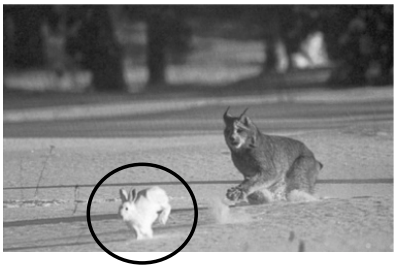
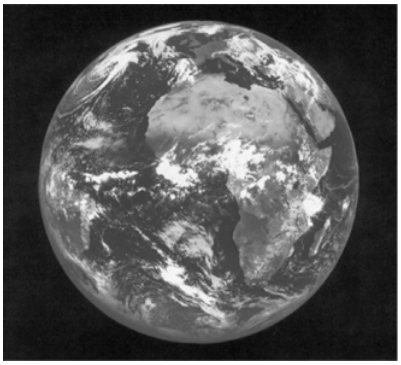
The Neurobiology of Trauma

(and Healing)

David Lisak, Ph.D.



WHO DO YOU IDENTIFY WITH?



Chimp-Human Co-evolution

Behavioral Legacies

Chimpanzees Use Tools


Using Flat Rocks to Crack Open Nuts


Using Twigs to Fish for Termites

Using Wadded Leaf Sponges to Soak Up Drinking Water

NOT Using Wadded Leaf Sponges to Soak Up Drinking Water

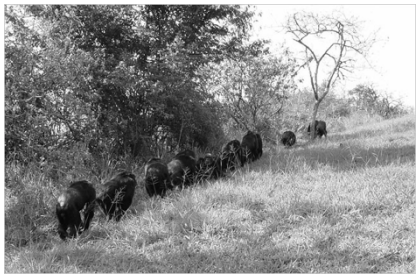
Chimpanzees Hunt for Meat

Hunting & Killing Colobus Monkeys

Brazilian Nukak Hunting Monkeys

Hunting & Killing Bush Babies

Chimpanzees are Territorial

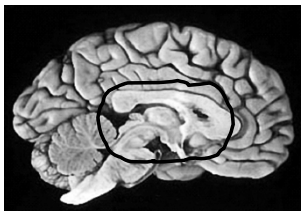


Male chimps patrolling the perimeter of their territory

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

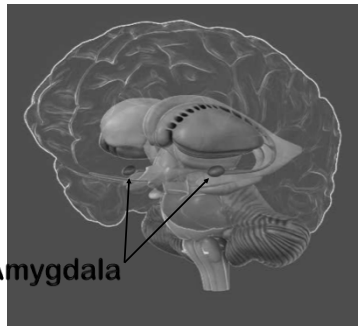
Our limbic structures are legacies of our mammalian & primate past

