

Brain Development and Trauma: The Basics

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Trauma and the Brain

- Trauma shapes not only how we interact in the world, but also how we physically and developmentally grow
- You are your Brain!!



Trauma and the Brain

Paradigm shift

- Many behaviors that are seen could be a symptom or reaction to a traumatic experience
- A more accurate way to view the child may be to fully determine a child's trauma history and to understand the impact that trauma has had on the child's development

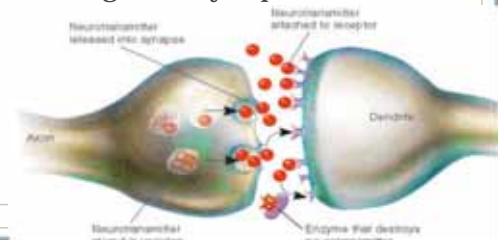
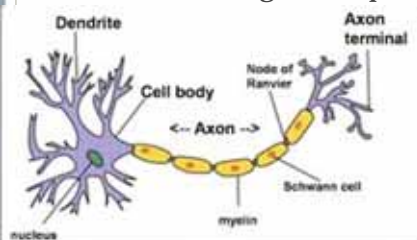


Brain Development



Brain Anatomy 101

- At birth, the structure of the brain is present, but its development is far from complete
- The brain is developed from the inside out – starting with brain-stem
- It is composed of neurons & synapses
- Learning and repeated experience creates and strengthens synapses

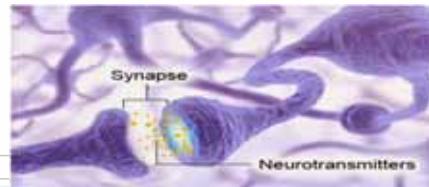


Neurons & Synapses

- Each neuron receives electrical inputs from about 1000 other neurons
- Synapses connects neurons to each other
- Synaptic connection is how we learn
- By 8 months of age, the brain may have 1000 trillion synapses
- The density of synapses reaches its peak at about age 3
- By age 16, the number of synapses has dropped to adult levels, through a natural process called *pruning : as do not use loose, until levels out*

Neurotransmitters

- Neurotransmitters are the chemical messengers that help our bodies think, feel, and move
- Neurotransmitters include:
 - Serotonin
 - Dopamine
- The levels of key neurotransmitters in many children who have experienced stress or trauma are often too high, too low, and/or out of balance



Neurons and Genes

- Neurons are comprised of genes
- There are between 30,000 to 50,000 genes in the human body
- One-third to one-half of these genes affect the development of the nervous system
- At least half of these genes depend on [environmental stimulation](#) to be activated, known as [gene activation](#)



Gene Activation

Experiences in childhood influence brain growth

- Through a process called gene transcription, neurons are activated, which allows for growth and development of the brain

➡ Positive experiences can activate genes, and create new proteins that can strengthen healthy neural connections, and promote learning

➡ Adverse/Negative experiences can inhibit gene activation, and induce a cascade of chemical and hormonal changes that delay the development and integration of the brain

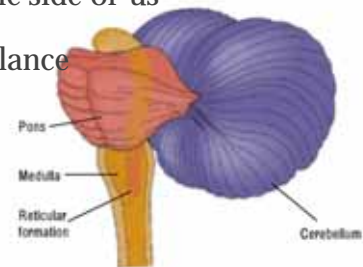
The Triune Brain

- Brain Stem – home of the fight/flight/freeze
- Limbic System – Emotions
- Cerebral Cortex – Thinking



The Brainstem

- Receives and gives messages to the body
- Is responsible regulating the heart and lungs
- Is closely connected to your instincts and drives
- The reptile part of our brain – controls the animalistic side of us
- The basic housekeeper – responsible for chemical balance
- Is highly responsive to threat throughout life-span

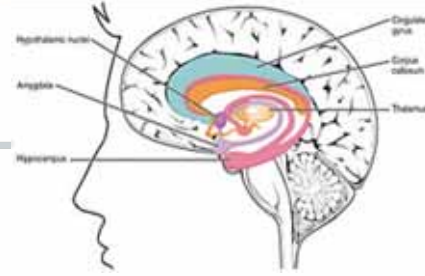


The Brainstem

- The Brainstem Controls:
 - Hearing
 - Eye/body movements
 - Voluntary motor function
 - Motor control
 - Sensory analysis
 - Levels of consciousness
 - Vital body functions, such as breathing and heart rate
 - The home of the Freeze, Fight, or Flight response (trauma causes easily triggered)
- **80% of kids from hard places have sensory processing issues.**
Only responding, just reacting, not thinking – so talking at them doesn't work – must be sensory



The Limbic System



- The emotional and Mammalian part
- Formed after birth
- Is in charge of our evaluative functions; it assigns meaning to what our body is perceiving
- Works closely with the brainstem, creating our emotions and drives the physical responses to the them
- Vital in creating memories
- Learn emotions thru attachments – when not attaching, not learning emotions (empathy too)

Emotional Brain

- **The Reptile Brain (Brain Stem & Hypothalamus) + Limbic System**
= **EMOTIONAL BRAIN**
- Emotional Brain is at the heart of Central Nervous System
- Key task is to look out for our welfare – detects danger or special opportunity
- Releases hormones that result in visceral sensations (from mild queasiness to panic)
- These sensations are influence small and large decisions we make: what to eat, music we like, who we are attracted too etc.

