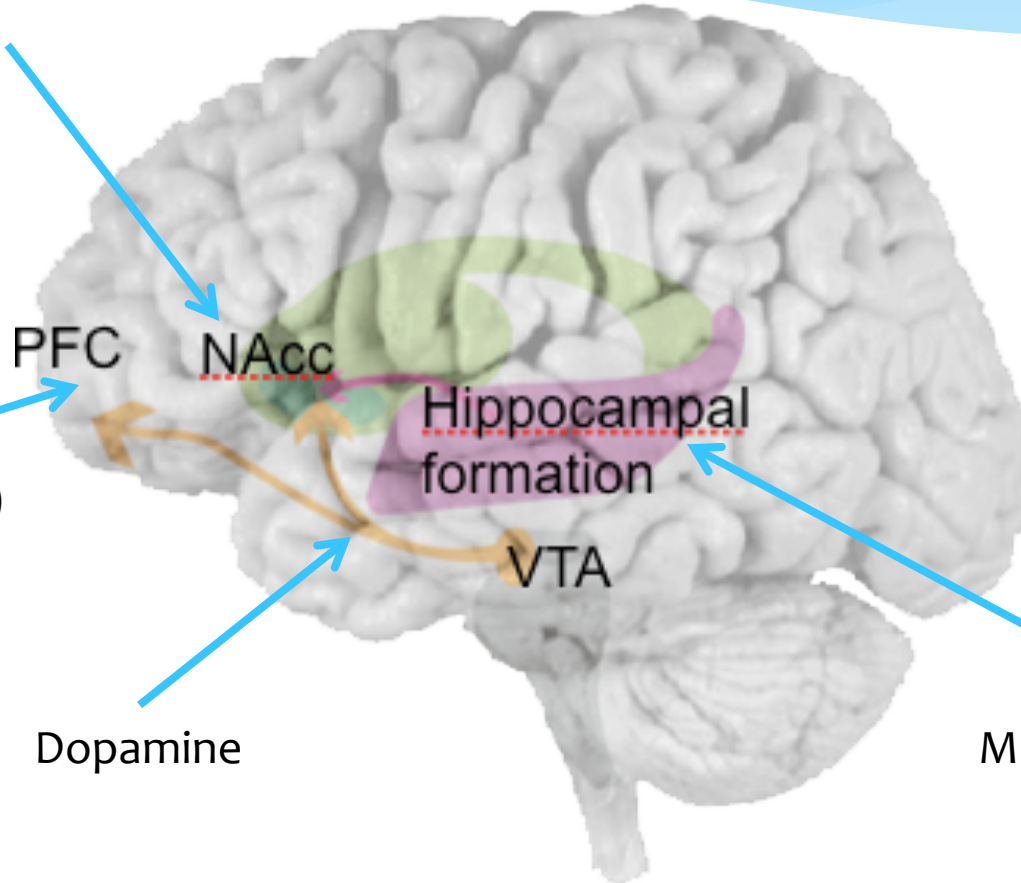
Working Memory
Cognitive Control
Planning



Valence (pos/neg)
Input to Amygdala

Reward Circuits

Reward/Addiction



PFC

NAcc

Hippocampal
formation

VTA

Orbital PFC
(value; past rewards)

Dopamine

Memory for Events

Reward Sensitivity and Cognitive Control

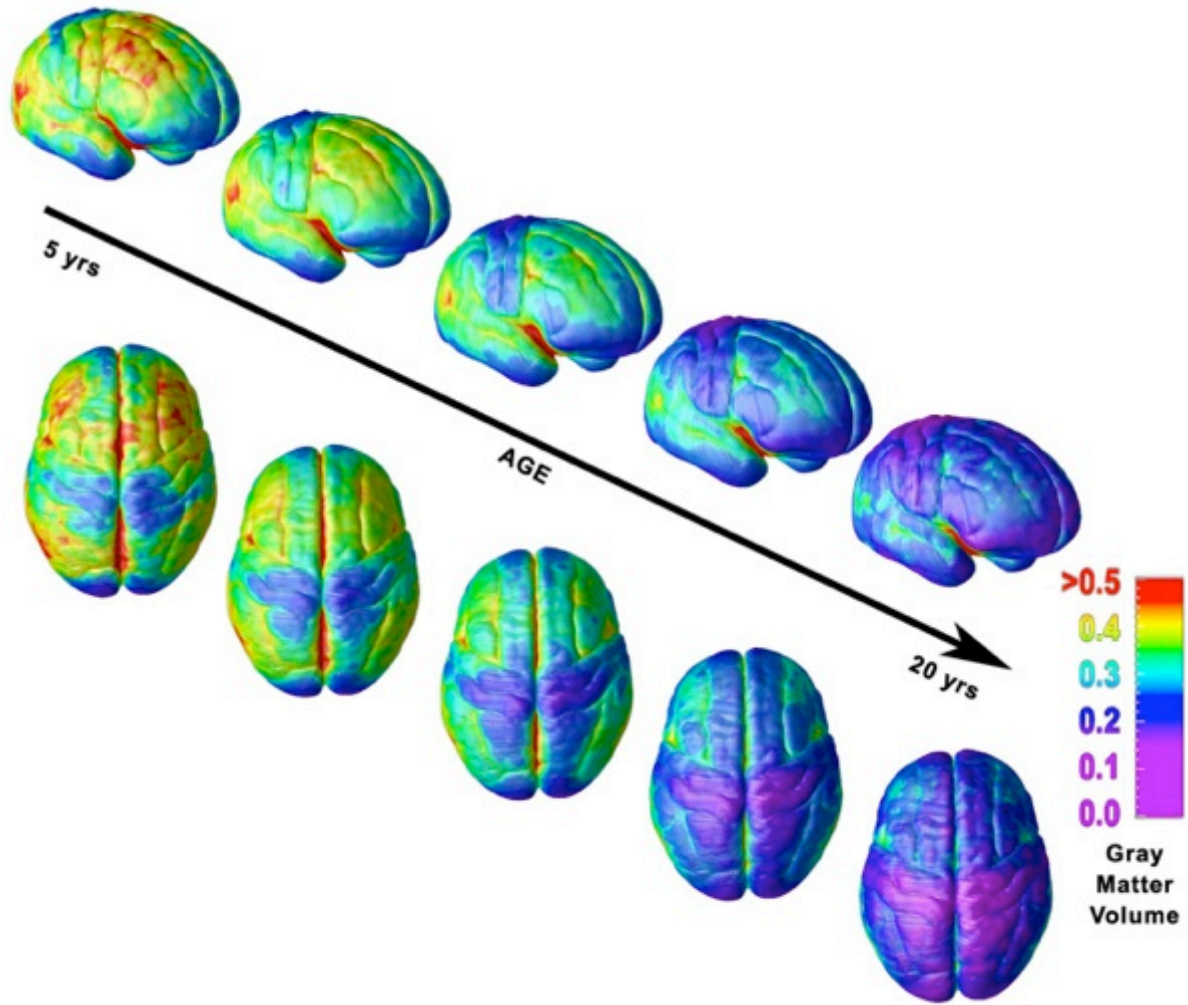
Rational
Decision Making
& Cognitive
Control