The Fear System

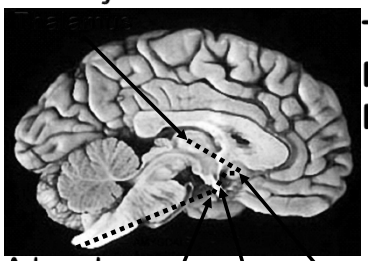
Sensory Cortex

Critical Brain Structures in the Fear System

Pituitary Amygdala Hypothalamus



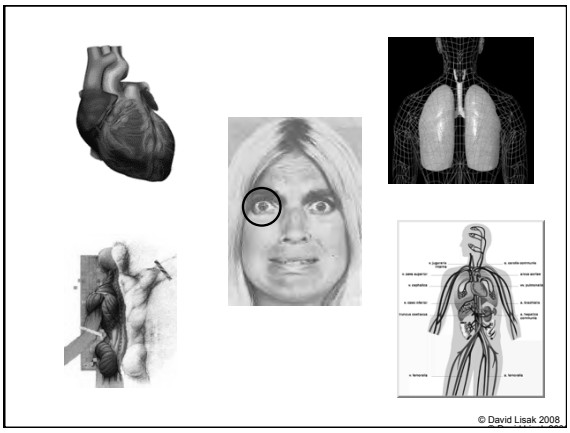
Sensory



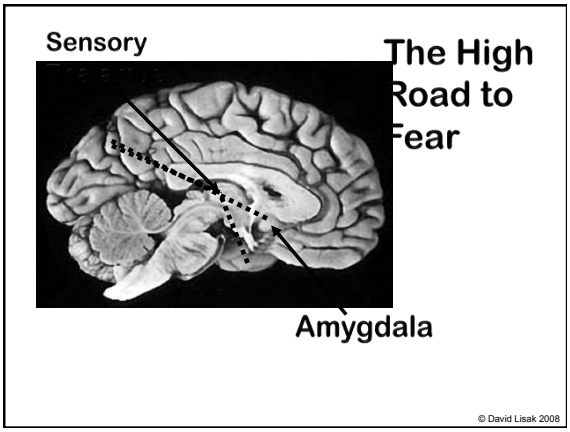
The Fear Pathway

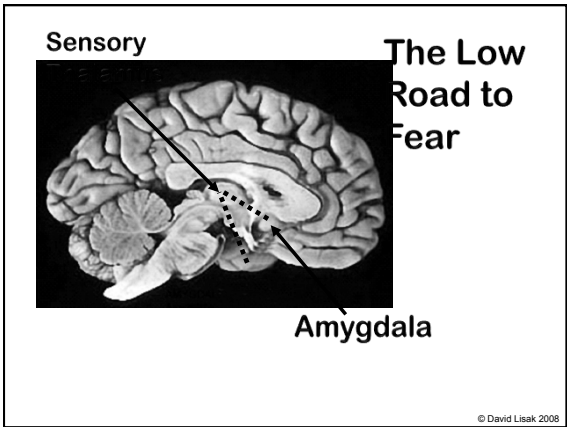
Adrenals Pituitary Amygdala Hypothalamus

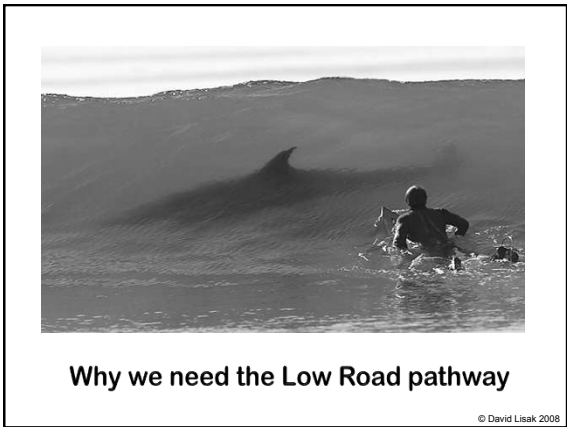

© David Lisak 2008


© David Lisak 2008


What would you experience if these two guys suddenly walked in the door to this room?
© David Lisak 2008


Sensory
The High Road to Fear
Amygdala
© David Lisak 2008


Sensory
The Low Road to Fear
Amygdala
© David Lisak 2008

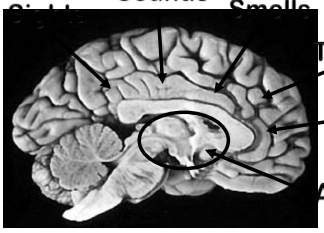

Why we need the Low Road pathway
© David Lisak 2008

Problem: The sub-cortical sensory sponge effect

Amygdala

The Low Road Pathway

Problem: The sub-cortical sensory sponge effect



Sounds

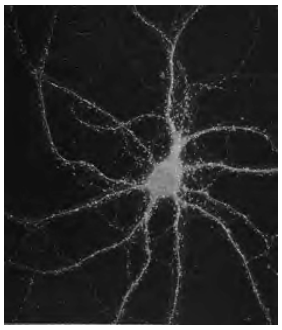
Tastes

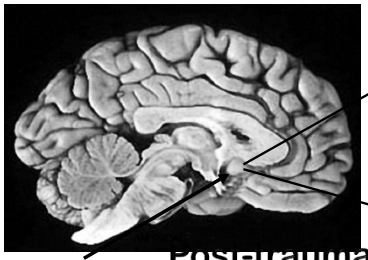
Touch

Amygdala

The Low Road Pathway

When we say "encoded" what do we mean?