The Cerebral Cortex

- Is responsible for our thinking that is abstract, symbolic, moral, & insightful

- Lobes are located here:

- **Frontal** – Forethought; Judgement
- **Parietal** – Sensory processing
- **Occipital** – Vision
- **Temporal** – memory, mood stabilization, reading faces & social cues, spirituality



The Prefrontal Cortex

This front-most part of the brain which is just behind the eyes, has been associated in cognitive neuroscience studies with processes like:

- Regulating the body and emotions
- Attuning to other people
- Being flexible
- Having empathy & self-awareness
- Being in touch with your intuition & morality
- Losing your fears



Kids from hard places have difficulty accessing prefrontal cortex

Frontal Lobe: Executive Functioning

- The frontal lobe is responsible for much of the executive functioning of the brain
- Functions include:
 - Attention
 - Working memory
 - Planning, organizing
 - Forethought
 - Impulse control

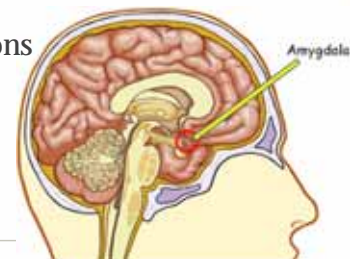


Identifying Danger: High vs. Low Road

- **Inside the Limbic System**, the Thalamus takes in sensory information and integrates with our perceptions
- This information is then passed down:
 - **High Road** – goes straight to Prefrontal Cortex (watchtower) – offering a view from on high
 - Trauma prevents us from accessing our Prefrontal Cortex
 - **Low Road** – activates the amygdala (smoke detector) which triggers the release of cortisol and adrenaline – Fight/Flight/Freeze
 - Low Road much faster

Amygdala

- Fear Receptor
- Begins to develop in utero and is fully functioning at six months gestation
- Triggers an unconscious fight/flight/freeze mechanism in response to real or perceived threat (triggered by the brain stem)
- Important in the processing and regulation of emotions
- Home of implicit memories (unconscious)
- Takes in information through the 5 senses



Hippocampus

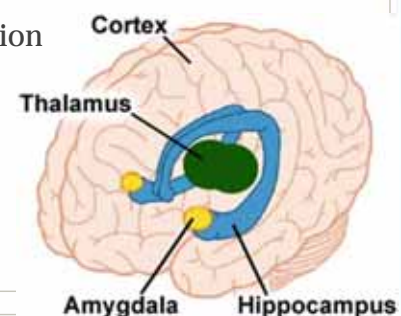
- When the amygdala is triggered, it “calls out” and activates the hippocampus
- The hippocampus releases cortisol to calm and regulate the brain
- Home of Explicit memories (conscious recollection)
- Fully developed by age 3
- Home of short term memory and rational decision making (cause-and-effect thinking)
- From age 6 month to 3 years – calming occurs externally until hippocampus develops

TRAUMA → ALARM → NEURONS

- Trauma, or adverse childhood experiences, is perceived and activates the brain's **alarm system** – **The Low Road**
- The alarm (Amygdala) communicates through chemicals and initiates a wave of neurotransmitters including adrenalin and the hormone cortisol (Hippocampus)
- The brain organizes and changes to reflect this pattern

A “Hijacked” Brain

- When the amygdala stays activated (repeated stimulus or no external regulation), the hippocampus continues to release cortisol to try to calm the brain down
- The brain becomes “**hijacked**” or flooded with cortisol
- The limbic system loses its ability to regulate emotion



Hijacked Brain – Prefrontal Cortex

REMEMBER:

- Prefrontal cortex is involved in cognitive processing of decision making
- Prefrontal cortex is where regulation and attachment solidify
- When the brain is flooded with cortisol, it pools on the frontal cortex
- When the prefrontal cortex is flooded, it inhibits regulation, the ability to attach, and cause & effect thinking
- This pooling inhibits the frontal cortex from fully developing



In Other Words:

- Amygdala says “I’m afraid, I need help” and reaches out to the Hippocampus - which releases Cortisol -- a little cortisol is calming - too much has reactive affect -- too much cortisol stores in Frontal Lobe so can’t regulate fears
- When this happens, need to increase serotonin and decrease cortisol
 - Deep Breathing for 3 minutes
 - Fun and Calming environment reduces Cortisol levels by 50% within 7-14 days



Cortisol Pooling

- Leads to changes in:
 - Attention
 - Impulse control
 - Sleep
 - Fine motor control
 - Dysregulation in many functions



Dan Seigle – Hand Model of Brain

- <https://www.youtube.com/watch?v=gm9CIJ74Oxw>

Neurochemical Systems

- Due to these neurochemical changes (caused by cortisol pooling), a traumatized child may exhibit:
 - Motor hyperactivity
 - Anxiety
 - Behavioral impulsivity
 - Sleep problems
 - Tachycardia
 - Hypertension

- Preliminary studies are showing altered cardiovascular regulation (increased resting heart rate) suggesting altered autonomic regulation at the level of the brainstem



So.....