Childhood

Adolescence

Young Adult





Reward Sensitivity and Cognitive

Rational
Decision Making
& Cognitive
Control



Reward Sensitivity

Childhood

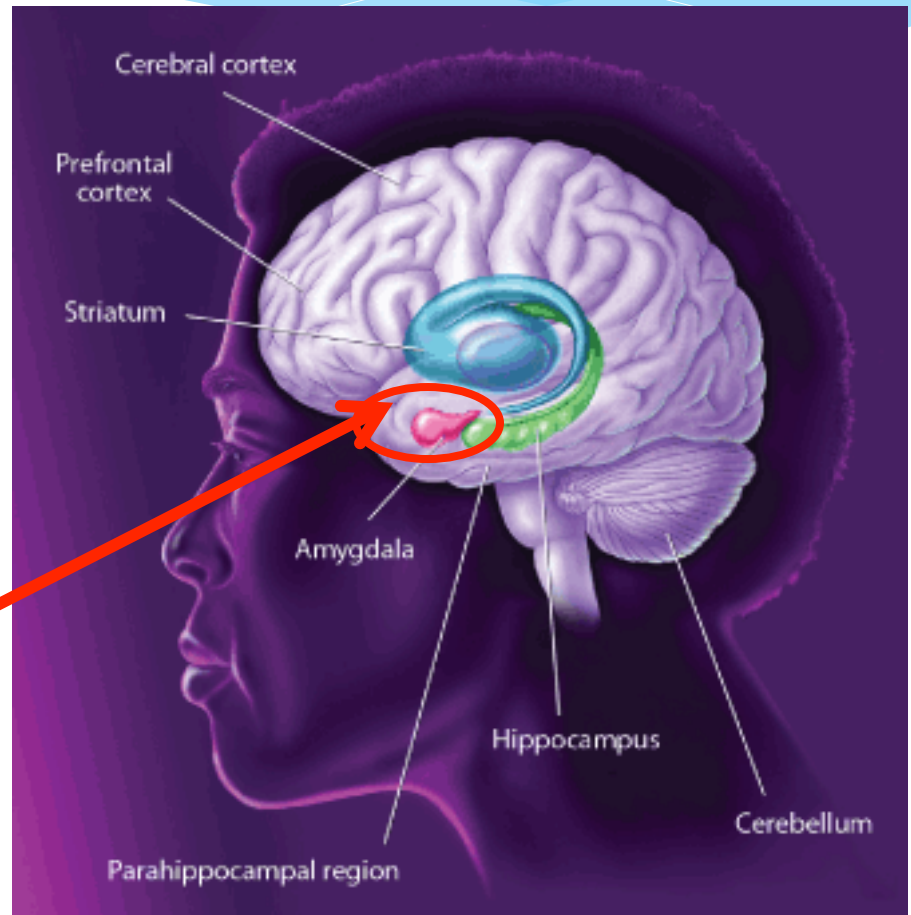
Adolescence

Young Adult

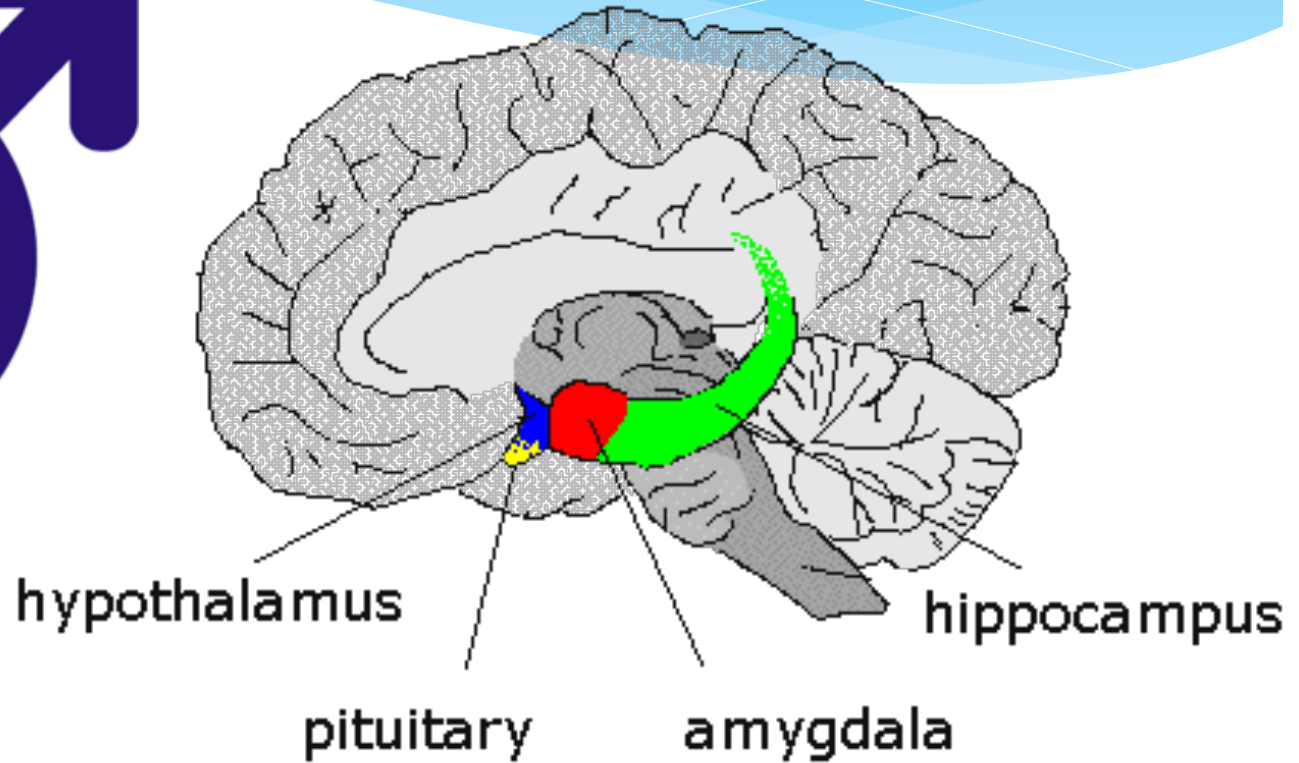
Fear and Its Regulation



FEAR

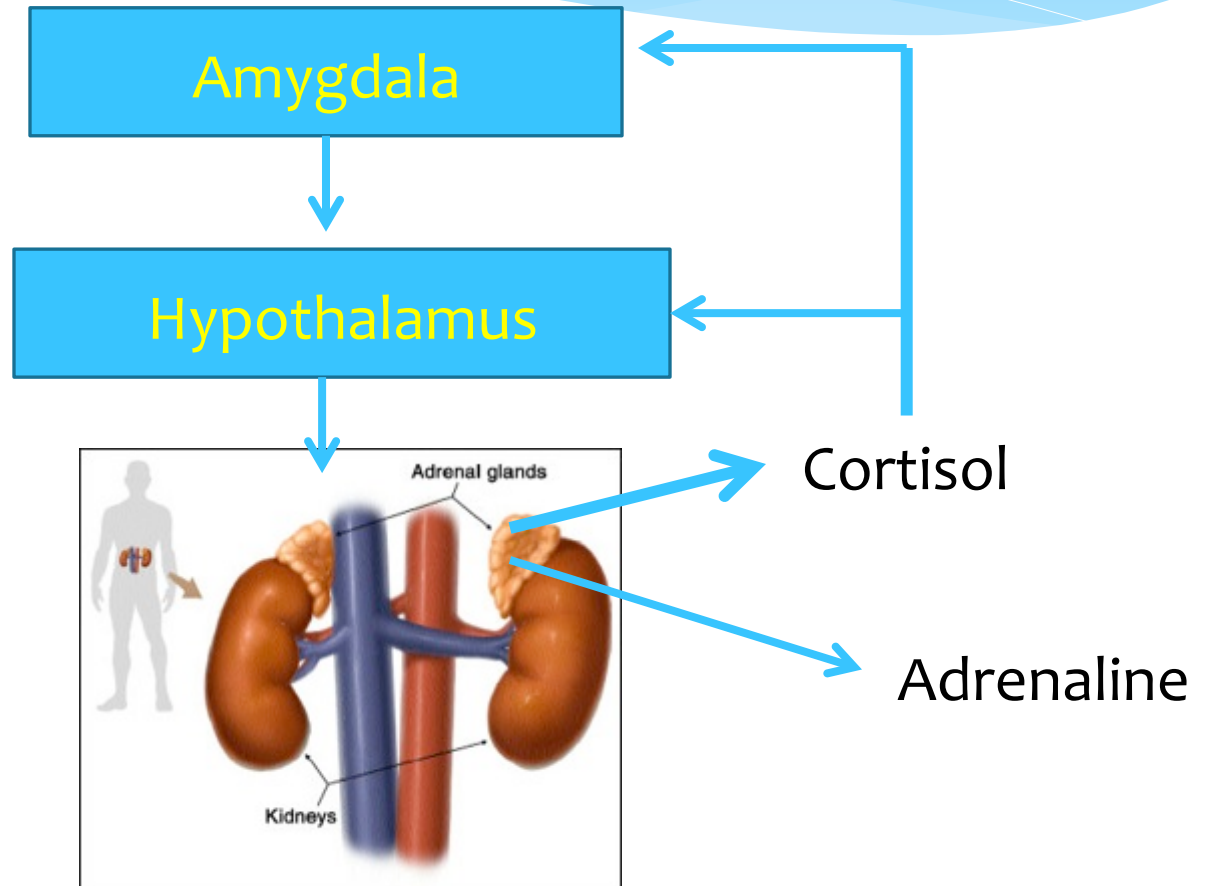


