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

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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
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)
Neural Circuits are Wired in a Bottom-Up Sequence

Sensory Pathways (Vision, Hearing)

Language

Higher Cognitive Function

FIRST YEARS

Birth (Months) (Years)

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

Age at Random Assignment to Therapeutic Foster Care

IQ Scores

- 7-18 mos
- 18-24 mos
- 24-30 mos
- 30+ 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
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
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
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
* 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)
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

[Graph showing standard scores for Sad/Lonely, Separation Anxiety, and General Anxiety for PI, EA/FC, and NA categories.]

Wiik et al., 2011
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

Loman et al., unpublished
Balloon Analogue Risk Task
BART

PRE-Pubertal

Press to Collect $$$
Press this button to pump up the balloon

Total Earned $ 00.00
Last Balloon $ 00.00

PUMPS

PI
NA
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)
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 MATUREITY**

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.

5 10 20

Blue indicates a maturing 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

Orbital PFC (value; past rewards)

PFC → NAcc

Hippocampal formation

Dopamine

VTA

Memory for Events
Rational Decision Making 
& Cognitive Control

Reward Sensitivity and Cognitive Control

Childhood       Adolescence       Young Adult
Rational Decision Making & Cognitive Control

Reward Sensitivity and Cognitive Control

Childhood  Adolescence  Young Adult
Fear and Its Regulation

FEAR

FEAR
Sex Hormones Change the Brain

2nd Sensitive Period
Increase in Response to the Trier Social Stress Test with Puberty

Cortisol in ug/dl

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)

<table>
<thead>
<tr>
<th>Left Prefrontal Cortex</th>
<th>Right Prefrontal Cortex</th>
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* Denotes significant difference.
Fear and the Amygdala (9-18 years of age)

Maheu et al., 2010
Early Deprived Youth Respond More to Negative Faces

Maheu et al., 2010
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

Mehta et al., 2010
Thrill and Adventure Seeking and Social Disinhibition

Loman et al., unpublished
BART and PUBERTY

- BART and PUMPS
  - Pre/Early
  - Mid/Late

Graph showing comparison between PI and NA categories for Pre/Early and Mid/Late stages.
Increase in HPA Reactivity to Performance Stressor with Puberty

Stroud et al., 2009
Cortisol Levels 6-7 years Post Adoption
Romanian Children Adopted in 1990-1991
Ames Study of British Columbia

Romanian Institutionalized Group

Salivary Cortisol in ug/dl

Gunnar et al., 2001
GROWTH (HEIGHT) SUPPRESSION IN INSTITUTIONALIZED CHILDREN

Lack of Nurture
Poor Nutrition
Parasites/Illness

Chronic Stress
CRF– Decrease GH
CORT–Decreases Tissue Response to GH

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

Parent Reported Deprivation
IA Foster and Institutions

N=1,125
Growth System and HPA Axis

- **GHRH (+)**
- **Somatostatin (-)**

- **Cortisol**
- **GH**
- **IGF-1**

- **Bone Growth**
- **Muscle Development**
STUNTING MODERATES RELATIONS BETWEEN INSTITUTIONAL CARE AND CORTISOL LEVELS

Salivary Cortisol in ug/dl

Children 9-11 years
Trier Social Stress Test

Speech Math

Minutes

base 0 10 20 30 40

0.3
0.25
0.2
0.2
0.15
0.1
0.1
0.05

PI-Stunted
Non-Adopted
PI-Non Stunted

Gunnar et al., Psychoneuroendocrinology, 2009
Pubertal Stress Recalibration Hypothesis

Conditions
- Harsh
- Benign

Neuronal Development
- Plasticity
- Stability
- Plasticity
- Stability

Development
Degree of Abnormality in the Cortisol Awakening Response

12 and 13 year olds

- pre/early: 20
- mid/late: 10

Legend:
- PI
- NA
Teen Years

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