The Brain becomes:

- Sensitized
- Over-reactive
- Dysfunctional



Pattern creates a persisting fear state and the state becomes a characteristic of that brain

In other words, **every behavior is motivated out of fear**

Fear Changes the Way We Think

- In a state of fear, we use the lower, more primitive parts of our brain (brainstem: fight, flight, freeze)
- As the perceived threat level goes up, the less thoughtful and the more reactive our responses become
- Actions and behaviors in this state are governed by emotional and reactive thinking styles



Biological Based Fear Responses

- | | |
|--------------------|---|
| • Manipulation | Food issues: Gorging; Starving; Purging |
| • Lying | Enuresis |
| • Stealing | Encopresis (soiling self) |
| • Hoarding | |
| • Aggression | |
| • Defiance | |
| • Poor eye contact | |
| • Self-harm | |
| • Sleep issues | |

Kindling

- Complex (or Chronic) trauma can impair the stress response even more than a single event due, in part, to a mechanism known as [kindling](#)
 - Fire analogy - smoldering until breeze hits and blows up
- Amygdala is over-reacting when experience trauma
- Amygdala becomes so reactive that it no longer takes a great deal of stimulation to set it off



Lizard to Lizard Thinking

- Dysregulated parent/adult and dysregulated child are both trying to problem solve while operating from their brainstems!



- The person with the most power needs to pull out of their lizard state and calm self down before calming child

“Removed” Video Part 1

- <https://www.youtube.com/watch?v=lOeQUwdAjE0>

There is Hope!

- Plasticity
- The brain is very “plastic” - meaning its capable of changing in responses to experiences, especially repetitive and patterned experiences
- The brain is most plastic during early childhood, while it has the capacity for change throughout the life span
- Aggressive early identification and intervention is key
- Can learn to calm the brain - deep breathing, yoga, sensory exercises



Lowering Cortisol Levels

- Cortisol levels decrease by 50% within 7-14 days; and can return to normal levels in 30 days!!

What helps decrease cortisol levels:

- physical activity
 - sensory input
 - predictability
 - a sense of control
- Must be repetitive, consistent, patterned, and frequent



Resilience

- Resilience is the process of adapting well in the face of adversity, trauma, tragedy, threats, or significant sources of stress
- Research shows that resilience is ordinary (God Given), not extraordinary
- Resilience involves thoughts, behaviors, and actions that can be learned and developed in anyone
- Look for resiliency!!!



Factors in Resilience

- The capacity to make realistic plans and take steps to carry them out
- A positive view of yourself and confidence in your strengths and abilities (seeing self as God does)
- Skills in communication and problem solving
- The capacity to manage strong feelings and impulses
- Recent studies suggest children resilience is less about their ability to overcome life challenges and **more about the child's informal and formal social networks, the child's environment**, to facilitate positive development under times of stress
- While personal motivation to adapt after trauma is still important, the environment that supports or denies access to what the child needs to adapt is equally if not more important

Trauma-Informed Care

- A perspective of resilience that takes into account the individuals environment helps to work against unnecessarily blaming a child for the affective or behavioral responses to his/her trauma
- Trauma Informed Care strives to recognize trauma, strengths, and trigger and customize treatment based on the unique experiences, culture, and context of the trauma survivor

One significant person can make a difference in a child's life!

Intervention

Quick ways to help a child relax

- Get down to their level physically, be kneeling or sitting
- Speak softly and gently in a warm voice
- Offer a stress ball or fidget toy that he can press and squeeze
- Offer a piece of gum - chewing is calming
- Offer a sweet sucking candy or lollipop - sucking is calming
- Offer to sit or stand farther away from her
- Encourage him to take deep, slow breaths -- smell the cookies, blow out the birthday candles

Rd-Do's -- [Let's try that again](#)

Keys to Trauma-Informed Care

- Safety
- Relationship
- Psychoeducation
- Parenting skills
- Emotional regulation –relaxation, yoga, progressive muscle relaxation, emotions jar
- Affect identification – body drawing, emotion color wheel feelings bingo
- Affect expression – clay, art work
- Coping skills – positive self-talk
- Exposure/exploration of the trauma – professional therapy
- Identification of future (hope, resiliency, strengths, positivity)



“Removed” Part 2

- <https://www.youtube.com/watch?v=I1fGmEa6WnY>

“Not all of us can do great things. But we can do small things with great love.”

— [Mother Teresa](#)