Sex Hormones Change the Brain

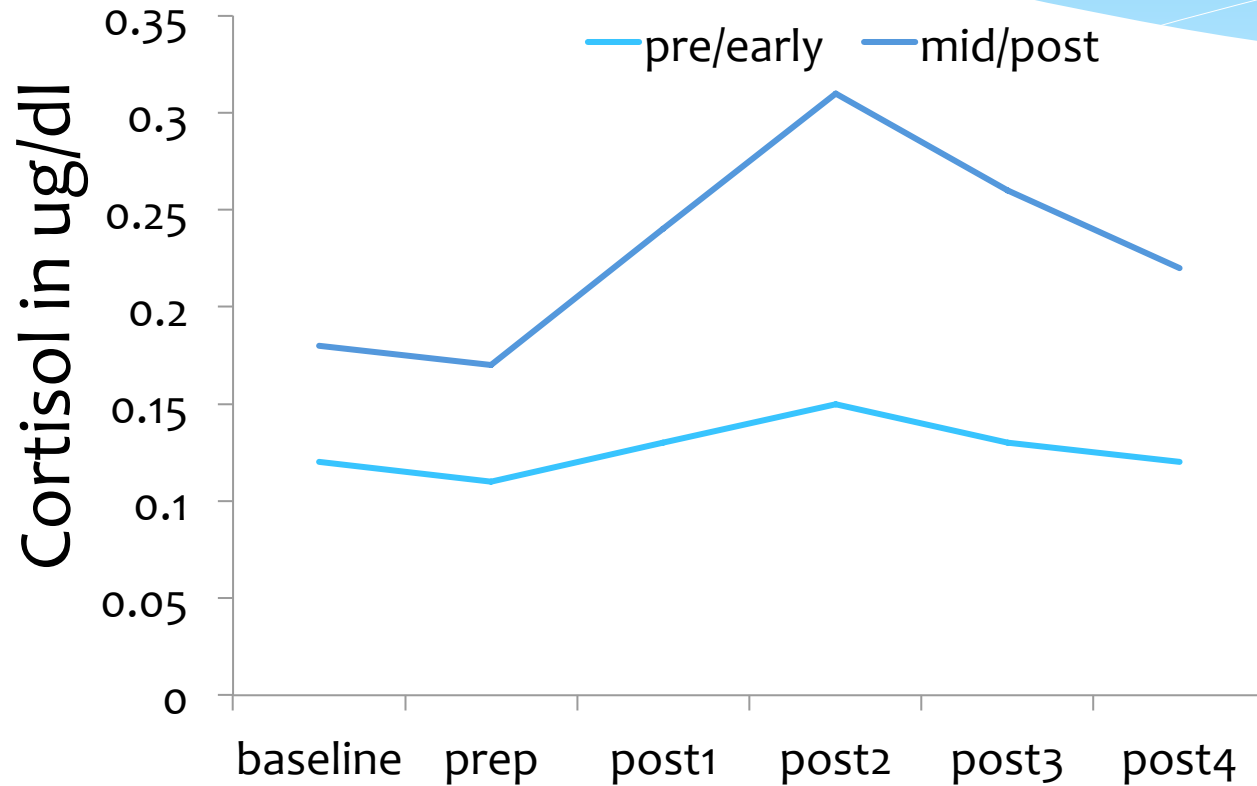


2nd Sensitive Period

Fear and Stress



Increase in Response to the Trier Social Stress Test with Puberty



Gunnar et al., 2009

Age range: 9 to 15 years



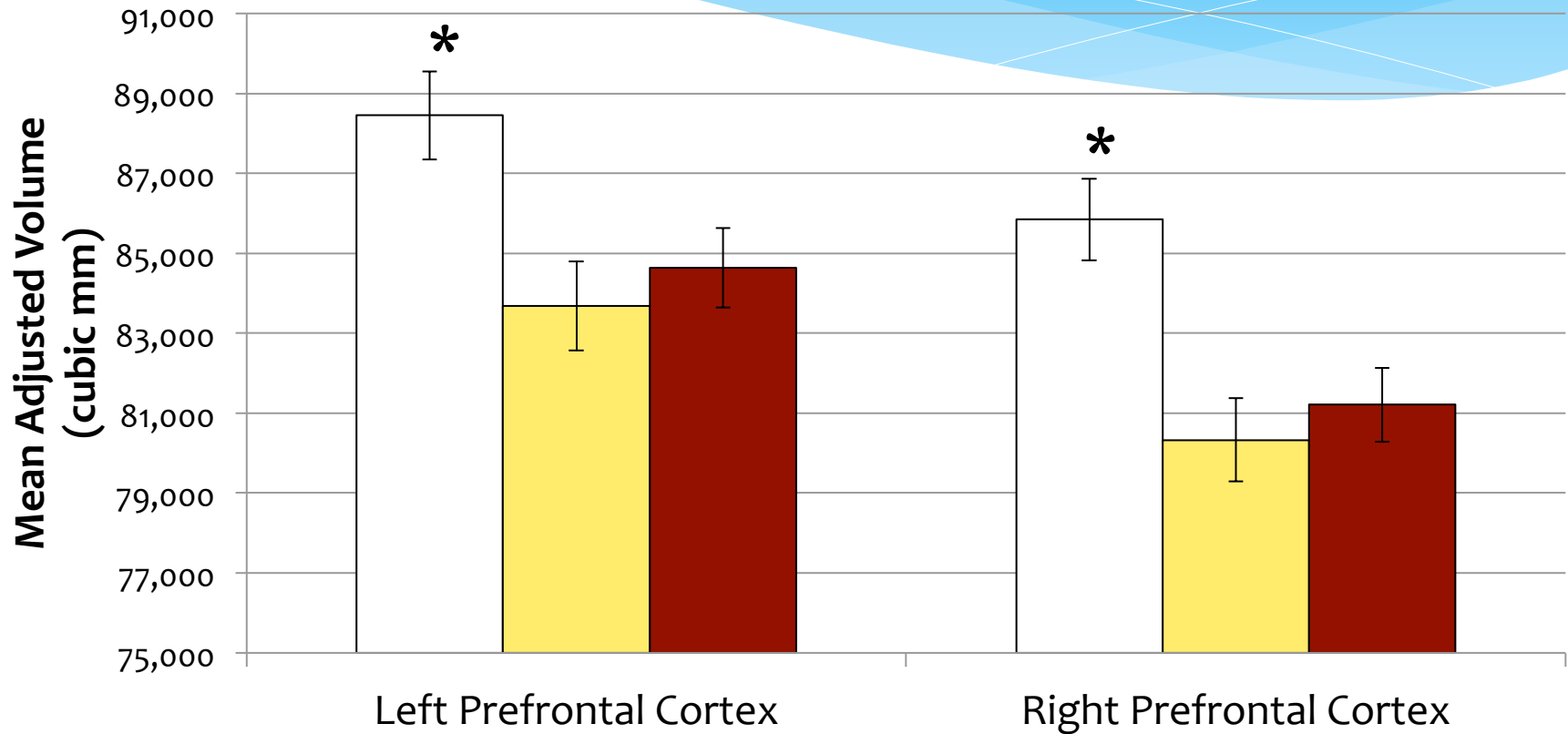
Emerging work on
Neurobehavioral Development
and Puberty in PI youth