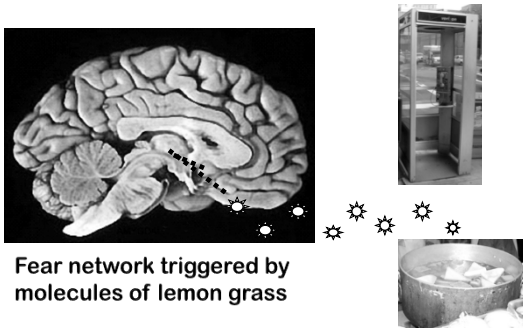
Amygdala

Post-trauma, Amygdala-based Fear Network

Post-trauma, Amygdala-based Fear Network

A Case Study

Longevity of Fear Networks

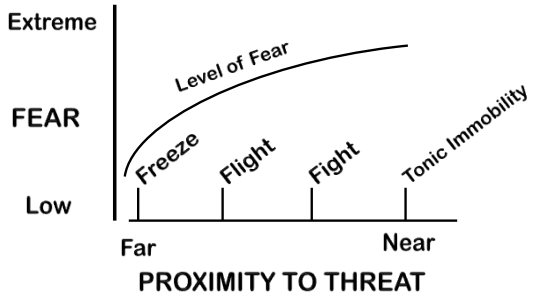


Fear network triggered by molecules of lemon grass

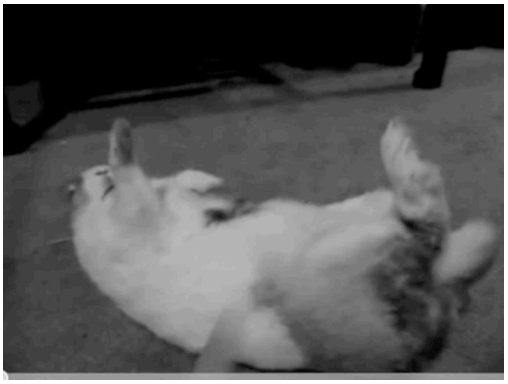
Anatomy of a 25-year Old Memory

Tonic Immobility & the Freeze Response:

Understanding Victim Behavior



Marx, B.P., Forsyth, J.P., Gallup, G.G., & Fuse, T. (2008). Tonic immobility as an evolved predator defense: Implications for sexual assault survivors. 74-90.



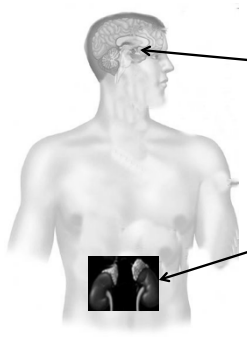
TI & Sexual Assault

- 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 ½ of CSA victims

Marx, B.P., Forsyth, J.P., Gallup, G.G., & Fuse, T. (2008). Tonic immobility as an evolved predator defense: Implications for sexual assault survivors. 74-90.

Trauma and Neurodevelopment

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

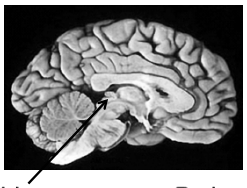


Brain reacts to stress or trauma

by

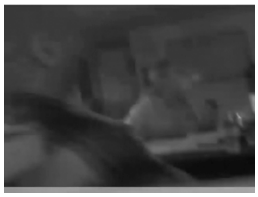
Triggering the release of adrenaline

Child Abuse & Response to Stress



Glucocorticoid receptors in the hippocampus reduced ⟹ Reduced capacity to return to baseline after stress

McGowan, P.O., Sasaki, A., D'Alessio, A.C., Dymov, S., Labonte, B., Szyf, M., Turecki, G., Meaney, M.J. (2009). Epigenetic Regulation of the Glucocorticoid Receptor in Human Brain Associates with Childhood Abuse. *Neuroscience*, *12*, 342-348.



Effects of Chronic Trauma on the Developing Brain

- Chronic trauma shapes the developing brain
- Brain becomes hyper-sensitive & hyper-reactive to trauma cues

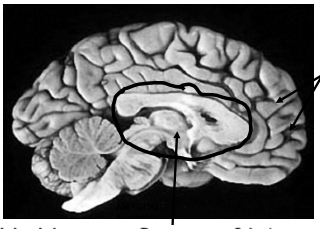
Effects of Chronic Trauma on the Developing Brain

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.

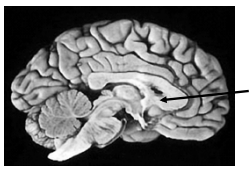
Combined Effects of Chronic Trauma & Neglect



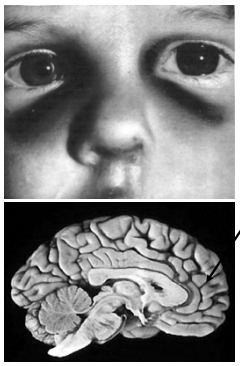
Frontal cortex: Source of impulse control & emotion regulation

