Working Together to Reduce the Impact of Trauma in Young Children

Creative Collaboration and the neurodevelopmental / neurobehavioral impact of traumatic stress

25 August 2011
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Role of Stress in Child Development
Classifying Stress

Positive Stress

- Moderate / brief exposures
- Important / necessary for healthy development
Classifying Stress

**Tolerable Stress**

- Significant (and often severe) stress exposure
- Potentially damaging
- Buffeted by supportive adult relationships
Classifying Stress

Toxic Stress

- Strong, frequent, prolonged exposure
- No (or inadequate) adult buffering & support
Prolonged Toxic Stress: Can Lead to Ill Health

• Via interaction between multiple components:
  – Behavioral
  – Cognitive
  – Physiological
  – Neural
Coping Responses to Stress
The Two-edged Sword

• Coping responses influence both:

  – the *risk* for worsening and...
  – the *resilience* against ill health
Brain as both mediator & target of chronic toxic stress

- Brain determines what is threatening
- Brain regulates behavioral and physiological responses to stress
- Brain directs final outcomes of toxic stress:
  - Resilience (+/- intervention) → normal balance
  - Downward spiral to ill mental / physical health

McEwen 2010
Socio-economic challenges influence developmental toxic stress

- Early maltreatment
- Conflict in family relationships
- Stressful life events
- Adverse physical / social conditions

McEwen 2010
Chronic Developmental Toxic Stress Influences Neuroplasticity

- **Structure & function** of the brain are changed
  - Amygdala
  - Hippocampus
  - Prefrontal cortex

- Neuroplasticity in turn influences:
  - Emotional regulation / expression
  - Stress reactivity
  - Stress recovery
  - Coping
  - Premature aging?

McEwen 2010
Hippocampus & Amygdala
Prefrontal Cortex
Toxic Stress does not automatically equal permanent damage

• **Recovery** depends on:
  
  – Resilience
  
  – Preventive strategies / effective social policy
  
  – Intervention strategies:
    
    • Medication
    
    • Psychotherapies
    
    • Physiological therapies (OT, Music Therapy, Somatic Therapy)
    
    • Life-style factors (exercise, dietary changes, social supports)
Social policies = top-down interventions

- Public & private child welfare policies have direct impact on the brain
  - Resiliency
  - Neuroplasticity

McEwen 2010
Systems-change really does change the brain!
Get ready for Science class!!
Building the brain
From simple to complex:
Hierarchy of brain function

Neocortex
Limbic
Diencephalon
Brainstem

Abstract Thought
Concrete Thought
Executive Function
Attachment
Sexual Behavior
Emotion Generation
Motor Regulation
Motivation
Arousal
Sleep
BP / Heart Rate
Respiratory Drive
Body Temperature

All sensory input enters here

Perry 2006
Rebuilding the Brain

Neural systems can be changed / treated but some systems are easier to change.

Complexity

Neocortex

Limbic

Diencephalon

Brainstem

Plasticity & Ease of change
Driving Miss-Behavior
Vehicle-Brain Metaphor

- Accelerator
- Brakes
- Steering
Floorin’ it: 0 to 60 in 4.3 seconds!

Importance of the accelerator
Accelerator: key “contributors”

- **Generating** Brain Energy (“RPM” of the brain)
- Risk-taking behavior
- Anxiety / Panic
- Anger / Explosiveness
- Mania / Hypomania
Arousal Genesis / Regulation

Way too wound-up / “wild” (“Tigger - on crack”)

Too wound-up (Tigger)

Optimal “Goldilocks” Arousal

Bored / Low energy / Tired & sleepy (Ee-yore)

Total shut-down (via parasympathetics) “Ee-yore on Quaaludes”
Optimal arousal necessary to best regulate / manage / experience emotions

(Novel methods of arousal monitoring in the lab)
Affect Tolerance: 
Expanding the comfort zone

Ogden 2009
The Anxious World of Piglet

Fight-Flight-Freeze is in the breeze

“It’s not easy being brave when you’re only a Very Small Animal”
The Confusing Picture of Anxiety

Fight-Flight-Freeze

- Anxiety / Panic as source for reactive anger ➔ aggression
- Anxiety – Attention – Language interplay in kids with aggression
Anger / Explosiveness:
Critical Link to Reactive Aggression

- Many faces of anger
- Anger as coping skill
- (“Just anger” as clinical progress!)
- Aggression = Anger \textit{plus} “bad” brakes
The Prefrontal Cortex:
The home of Executive Function

