Brain Development and the Effects of Child Maltreatment

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Normal brain development

- Primitive structures develop first for survival needs: heartbeat, breathing
- Humans born most neurologically incomplete
- Not designed to survive on our own
- Most brain growth occurs after birth
- 90% brain growth in first three years
- Develops from back to front

INFANT BRAIN DEVELOPMENT

- Born with 100 billion brain cells (neurons)
- Each makes up to 10,000 connections
  - By age three: 1000 trillion connections
  - twice as many as an adult
Brain development

- Connects to other neurons
- Develops fastest “routes” into neural pathways
- Makes structural changes in response to experiences
- Repeated use causes axon and neural pathways to get stronger and faster
- Called “use-dependent neurodevelopment”

Brain builds itself, based on the experiences it has
Pruning

• Brain is a “use it or lose it” machine
• In childhood:
  • Connections used are kept
  • Connections little used are pruned away
• Activity level decides which
Long-term benefits

More nurturing caregiving = better stress response in later life

- Without it, imbalance in brain chemicals
- Less able to calm self; intense reactions

- Children who attend preschool:
  - 52% less maltreatment
  - greatest difference in behavior seen when they were 10-17 y.o.
Parents’ verbal interaction with preschoolers

- Lower class: 10 million words
- Middle / working class: 20 million words
- Professionals: 35 million words

Not just total words, but different vocabulary
- Improved preschool vocabulary predicts better reading skills and school performance

Farkas, 2004
What doesn’t work

- Babies 6 – 8 months old
  Every hour watching = 6 – 9 fewer words
- Language needs to be learned in direct interaction with another person
- Videos and computer programs
- Television and other media should be avoided for infants and children under 2 (or suffer delay in language development)
Nurturing development

Optimum brain growth occurs from stimulation that is:

- frequent, regular, predictable
- in warm, supportive relationship
- involves several senses
- associated with fun, excitement, humor, comfort
- involves child’s interests

Brain grows to fit environment it experiences
Relationship with parent that:

**Promotes child’s potential**

- Gentle responsive nurturing
- Clear, consistent expectations
- Verbal stimulation with positive emotional expression
- Stable environment and caregiver

**Creates developmental risk**

- Neglect of physical or emotional needs
- Harsh or inconsistent punishment
- Little expressive speech to child; excessive prohibitions
- Frequent changes in caregiver, routines
Teenage Brain

1. Doesn’t function like adult brain
2. Needs more sleep
3. Less able to recognize facial expressions
4. “Insulation” of nerves not complete

Incomplete structure and chemistry
Prefrontal cortex: last part to develop
is involved in judgment and calming emotions
thrill-seeking, risk-taking:
releases dopamine (occurs in other animals, too)
Brain development in adolescents

Sleep / arousal differences

✧ Need more sleep
  - average 9 hours, 15 minutes
  - increased daytime sleepiness

don’t

✧ Biological clock set later
  - biological tendency to stay up later at night and wake up later in the morning

✧ More sleep = better grades
  - REM sleep is needed for memory
Brain development in adolescents

- Often not able to accurately recognize facial expressions

- So, have more difficulty interpreting social situations
Brain development in adolescents

Myelinating nerve cells in brain

- Myelin: fatty substance that coats nerves and acts like insulation on electric cord
- Allows electrical impulses to travel more quickly and efficiently
- Last part to myelinate is prefrontal cortex: regulates judgment, emotion, impulsivity
- Not complete until early twenties
- Happens earlier in girls than boys
Puberty

Sudden activation of hormones affects drives, motivation, emotions (occurs early)

+ Slow, gradual emergence of cognitive control (occurs late)

= Time of vulnerability

Turned on turbo charger, but with an unskilled driver
Effects of trauma, stress and maltreatment:

Childhood trauma

- Highly prevalent: 20 - 40% of population
- Elevates suicide risk
- Increases risk of mental disorders
- Increases risk of physical disorders

50% of children exposed to trauma develop pathology of some form
Developmental Trauma: recognize that there is dysregulation across all domains of function – emotions, memory, sensory integration, coordination, arousal, learning, behavior, aggression, cognition, relationships

In children with this history, think of it as “disorder” that dysregulates all systems
Childhood trauma affects developing brain

1. Causes deformities / abnormalities of brain
2. Changes physical stress response system
3. Creates deficits in normal learning
1. **Deformities and abnormalities of brain**

- Head injuries
- Corpus callosum
- Smaller brain volume (equals lower IQ)
- Hippocampus reduced
- Fewer synaptic connections

Younger the child is, more extensive the trauma, becomes “hard-wired”; less likely to change significantly.
2. Childhood trauma changes biochemical functioning

Stress response dysregulation

- Threats result in increased corticosteroid levels: release of chemicals from fright / stress
- Continuous in chronic adversity
- Make more vulnerable to subsequent trauma
- Damage is cumulative