Limbic area: Source of intense emotions and impulses

How Cortical Inhibition Develops

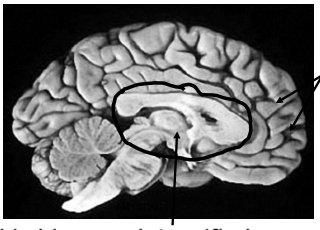


Childhood trauma generates extremely intense limbic activity that can lead to an over-perception of threat & aggressive impulses



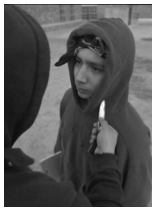
Child neglect delays the development of cortically based networks that inhibit and channel intense emotions and impulses

Combined Effects of Chronic Trauma & Neglect



Frontal cortex: Weakened capacity for impulse control

Limbic area: Intensified emotions & impulses



The Cycle of Violence

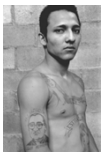
David Lisak, Ph.D.

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

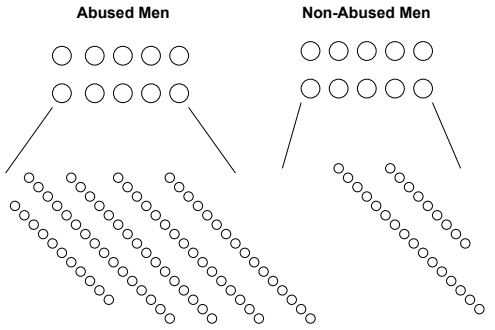
Hardened

The Cycle of Violence

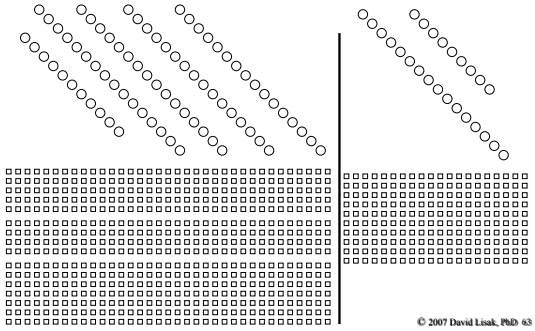
Why we need to be concerned…

The Inter-Generational Progression of the Cycle of Violence

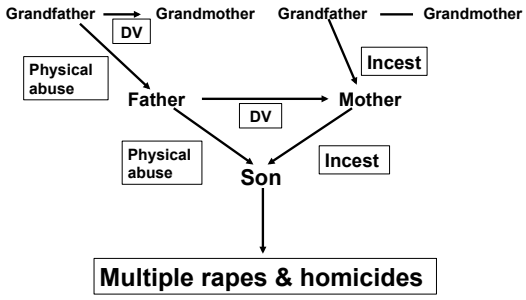
If each perpetrator has 25 victims…



The third "generation"…



The Cycle of Violence: 3 Generations (I)



The Cycle of Violence

The Questions

1. What is the evidence for the "cycle of violence"?
2. What are the intervening factors?
3. Why is it mainly men?

The Cycle of Violence: Evidence

Kaufman & Zigler, 1987

One third of abused children go on to abuse their own children.

The Cycle of Violence: Evidence

Weeks and Widom, 1998

More than 2/3's of male convicts had histories of childhood victimization.

The Cycle of Violence: Evidence

Lisak, Hopper & Song, 1996

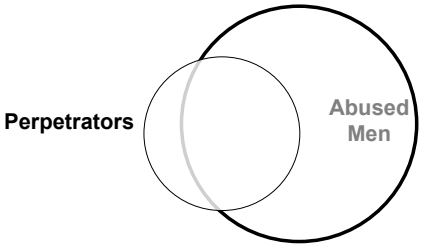
70% of "undetected" male perpetrators had histories of childhood abuse

The Cycle of Violence: Evidence

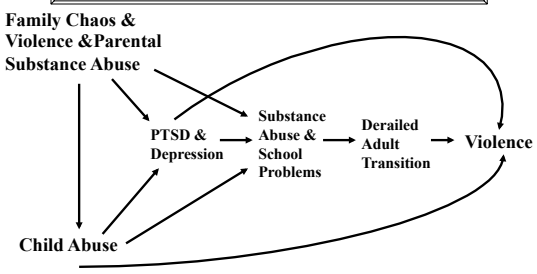
Dutton and Hart (1992)

41% of 604 male felons had suffered "severe childhood abuse."

The Relationship Between Abuse & Perpetration



Pathways to Violence



These relationships confirmed by scores of studies.

Can We Stop the Cycle?

Do we suffer from lack of know-how?

Or lack of will?

Can We Stop the Cycle?