Executive Function:
The "brakes" of the brain

- Working memory / memory recall
- Focusing (locking, shifting & sustaining)
- Planning / organizing
- Self-monitoring of behavior/action
  - Impulse control
- Regulation

\[ 
\text{Executive Function:}\quad \text{The "brakes" of the brain} \\
\text{- Working memory / memory recall} \\
\text{- Focusing (locking, shifting & sustaining)} \\
\text{- Planning / organizing} \\
\text{- Self-monitoring of behavior/action} \\
\text{  - Impulse control} \\
\text{- Regulation} \]
Executive Function:
Promotes / enhances regulation of:

- Attention / Arousal
- Behavior / Action
- Mood / Emotion
The Delicate Balance of Regulation: Final brain control of emotion / behavior

Top-Down "Brakes" (Prefrontal Cortex)

Bottom-Up "Accelerator" (Brainstem/Limbic System)
Don’t Forget About the Steering

• Conscious control of behavior
• Importance of **tight, predictable structure** for optimal behavior management
• Willfulness misconceptions
  – It’s not *all* willful!
  – Fading control at the “edge of the cliff”
    • Behavioral “curve balls” in homes, schools, detention...
Final Thoughts re Regulation: Power Steering vs Manual Steering

- **Regulated** steering = *power* steering!
  - Easier to make appropriate motor / behavioral decisions while regulated

- **Dysregulated** steering = *manual* steering
  - Tougher to keep the behavioral “car” on the road
Regulatory “Secret”
The Good Life in the “Comfort Zone”

**Optimal** Regulation =

**Optimal** Learning, Behavior, Attention, Memory
Neurobiology of Development

• Brain "sculpts" itself in response to the environment **AT THE SAME TIME** it is developing (via genetic blueprints)
Experience alters brain structure

• These sculpted *structural changes* allow the child’s brain to become the *best brain* for the given surroundings
  – Implications for traumatic stress
  – Implications for foster care placements
Streams of Development: Importance of Connectedness

- Moral
- Social
- Cognitive
- Emotional
Social Communication in traumatized / FASD children
Social Communication: Basic Structure

Social Cognition

Executive Function

Language Function
Social Communication: Trauma / FASD Impacts each area!

Executive Function

Social Cognition

Language Function
When development *veers* off course...
The Brain-Behavior connection: 3 major & intertwined components

- **Genetics / Epigenetics** – What you inherit from both parents

- **Intrauterine environment** – During pregnancy

- **Extrauterine environment** – After pregnancy
The Brain-Behavior Connection: Complexities & Realities

- Genetics / Epigenetics
  - Neurodevelopmental strengths / weaknesses
  - Temperament / Personality
  - Family history of:
    - Attentional disorders
    - Learning disorders (e.g., Dyslexia)
    - Mood disorders (Depression / Bipolar)
    - Anxiety Disorders
    - Neuropsychiatric disorders (Tourette Disorder)
Behavioral Epigenetics: The future is now!

- Epigenetics: chemical alterations to DNA after conception
- May well be the ultimate link between nature & nature
- Some evidence that (on occasion) these alterations may be passed on to the next generation
- Remains (somewhat) controversial
The Brain-Behavior Connection: Complexities & Realities

- **Intrauterine environment**
  - Exposure to drugs (legal / illegal)
  - Exposure to alcohol
  - Maternal stress
  - Maternal nutrition
The Brain-Behavior Connection: Complexities & Realities

• Intrauterine Drug Exposure:
  – The “Myth” of Meth (& crack / cocaine)
  – “Mixing and matching” while pregnant
  – Multiple drug use in pregnancy overwhelms even ultra-fast research computers!
  – Nicotine use increases ADHD risk 4-fold
  – Cannabis use remains a mystery
  – The need for animal models to clarify
  – Slowly accumulating data base of Rx drugs and their effects on fetal development
Influence of Prenatal Alcohol Exposure
FAS: not the whole story
Fetal Alcohol Spectrum Disorders (FASD)

- Fetal Alcohol Syndrome
- Partial FAS
- Alcohol-related Neurodevelopmental Disorder (ARND) ("mild-moderate" FAS)
- Prenatal Exposure to Alcohol (clinically suspected to have FAS but appear physically normal)

Adapted from Streissguth
Human fetus:
7 weeks of gestation
Fetal Alcohol Spectrum Disorder: Affects Multiple Body Systems