Prefrontal Cortex Volume x Group

Minnesota Controls

Earlier Adopted
(≤ 12 months)

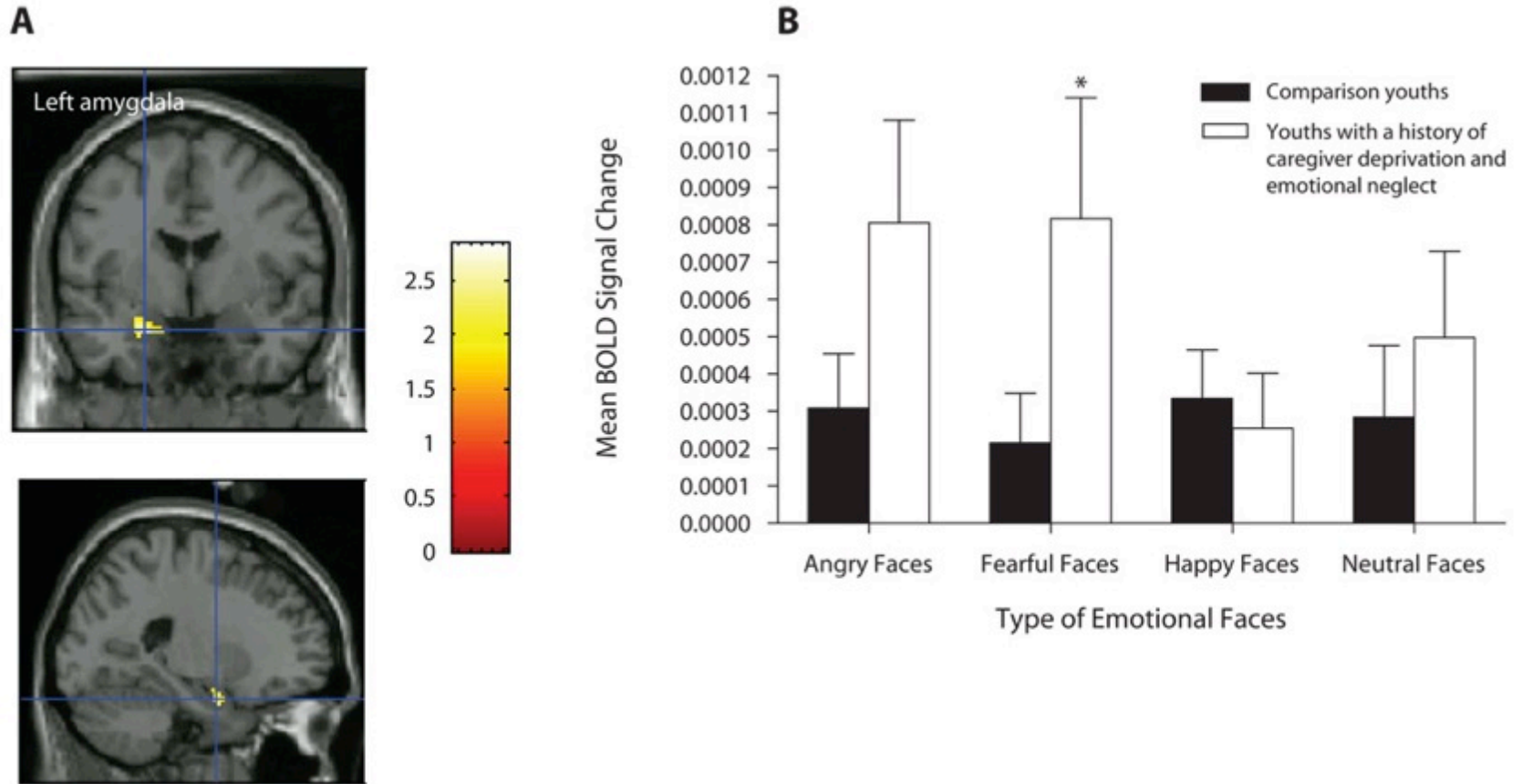
Later Adopted
(> 12 months)



Fear and the Amygdala (9-18 years of age)