Project STAR in Tennessee

- Randomly reduced class size in K – 3 ONLY
- As high schoolers, small class students:
  - had higher GPA's
  - higher graduation rates
  - lower drop-out rates
  - more likely to go to college

Can We Stop the Cycle?

- Axiom: Earlier the better!
- School issues: teacher #'s; teacher pay; specialists
- Social services: #'s; pay; training
- One caring adult can turn a life around

Neurobiology of Healing

Neural Plasticity

Neural Plasticity

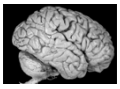
Learning

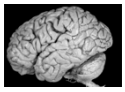
Adaptation

Rehabilitation

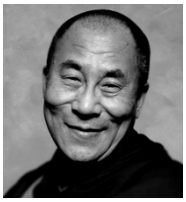
Neural Plasticity

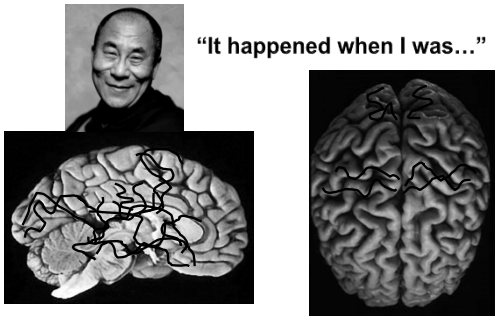
The brain's capacity to re-organize neural circuitry in response to changes in the internal or external environment.





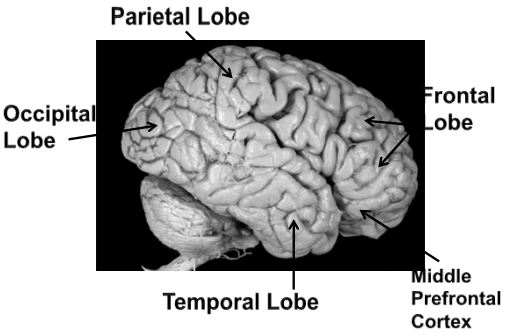
Neural Plasticity and the Dalai Lama





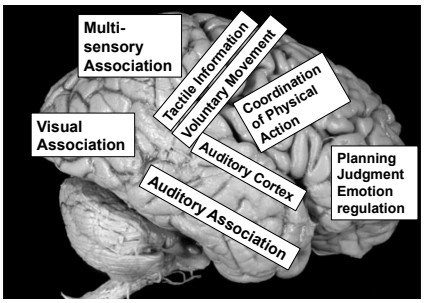
The Neurobiology of Healing

Cortical Anatomy



The Cortical Lobes

Sub-areas of the Middle Prefrontal Cortex



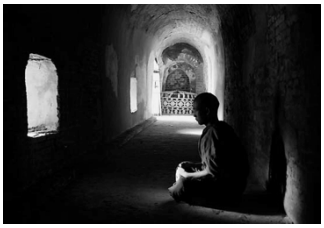
Functional Architecture of the Cortex

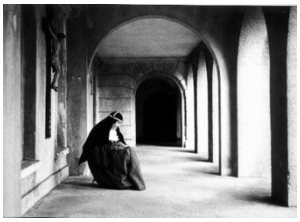
Mindfulness Meditation and the Neurobiology of Healing

Meditation is a form of mental training

Train focus on breath/image/idea

Clear consciousness of distracting "mind chatter"

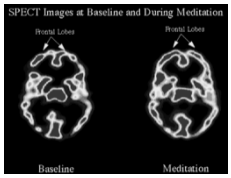




Brain imaging studies indicate common neural states across diverse traditions of meditation.

Does meditation change the brain?

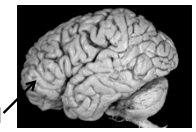
Yes



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**

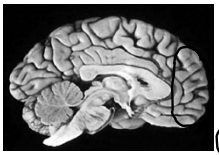


Cahn, B.R. & Polich, J. (2006). Meditation states and traits: EEG, ERP, and neuro-imaging studies. 180-211.

Meditation associated with increased thickness in the middle prefrontal cortex

Lazar, S.W., Kerr, C.E., Wasserman, R.H., Gray, J.R., Greve, D.N., Treadway, M.T. et al. (2005). Meditation experience is associated with increased cortical thickness. *Neuroreport, 16 (17)*, 1893-1897.

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



Bodily regulation
Attuned communication
Emotional balance
Response flexibility
Empathy
Self insight
Fear modulation
Intuition
Morality

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