The Neurobiology of Trauma (and Healing)
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Who do you identify with?

Chimp-Human Co-evolution Behavioral Legacies

Chimpanzees Use Tools
Brazilian Nukak Hunting Monkeys

Hunting & Killing Bush Babies

Chimpanzees are Territorial

Male chimps patrolling the perimeter of their territory

Homo Sapiens are Territorial

So many reasons to study the chimp
The Lesson

The human brain is a multi-layered map of millions of years of evolution

Our limbic structures are legacies of our mammalian & primate past

The Fear System

Sensory

Cortex

Critical Brain Structures in the Fear System

Pituitary

Amygdala

Hypothalamus

The Fear Pathway

Sensory

Adrenals

Pituitary

Amygdala

Hypothalamus

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What would you experience if these two guys suddenly walked in the door to this room?

The High Road to Fear

Sensory

Amygdala

Why we need the Low Road pathway
Problem: The sub-cortical sensory sponge effect

The Low Road Pathway

Problem: The sub-cortical sensory sponge effect

Sounds

Tastes

Touch

The Low Road Pathway

When we say “encoded” what do we mean?

Post-trauma, Amygdala-based Fear Network

Post-trauma, Amygdala-based Fear Network

A Case Study
Longevity of Fear Networks

Tonic Immobility & the Freeze Response: Understanding Victim Behavior

TI & Sexual Assault

- Humans: real or perceived entrapment
- Perception of entrapment shaped by prior experience (prior victimization)
- TI symptoms identified in more than 1/3 of adult rape victims
- TI symptoms identified in more than 1/2 of CSA victims
**Trauma and Neurodevelopment**

How Childhood Trauma Shapes the Brain’s Future Response to Stressful and Traumatic Experiences

Brain reacts to stress or trauma by triggering the release of adrenaline

Child Abuse & Response to Stress

Glucocorticoid receptors in the hippocampus reduced, leading to reduced capacity to return to baseline after stress

Effects of Chronic Trauma on the Developing Brain

- Chronic trauma shapes the developing brain
- Brain becomes hypersensitive and hyper-reactive to trauma cues

Effects of Chronic Trauma on the Developing Brain

Child's brain becomes hyper-sensitive to subtle facial indicators of threat.

Effects of Chronic Trauma on the Developing Brain

Child becomes prone to chronic hyper-arousal and hyper-vigilance.

Combined Effects of Chronic Trauma & Neglect

Frontal cortex: Source of impulse control & emotion regulation

Limbic area: Source of intense emotions and impulses

How Cortical Inhibition Develops

Childhood trauma generates extremely intense limbic activity that can lead to an over-perception of threat & aggressive impulses

Child neglect delays the development of cortically based networks that inhibit and channel intense emotions and impulses
Combined Effects of Chronic Trauma & Neglect

Frontal cortex: Weakened capacity for impulse control

Limbic area: Intensified emotions & impulses

The Cycle of Violence

Childhood abuse significantly increases the risk that the abused child will themselves go on to be abusive or violent.

From Victim to Victimizer

Abused

Learns to be tough

Hardened

The Cycle of Violence: 3 Generations (I)

Grandfather — Grandmother

Grandfather — Grandmother

Physical abuse

Physical abuse

Incest

Incest

Multiple rapes & homicides

Neurobiology of Healing
Neural Plasticity

The brain's capacity to re-organize neural circuitry in response to changes in the internal or external environment.

Neural Plasticity

Learning
Adaptation
Rehabilitation

Neural Plasticity and the Dalai Lama

Cortical Anatomy

“It happened when I was…”
The Neurobiology of Healing
Meditation is a form of mental training
Train focus on breath/image/idea
Clear consciousness of distracting “mind chatter”

Mindfulness Meditation and the Neurobiology of Healing

Brain imaging studies indicate common neural states across diverse traditions of meditation.
Does meditation change the brain?

Yes

2006 Psych Bull Review

Neurobiological Effects of Mediation Practice

- ERP studies suggest increased attention capacity and increased speed of processing
- Imaging studies show increased activation of frontal and prefrontal cortical areas


What human capacities are associated with increased activity in the Middle Prefrontal Cortex?

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