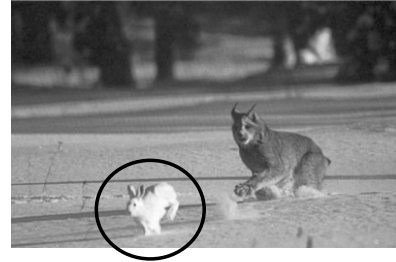


The Neurobiology of Trauma (and Healing)

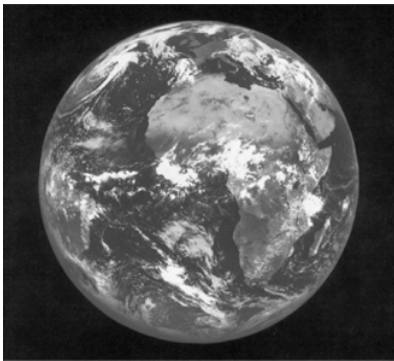
David Lisak, Ph.D.

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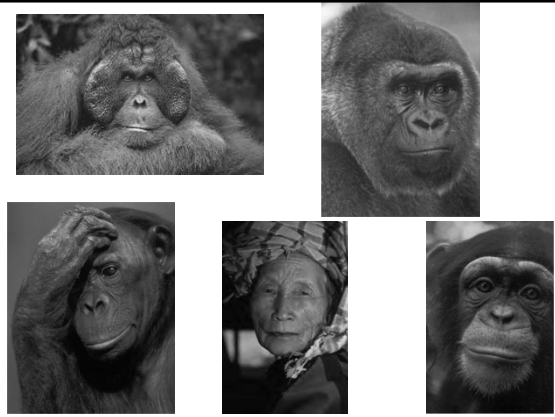


WHO DO YOU IDENTIFY WITH?

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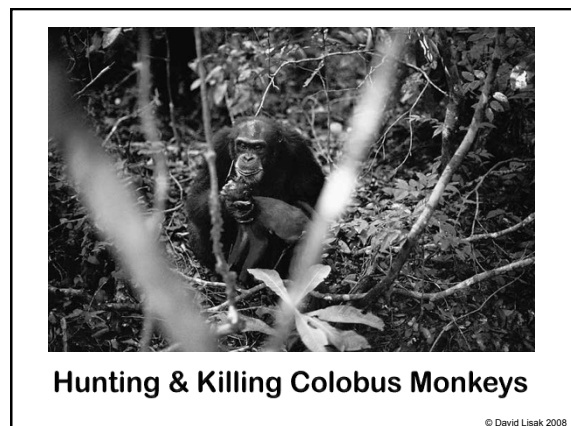
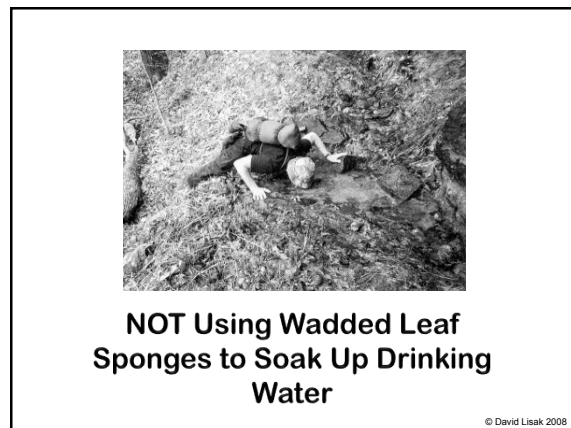
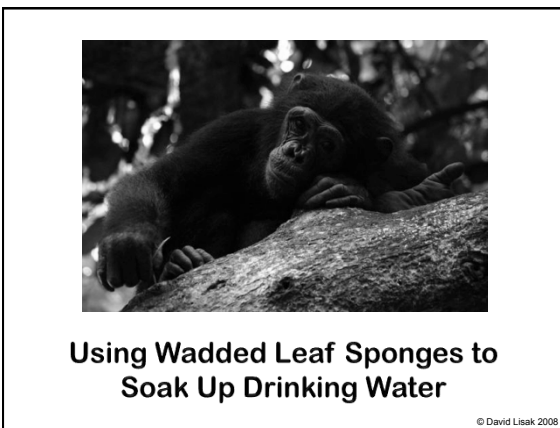
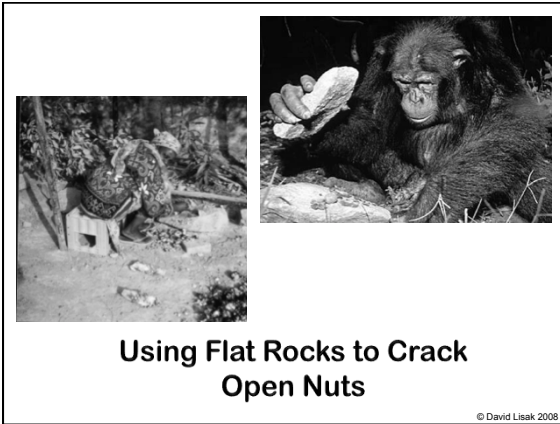
Chimp-Human Co-evolution Behavioral Legacies