Body memories: prior to language (28-36 mo) fight or flight reactions to smells, sounds, touch
Adverse Childhood Experiences: ACE Studies

- 47,000 people
- ACEs = increasingly higher incidence of:
  - Smoking, alcoholism, drug abuse, obesity, HIV
  - Heart disease, stroke, diabetes, emphysema
  - Bronchitis, hepatitis, liver/kidney disease
  - Cancers, STDs, arrests, irritable bowel syndrome
  - Depression, suicide, attempted suicide

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Autoimmunity affected: changes how immune system is built

Child trauma = 4 - 5% increased risk of autoimmune disorder over entire lifetime (rheumatoid arthritis, lupus, MS)

Pain response magnified

People with significant childhood trauma live 7-15 years shorter

Risk potential is cumulative.
Damage to DNA

- Children exposed to violence have wear and tear similar to aging.
- Stress of trauma speeds up telomere erosion
- More trauma, faster telomeres erode

Telomeres:
Protective coating that caps the ends of chromosomes. Each time cell divides, cap gets shorter. After 50-60 divisions, cell shuts down.
3. Creates deficits in normal learning

- Not just what happened to them, it’s what didn’t happen
- Developmental “holes” in language, socialization, reasoning
- Stimulation years later cannot make up for this deprivation; some ability is lost
- Over-arousal blocks cognitive processing, even years later
- “Bad” experiences replaced normal ones
“The ultimate end-point of chronically experiencing catastrophic trauma is progressive impairment of the ability to:

- adjust
- take defensive action on one’s behalf
- register affect / pain
- perceive self as different and unworthy.”
Rates of Occurrence

- While 12%-22% of children suffer from psychiatric disorders
- 35%-60% children in foster care have a 3X rate in general population
- Despite effective treatments, few kids get it (18%)
  - Maltreatment worsens existing disorders
  - Kids with disorders become targets
  - Abuse/neglect cause brain damage / dysfunction
Post Traumatic Stress Disorder (PTSD)

- 1/3 children 6-8 yrs. old in foster care
- Sexual abuse; witness DV or homicide = 50-70%
- Damage is cumulative over lifetime
- Children continuously exposed to danger, who witness, experience violence
  - stress hormones stay “on”
  - results in brain damage / changes in chemistry
  - Hypervigilence is symptom most correlated with decreased immune response
Attachment Disorders

- Inability to form normal relationships
- ¼ of children who are severely maltreated
- Over-developed right hemispheres (survival mechanisms: increased arousal)
- In extreme cases, self-stimulating behaviors, lose ability to tolerate any stimulation, severely impaired affect and pain reception, death in ¼ of cases
Conduct disorder (boys)
Borderline Personality disorder (girls)

Disorder of maltreatment: trauma-induced

Deformities / abnormalities of brain
- head injuries
- smaller brain volume = lower IQ
- smaller corpus collosum

Changes in biochemistry
Causes

Biological vulnerability (inherited)

- 18-20% of people born with more emotional sensitivity
- Parents help them learn to regulate emotions
- Add severe childhood trauma:

Genetics

Severe child abuse
Use child’s history to engender empathy

Behaviors often alienate those trying hard to help

Remind yourself (and colleagues) to see the hurt, scared child doing what they can to survive

Behaviors were life-saving once, but maladaptive now
Three important strategies

1. Encourage primary attachment figure: adult attuned to the child and consistently available with nurture / comfort

2. Support caregiver in getting help for their own trauma histories. Hard to stay attuned to child with own emotions / unmet needs

3. Build and maintain healthy connections outside immediate family (friends, teachers, coaches, teams, scouts, clubs, faith community)
Treatment Options

**EMDR**: Eye Movement Desensitization and Reprocessing = bilateral stimulation of brain

**Yoga**: Observing / feeling yourself: mindfulness, body control, gentle self-awareness. Book: Healing Trauma Through Yoga
- Being quiet and still is too hard, can’t tolerate; Focus on doing something while becoming more mindful;
  8 sessions decreased hyperarousal / increased mood

**TF-CBT / DBT**: Trauma-Focused Cognitive Behavior Therapy / Dialectical Behavior Therapy: Change negative thought patterns that reinforce and worsen symptoms of anxiety and depression

**Prolonged Exposure Therapy**: Systematic desensitization through imaginal and in vivo exposure; Repeated exposures reduce distress and avoidance of trauma reminders.
Improvement in 80% of those with PTSD
Recommendations for prevention

1. Early intervention to stop the trauma to give brain time to heal and grow in normal setting
2. Involve child in enriching activities that require brain to develop coordination / communication between sides: Music lessons
3. Early intervention to teach child coping skills in stress management and emotion regulation
Resiliency offers second chances: Most high-risk youths with serious problems in adolescence, were described by 30 as “resilient.”

A close relationship early in life is key to success: 
Always had one consistent adult who cared about them.