- Growth problems (including failure to thrive)
- Brain / CNS damage
- Cardiac defects
- Skeletal abnormalities
- Cranio-facial anomalies
- Kidney and other internal organs
- Respiratory problems
- Hearing / Vision problems
Fetal Alcohol Spectrum Disorder

- “Mild – Moderate” FASD is still very problematic
- It is all about *when* the drinking occurred (during the pregnancy) and *how much* alcohol was consumed
- Maternal blood alcohol level = fetal blood alcohol
- “Swiss cheese brain” issues
- Confusion over why *all* fetal ETOH exposure is not created equal
Recognition / Screening /Assessment of FASD
FASD: Critical Facial Abnormalities

- Palpebral fissure (small eyes)
- Thin upper lip
- Smooth philtrum
Fetal Alcohol Syndrome: It doesn’t always look like this
...It can look like this!...clinical examples of FAS: transcending race
Lip-philtrum guides

Hoyme, H. E. et al. Pediatrics
2005;115:39-47

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Measurement of palpebral fissures

Measuring palpebral fissure length
FASD: Impact on Brain Structure
Severe brain damage caused by prenatal alcohol exposure

Severe FAS

5-day old infants

Normal Brain

photo: Clarren, 1986
Corpus Callosum

• 100 million neurons!!!
• Connects the two brain hemispheres
• Allows the left side to communicate with the right side
• Assists the individual child to calm down during / after “meltdown”
• Is often damaged by prenatal alcohol exposure / traumatic stress
Corpus Callosum
Gross structural abnormalities in FAS
(12 year old male subjects)
Star Trek Medicine: Diffusion Tensor Imaging

Inter-hemispheric Fiber Tractography through Corpus Callosum

Fractional anisotropy maps

FASD

Control

Anatomical images
FASD Secondary Disabilities: Recent research findings

- A recent L/T study of individuals with FASD:
  - Mean age: 14 yrs (range 6-51 yrs)
  - N = 415
  - Mean IQ = 86 (Range 29-126)
  - 80% of the sample *not* raised by biological parents
  - 60% had trouble with the law
  - 50% were in confinement
  - 49% had repeated inappropriate sexual behavior
  - 35% had drug / alcohol problems
  - Early diagnosis 2-4 times more likely to prevent or lessen impact of these secondary disabilities

Streissguth 2004
Harsh Reality: Combined Brain Impact of FASD + Traumatic Stress

- CTAC Assessment Data: 37% of sample had trauma + FASD (Henry, et al 2007)
- Essential to factor-in *both* of these issues when dealing with at-risk children
- So...
Prenatal Stress

Video Clip: “Killer Stress”
The Brain-Behavior Connection: Complexities & Realities

- Chronic and Severe Prenatal Stress:
  - Growing appreciation of negative impact on fetus
  - What level of stress is damaging?
  - Some placental stress buffering is protective
  - By 12 weeks of gestation, the limbic system is susceptible to chronic stress (via cortisol)
  - Prenatal stress can lower birth weight
  - Prenatal can impact adult health (think ACE)
  - Solid early life parenting / attachment can be protective (and even reverse deleterious effects)
Prenatal Nutrition

- Fetus is not the “perfect parasite”
- Dutch WW II prenatal stress study:
  - Fetal Programming: Preparing the baby for the life outside the womb
- Overlap with prenatal alcohol exposure
The Brain-Behavior Connection: Complexities & Realities

- **Extrauterine environment**
  - Parental attachment / nurturing
  - Parental style / psychopathology
  - Nutritional status
  - Exposure to violence, natural disasters
  - Exposure to neglect
  - Exposure to abuse (verbal / emotional / physical / sexual)
Building the Brain: Using Mirrors

- **Mirror Neurons** “smart cells” that explain how we connect and relate to each other
The Brain-Behavior Connection: Complexities & Realities

• The 2-way street of attachment
  – Traumatized / FASD infants may have mirror neuron damage
    • Similar pattern may be seen in some ASD infants
  – Optimal attachment depends on both parent and infant having intact “mirror equipment”
  – Neurotypical parents adopting infants at birth can experience vague sense of unease & ineptness due to infant’s brain damage (similar to ASD)
  – “Double (attachment) whammy” of FASD & trauma
The Science of Attachment

- *Parenting From the Inside Out* by Daniel Siegel, MD
- *The Developing Brain* by Dan Siegel, MD
- *Mirroring People* by Marco Iacobani, MD
Child Traumatic Stress & the Developing Brain
“Trauma Trumps Everything!!!”

