Toxic Stress and its Impact on Early Learning and Health

PAT LEVITT, PH.D.
PROVOST PROFESSOR OF NEUROSCIENCE, PSYCHIATRY AND PHARMACY
DIRECTOR, ZILKHA NEUROGENETIC INSTITUTE
CHAIRMAN, DEPT. CELL AND NEUROBIOLOGY
KECK SCHOOL OF MEDICINE OF USC

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Building Healthy Brain Architecture – The Ingredients

•Our genes, and ultimately our developing brain architecture, are influenced powerfully by positive early experiences—and negative ones, too.

•Genes provide the hardware, but early experience is the software that drives the system.
Healthy development of brain architecture depends a lot on a kind of interaction experts call Serve and Return, based on an analogy from games like tennis and volleyball.

Serve and Return happens when young children instinctively reach out for interaction, through babbling, facial expressions, words, gestures, cries, etc. and adults respond by getting in sync and doing the same kind of babbling, gesturing, and so forth.

Serve and Return is that it works best with adults who are familiar to the child, like familiar partners.

Effects on everything from the chemicals in the brain to physical structures and connections there.
Experiences in childhood have a lasting impact on how our fear and anxiety systems work.

A balancing act

New homeostatic ‘set point’

early positive experiences
Early Childhood Adversity Can Influence a Range of Lifelong Outcomes

Research on the biology of stress helps explain some of the underlying reasons for differences in learning, behavior, and high risk for physical (cancer, cardio, diabetes), and mental health disorders.
Institutionalization and Neglect of Young Children Disrupts Body Chemistry

Percent of Children with Abnormal Stress Hormone Regulation

- 5% for Middle Class US Toddlers in Birth Families
- 35% for Neglected/Maltreated Toddlers Arriving from Orphanages Overseas

Source: Gunnar & Fisher (2006)
Disparities in Early Vocabulary Growth

Cumulative Vocabulary vs. Age (months)

SES = Socio-Economic Status

High SES
Middle SES
Low SES

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The Brain Architecture of Anxiety and Fear
The Brain Architecture of Memory and Learning
Secure Relationships Calm Children’s Stress Hormone Response

Source: Nachmias et al. (1996)
Sensitive Care Calms Children’s Stress Hormone Response in Parent’s Absence

Source: Nachmias et al. (1996)
Concept:

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

- Maternal rejection
- Harsh discipline
- >2 primary caregiver changes
- Physical abuse
- Sexual abuse
- Extreme social isolation

“epigenetics”
Significant Adversity Impairs Development in the First Three Years

Source: Barth et al. (2008)
Risk Factors for Adult Substance Abuse are Embedded in Adverse Childhood Experiences

Source: Dube et al, 2002

New Biological Evidence Links Maltreatment in Childhood to Greater Risk of Adult Heart Disease

Source: Danese et al. (2008)
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.
Sources of Toxic Stress in Young Children

- Maltreatment: 75
- Parental Substance Abuse: 98
- Postpartum Depression: 130

U.S. Children Ages 2-5 (per 1,000)

Source: Finkelhor et al. (2005)
Source: SAMHSA (2002)
Source: O-Hara & Swain (1996)
Persistent Stress Changes Brain Architecture

Normal

Chronic stress

Prefrontal Cortex and Hippocampus

Typical - neuron with many connections

Neuron damaged by toxic stress – fewer connections

Bock et al Cer Cort 15:802 (2005)
Research Says that Remediation and Prevention ARE Possible
Delayed Intervention Harms Development
Bucharest Early Intervention Program

Source: Nelson et al. (2007)
How Should We Act On the Science?
A healthier population begins with reducing toxic stress in early childhood, not just trying to change adult behavior.

Early childhood intervention programs can be a vehicle for enhancing lifelong health, not just preparing children to succeed in school.

A redesigned child welfare system could improve health outcomes by promoting positive relationships and adaptive development, not simply focusing on physical safety and custody.
The Childhood Roots of Health Disparities: How Adversity is Built Into the Body

- Conception
  - Biological Embedding during Sensitive Periods
  - Toxic Stress
  - Environmental Exposures
  - Malnutrition

- Early Childhood
  - Early Adversity
  - Cumulative Burden over Time
  - Physiological Disruption
    - Neurodevelopmental
    - Immune
    - Metabolic
    - Neuroendocrine
    - Cardiovascular

- Middle Childhood

- Adolescence
  - Disease/Disorder
  - Health-Threatening Behavior
  - Low Educational Achievement

- Adulthood

- Early Death
PREVENTING MENTAL, EMOTIONAL, AND BEHAVIORAL DISORDERS AMONG YOUNG PEOPLE
PROGRESS AND POSSIBILITIES

Mental, emotional, and behavioral (MEB) disorders—which include depression, conduct disorder, and substance abuse—afflict large numbers of young people. Studies indicate that MEB disorders are a major health threat and are as commonplace today among young people as a fractured limb—not inevitable but not of all unusual. Almost one in five young people have one or more MEB disorders at any given time. Among adults, half of all MEB disorders were first diagnosed by age 14 and three-fourths by age 24.

Many disorders have lifelong effects that include high psychosocial and economic costs, not only for the young people, but also for their families, schools, and communities. The financial costs in terms of treatment services and lost productivity are estimated at $247 billion annually. Beyond the financial costs, MEB disorders also interfere with young people’s ability to accomplish age and culturally appropriate developmental tasks, such as establishing healthy interpersonal relationships, succeeding in school, and making their way in the workforce.

Recent decades have seen an explosion in research related to the prevention of MEB disorders. Significant results of this research include improved understanding of the origins of MEB disorders and advances in methodological approaches that strengthen the causal inferences drawn from evaluations of preventive interventions and enable tracking of effects over multiple years. Many interventions have been tested in multiple randomized trials and show long-term reductions in MEB disorders and related problem behaviors, such as aggression, high-risk sexual behavior, and substance use, as well as such

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Maximizing Return on Investment

The basic principles of neuroscience indicate that later remediation will be more costly than preventive intervention in the first years of life.

Brains: more physiological energy needed to compensate for poorly formed neural circuits.

Society: higher cost of remedial education, clinical treatment, crime.
Think Broadly About Children’s Environment of Relationships

Plan from pregnancy to kindergarten, and look beyond education and health care.

Invest in the development and retention of a skilled early childhood workforce.

Make sure vulnerable children have access to stable, supportive relationships with adults—as early and as consistently as possible.
Science Points Toward a 3-Tiered Approach to Ensuring Healthy Development

1: Basic health services and early care and education available to all children to help build and sustain strong brains and bodies.

2: Broadly targeted interventions for children in poverty (e.g., income supports and early enrichment) to give all the chance to succeed.

3: Narrowly targeted, specialized services for children experiencing tolerable or toxic stress to prevent later problems.
PRESENTED BY PAT LEVITT, PH.D.
PROVOST PROFESSOR OF NEUROSCIENCE,
PSYCHIATRY AND PHARMACY
DIRECTOR, ZILKHA NEUROGENETIC INSTITUTE
KECK SCHOOL OF MEDICINE OF USC

plevitt@usc.edu
www.usc.edu/zni

http://www.developingchild.net
http://www.developingchild.harvard.edu