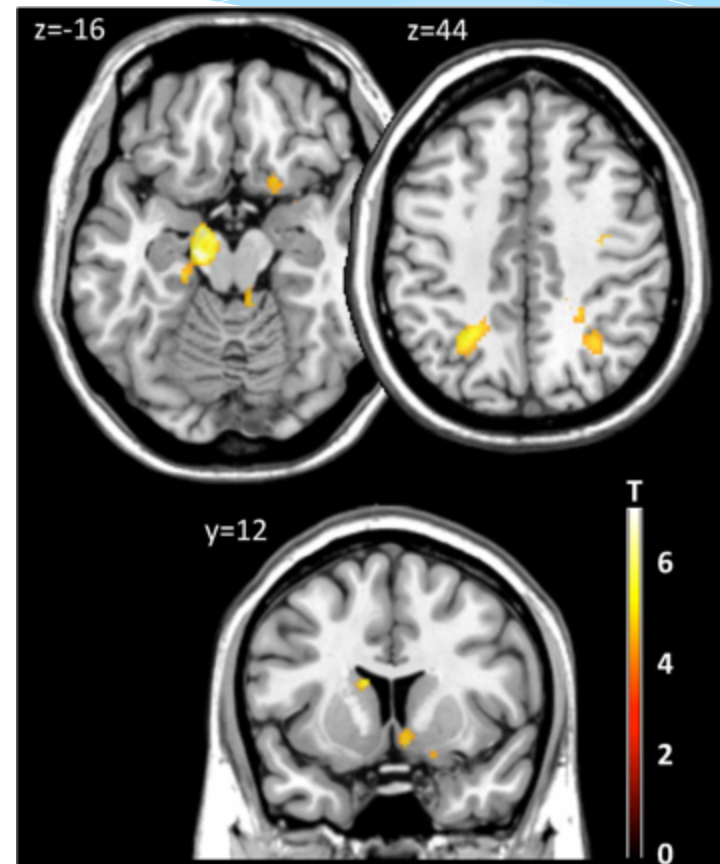


Early Deprived Youth Respond More to Negative Faces

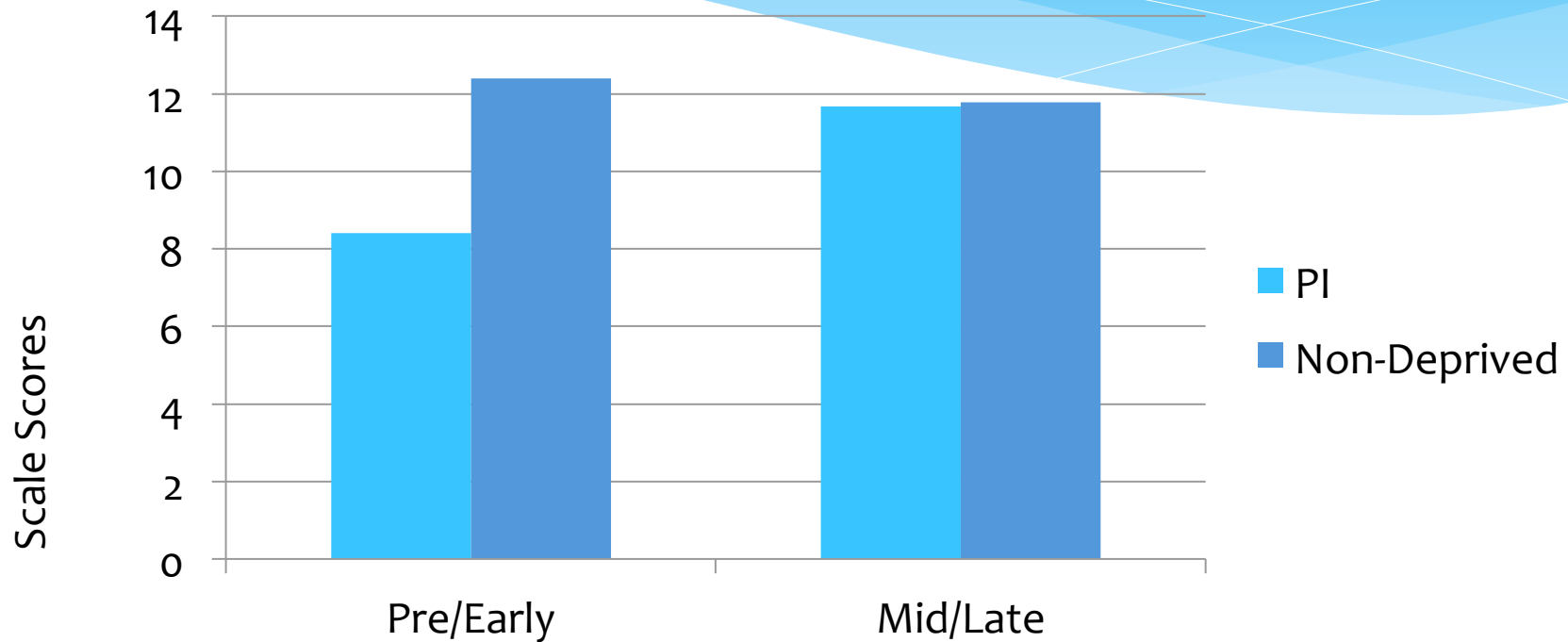


Hypo-responsiveness to Reward in PI Adolescence

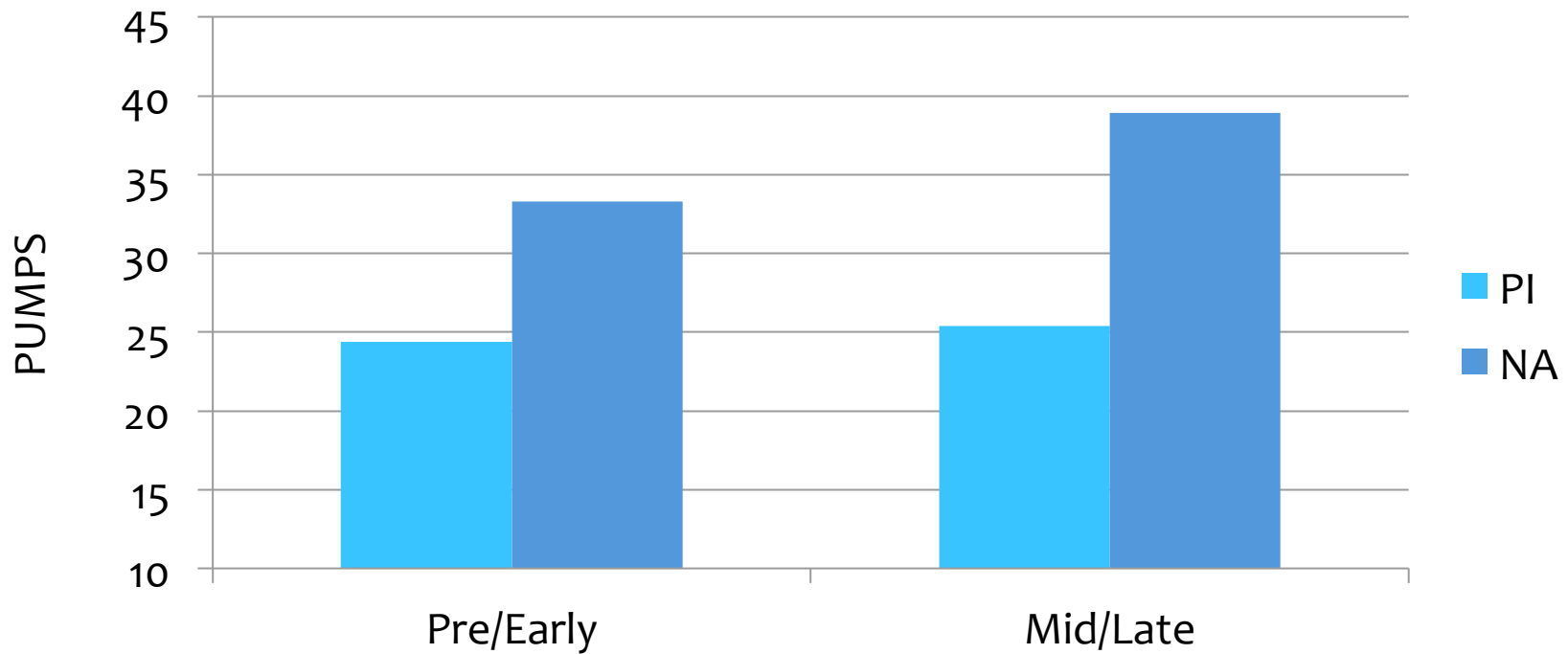
- * Monetary Incentive Task
- * Comparison Youth the Reward System responded
- * PI Youth, no response in the reward system
- * Caution: Extremely deprived



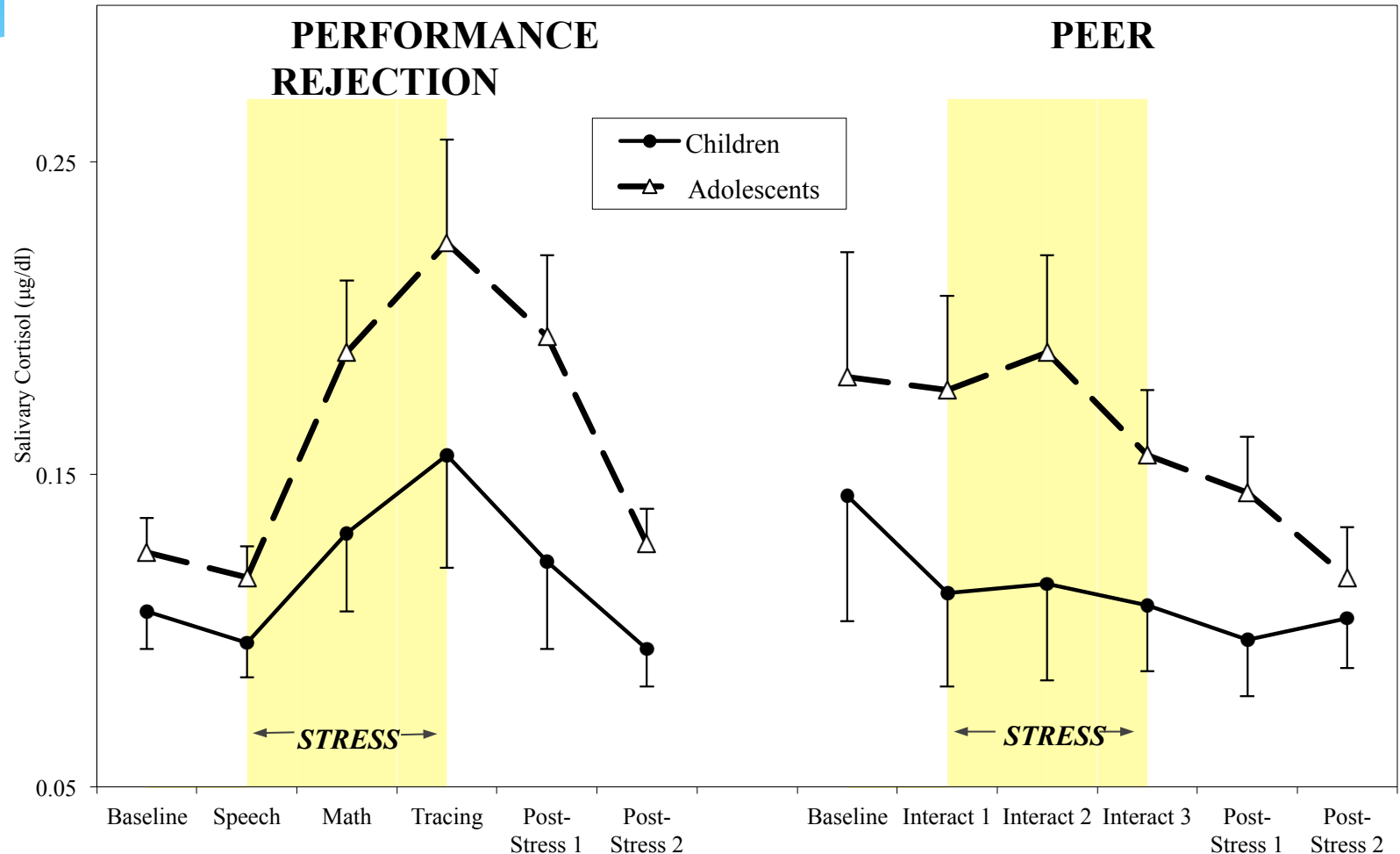
Thrill and Adventure Seeking and Social Disinhibition