Sandra Bloom, MD
Research reveals a strong link between all types of child abuse / neglect and the subsequent development of psychiatric illness in adulthood.

New findings link child traumatic stress with variety of adult medical illness.
Traumatic Stress & the Child’s Developing Brain

- Early childhood traumatic stress to the developing brain results in:
  - **Physical neuroplastic brain changes that**
    - Cause abnormal functioning (including memory)
    - Contribute to problematic behaviors
    - Contribute to developmental delays
    - Result in child being unable to **realize potential**
So... what about neglect???
But...this case only involves neglect!
Neglect: The **Worst** Offender
Developmental Impact of Neglect

- Physical growth delays ("failure to thrive")
- Language delays
- Cognitive / learning delays
- Regulatory (arousal / emotional / behavioral) issues
- Social communication problems
- Attachment dysfunction
- Immune dysfunction

De Bellis 2005
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Psychopharmacologic Treatment in Children / Adolescents
Changing Landscape of Psychotropic Medication

- Since 2000, many new medications have been introduced
- It is difficult for primary care physicians to keep pace with new meds
- Especially tough for JJ/MH professionals to get *useful* information on medication
- New choices = new treatment opportunities
- These are exciting times!!
Psychopharmacologic Treatment

• Psychopharmacology as part of multi-modal Tx

• Critical questions:
  – **When** to do meds!
  – **Which med** to do first?

• Adequate follow-up essential (the details matter!)

• For optimal medication treatment:
  – Need effective **collaboration / communication**
    • With parents / teachers / MH professionals / other supervisory adults (tutors / coaches / case managers / direct care staff/ OT’s / SLP’s)
Psychopharmacologic Treatment

• **Important points in using medications:**
  - Target Symptoms vs DSM-IV Diagnoses
  - “Deconstructing the DSM”
  - *Brain-based* meds (stay tuned!)
  - Impairment of function requirement:
    • **Starting** medications
    • Changing medication **doses**
    • Changing **type** of medication
Psychopharmacologic Treatment

Important points in using medications:

– Emphasize that the **GOAL** of med Tx is to **restore normal (as possible) brain function**

– Remember the **"COMFORT ZONE"**

– Optimal med Tx **allows** other treatment modalities (CBT, OT, DBT) to be more effective

– Impact of substance use / abuse
Remember, its all about...

Leveling the playing field !!!!
Specifics of optimized brain-based medication treatment
It’s baaaack!
Meds via vehicle-brain metaphor

• Accelerator
• Brakes
• Steering
Optimized Brain-based Medication Treatment

• **Major target area:**

  **Brakes:**
  – Focus / concentration
  – Arousal dysregulation
  – Executive dysfunction
    • Working memory
    • Impulse control
    • Hyperactivity
  – Mood dysregulation

• **Major target area:**

  **Accelerator:**
  – Sleep / arousal
  – Limbic irritability
    • Anger / explosiveness
    • Mood lability
  – Callosal dysfunction
  – Anxiety / OCD
  – Panic / Fight-Flight
  – Depression
Psychotropic Medication
Proposed Algorithm (Sloane 2011)

Key Clinical Questions:

1) Sleep Issues?  Y or N
2) Severe Mood Issues?  Y or N
3) Executive Dysfunction:
   - Impulse Control Issues?  Y or N
   - Regulation Issues?  Y or N

Revisit regulation until stable →→
Psychotropic Medication
Proposed Algorithm

• **If regulation is solid:**

5) Low motivation / low arousal?  Y or N
6) ↓ focus / attention?         Y or N
7) Depression? / Anxiety?      Y or N
Psychotropic Medication
Proposed Algorithm

• Are medications now optimized? Y or N
• Is the playing field now level? Y or N

• If not, use other physiologic treatments:
  – Sensory-focused occupational therapy
  – Exercise / Complex Movement (Yoga, Tai Chi)
  – Optimized nutrition
  – Expressive Therapies (Music, Art, Dance)
A level playing field allows other treatment modalities to be more effective

- Psychotherapy
- Case management
- Wraparound protocols
- Behavioral management
- Social skills training
- Parent training
- MST
- Tutoring
Remember...
Medication is the *beginning* of the journey (not the end)
Questions???