BART and PUBERTY

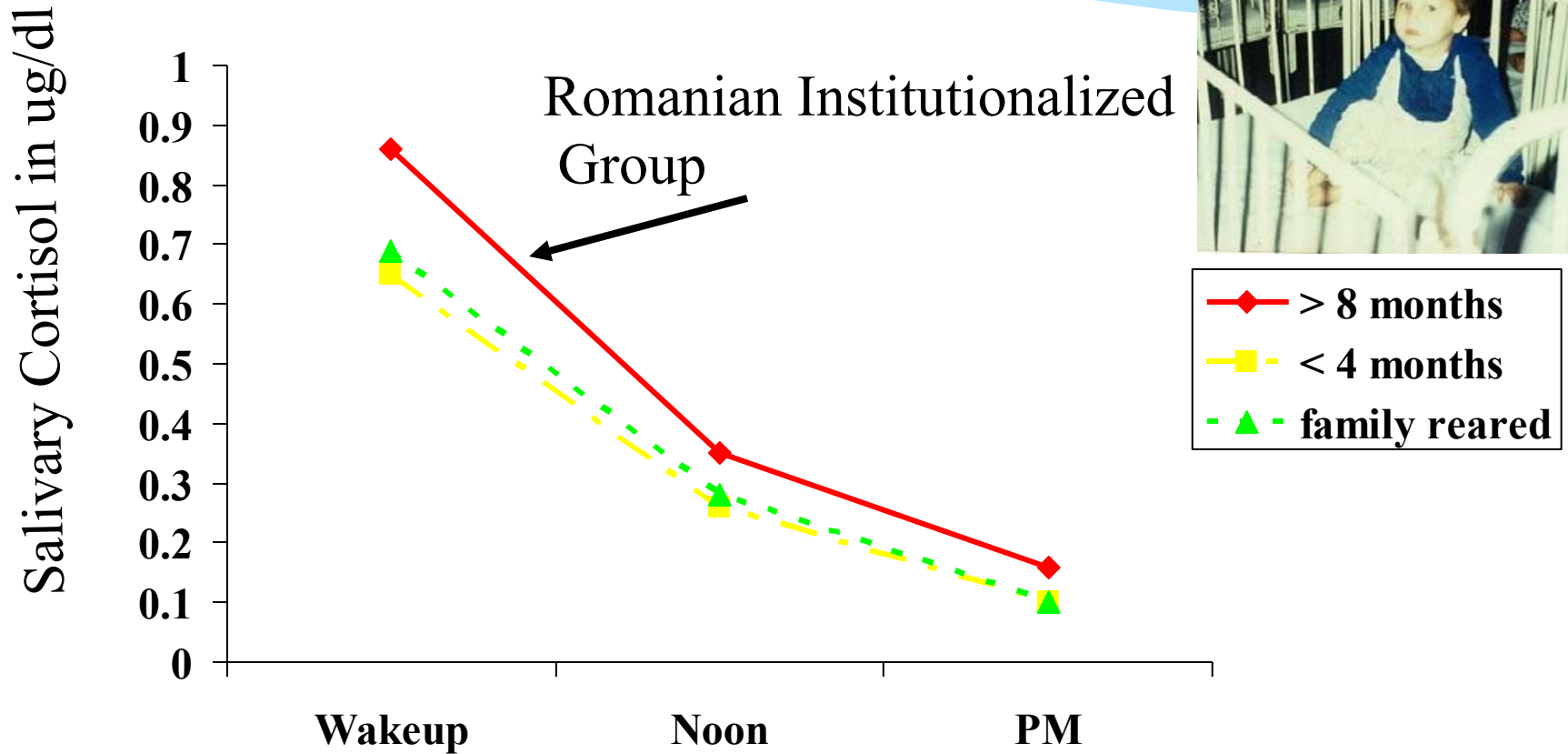


Increase in HPA Reactivity to Performance Stressor with Puberty



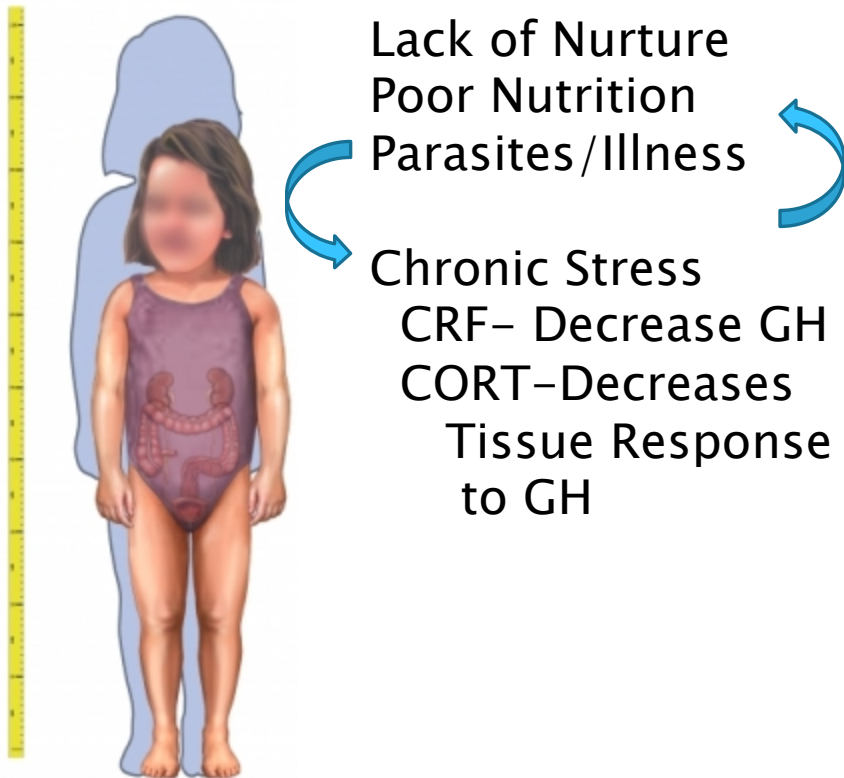
Cortisol Levels 6-7 years Post Adoption Romanian Children Adopted in 1990-1991

Ames Study of British Columbia

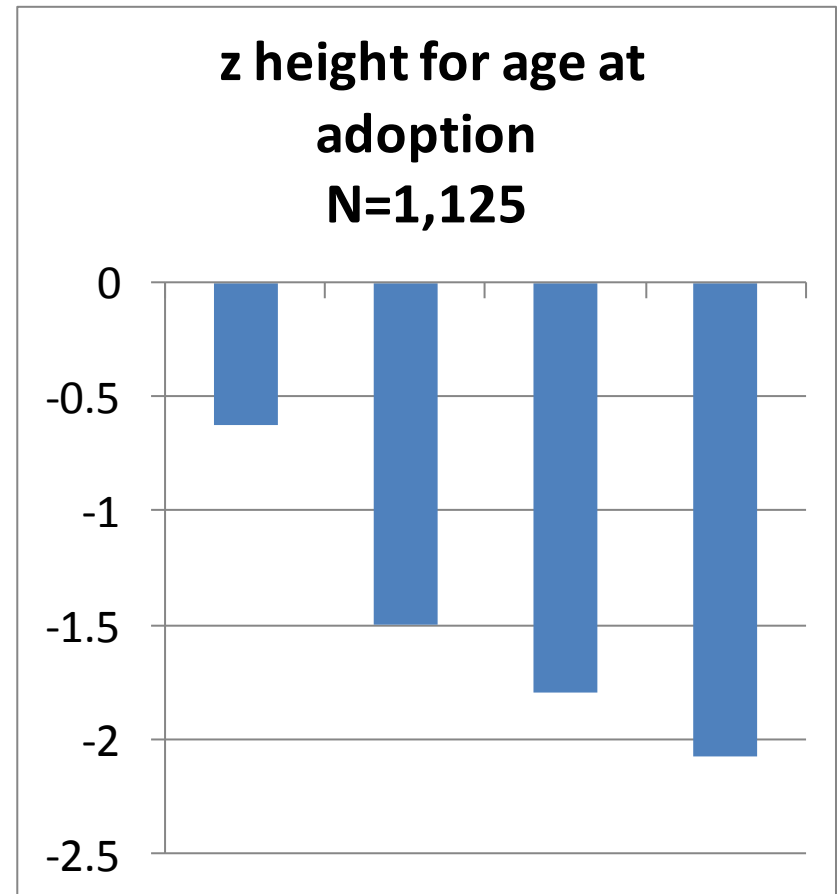


Gunnar et al., 2001

GROWTH (HEIGHT) SUPPRESSION IN INSTITUTIONALIZED CHILDREN



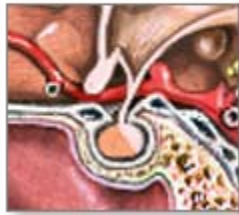
Stunted: $Z \leq -2$ Sds; 40% of PI children



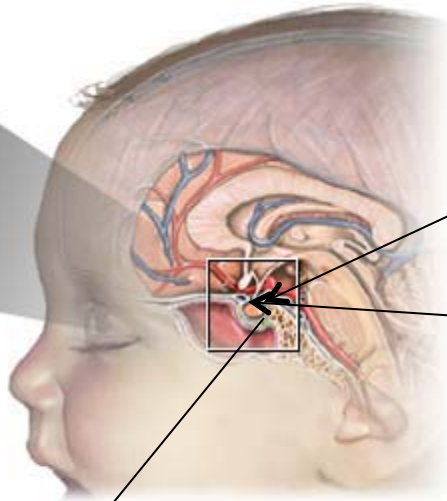
None mild mod severe

Parent Reported Deprivation
IA Foster and Institutions

Growth System and HPA Axis



The pituitary secretes hormones that are essential to growth and reproduction



GHRH (+)

Somatostatin (-)

CRH

+

GH

ADAM.

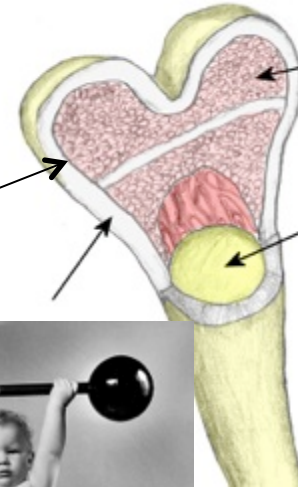
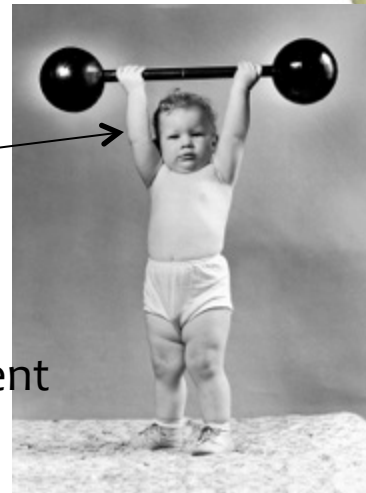
Cortisol

-

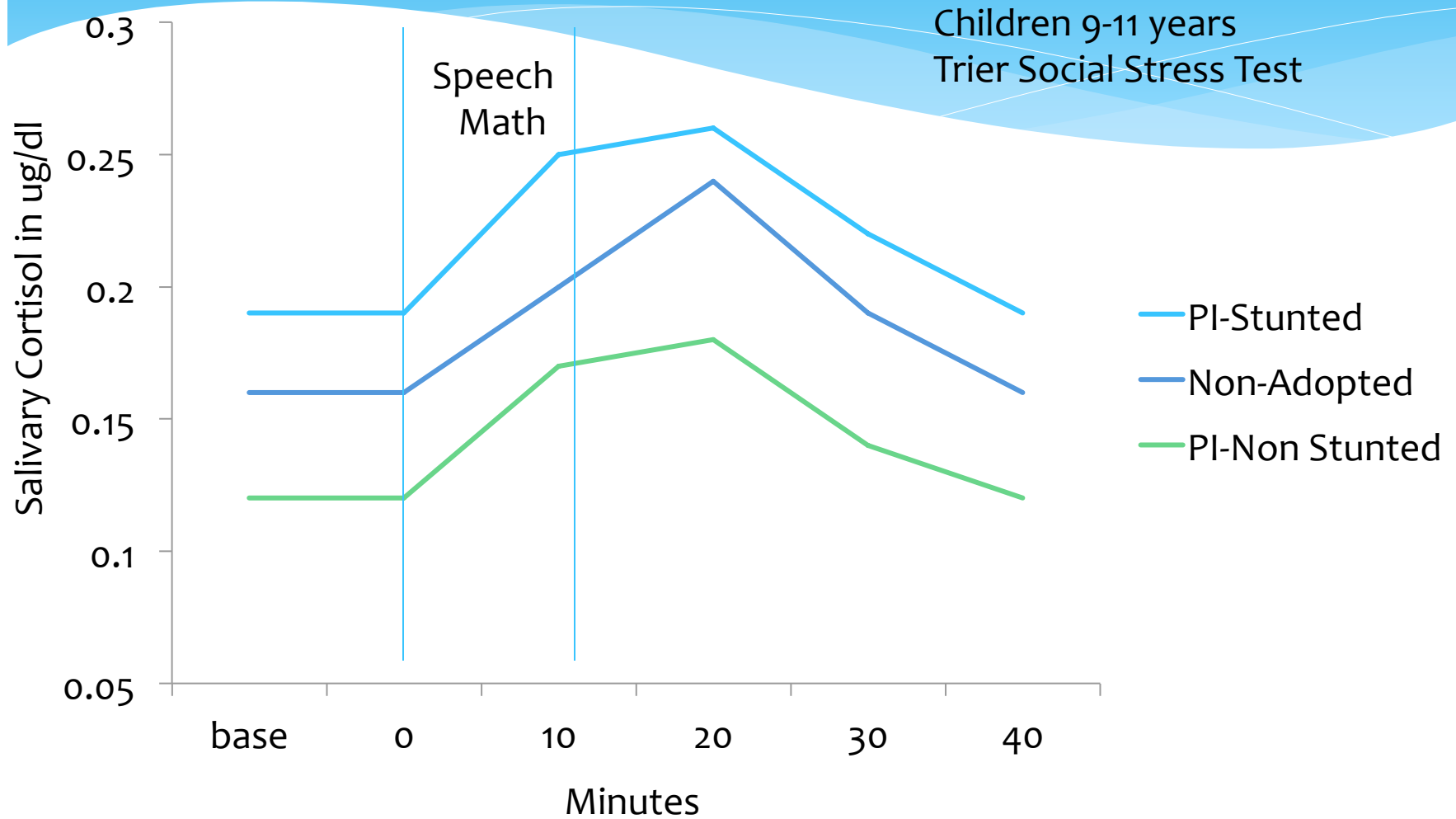
IGF-1

Bone Growth

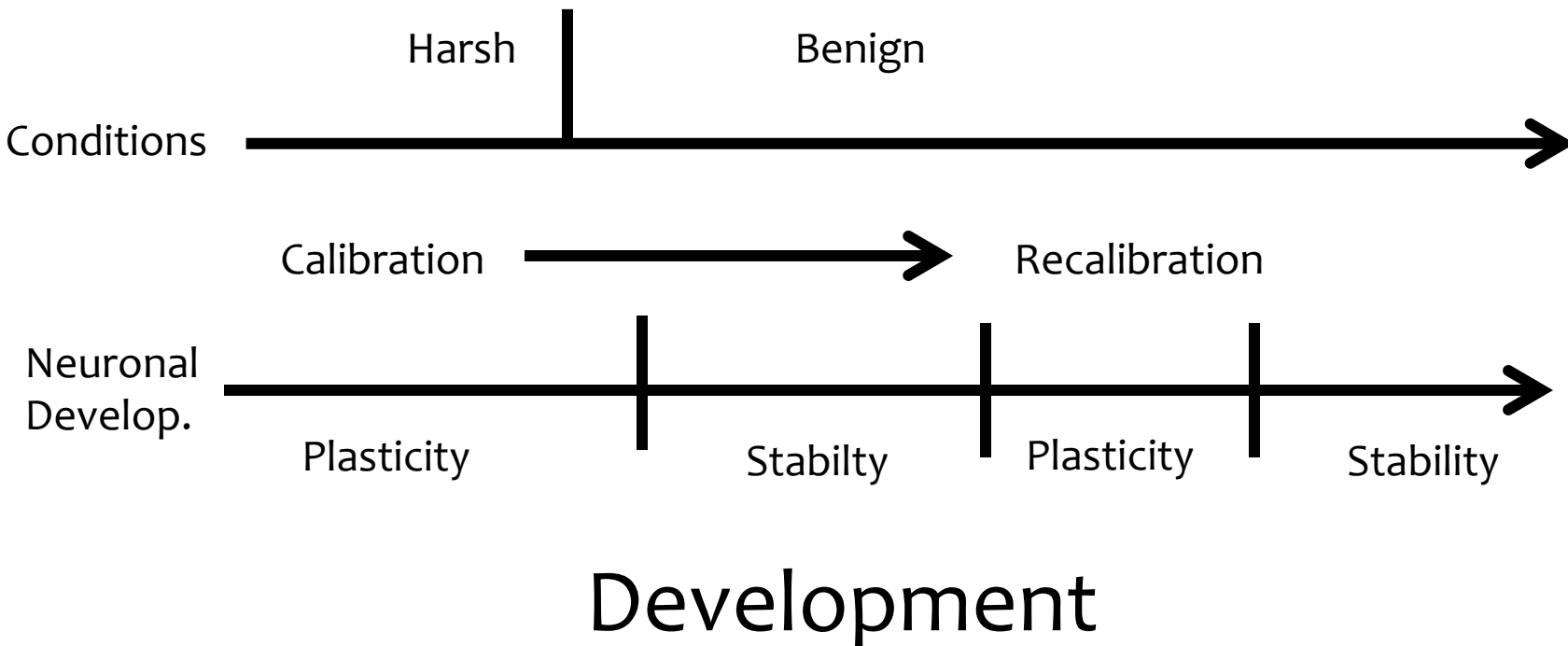
Muscle Development



STUNTING MODERATES RELATIONS BETWEEN INSTITUTIONAL CARE AND CORTISOL LEVELS

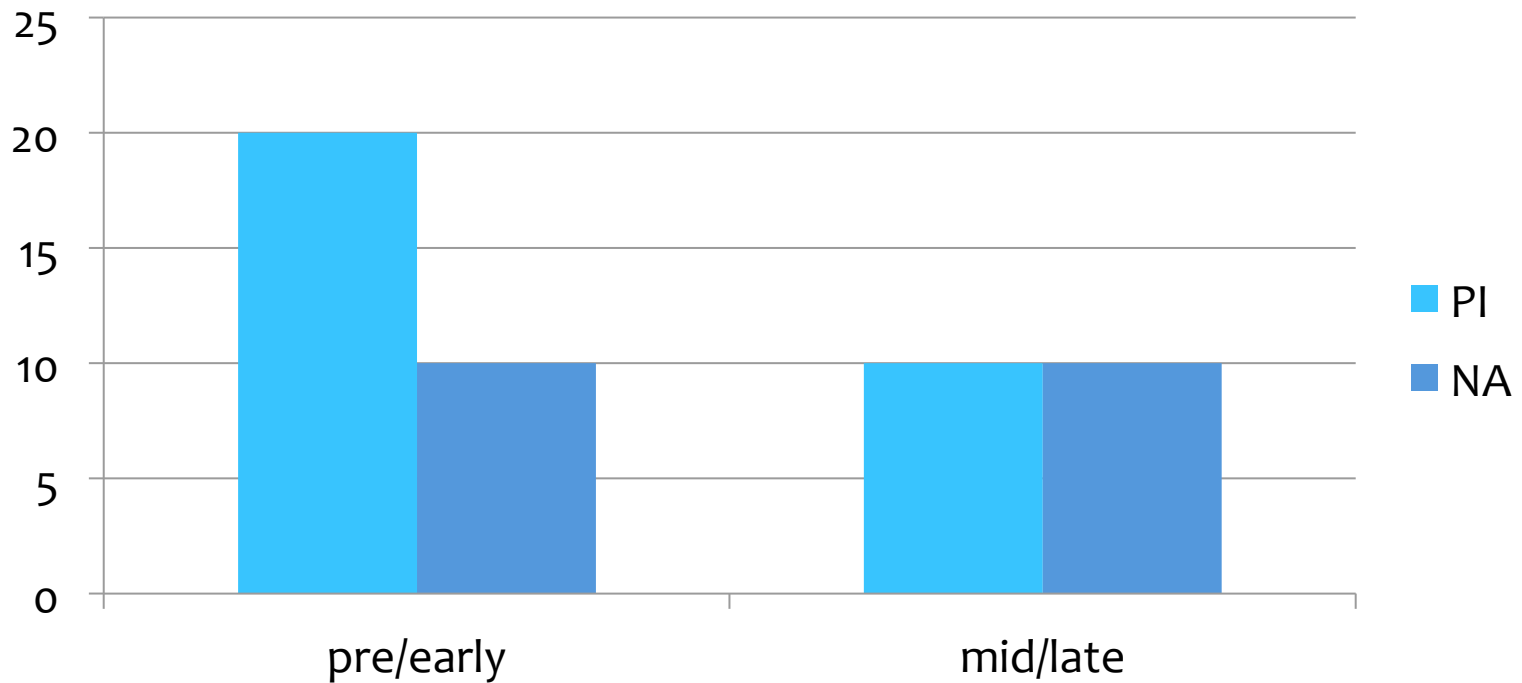


Pubertal Stress Recalibration Hypothesis



Degree of Abnormality in the Cortisol Awakening Response

12 and 13 year olds



Teen Years

(It was the best of times; it was the worst of times)



Summarize

- * Normative Development of the Teen Brain
 - * Maturation of brain regions involved in rationale decision making
 - * Period of increased activity of reward-sensitive/addiction-prone systems
 - * Period of Increased stress hormone activity and thus maybe plasticity of fear/anxiety systems
- * Development in children exposed to deprivation/neglect early in life
 - * Impaired/Delayed Development of systems involved in rational decision making
 - * Heightened responsivity in fear system
 - * Hypo-responsivity of brain reward systems
 - * Possibility of recalibration of stress system
 - * Critically important to reduce psychosocial stress in adolescence for PI children
 - * Support the development of skills that will allow them to successfully navigate the teen landscape making adolescence some of the best, not worst, of times

Thanks to Many

- * Gunnar Research Laboratory Staff & Students
 - * Bonny Donzella, Shanna Mliner, Kristin Frenn, Meg Bale, Bao Moua, Karina Quevedo, Anna Johnson, Michelle Loman, Kristen Wiik, Cam Hostinar, Elisa Esposito, Sarah Stellern, Jamie Lawler, Jena Doom,
- * International Adoption Project
 - * Dana Johnson, Maria Kroupina, Rich Lee
- * Early Experience, Stress and Neurobehavioral Development Center
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- * National Scientific Council on the Developing Child
- * National Institute of Mental Health