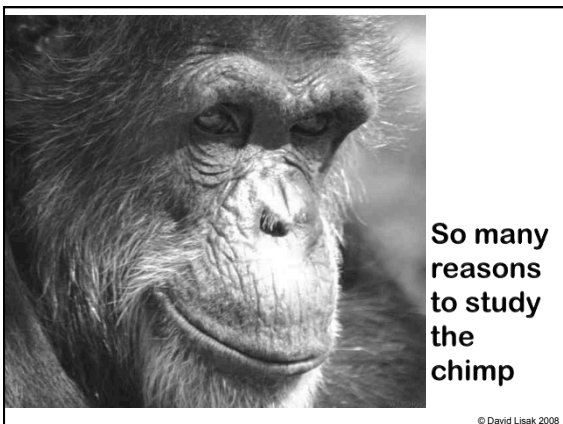
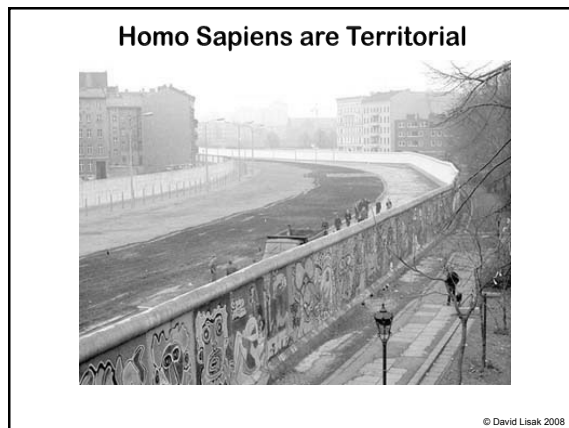
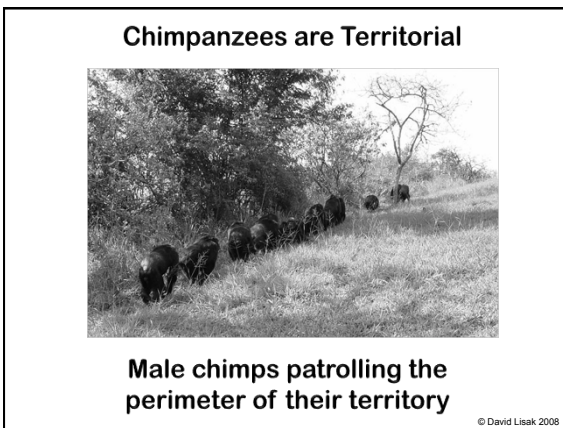
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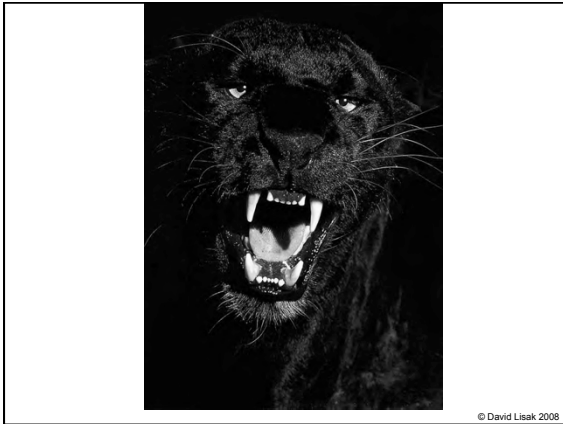


Chimpanzees Use Tools

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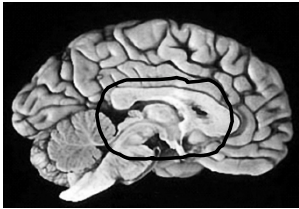






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The Lesson




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

Our limbic structures are legacies of our mammalian & primate past

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The Fear System

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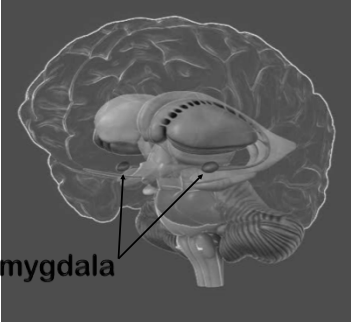


Sensory Cortex

Critical Brain Structures in the Fear System

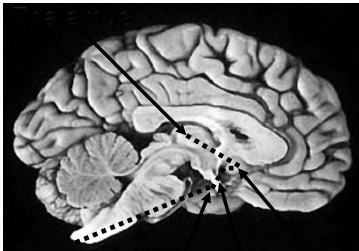
Pituitary Amygdala Hypothalamus

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Amygdala

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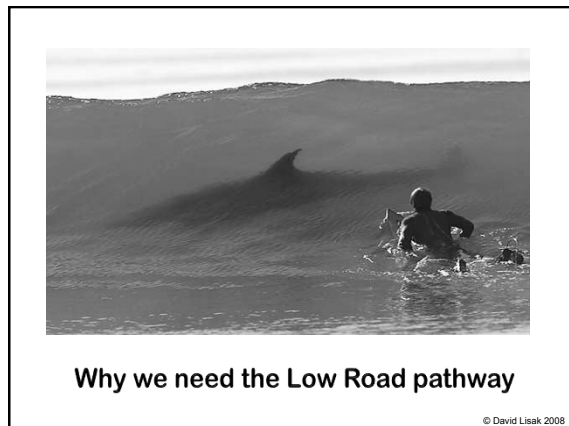
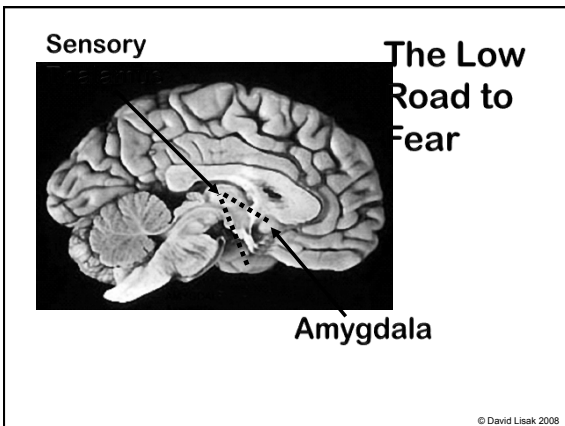
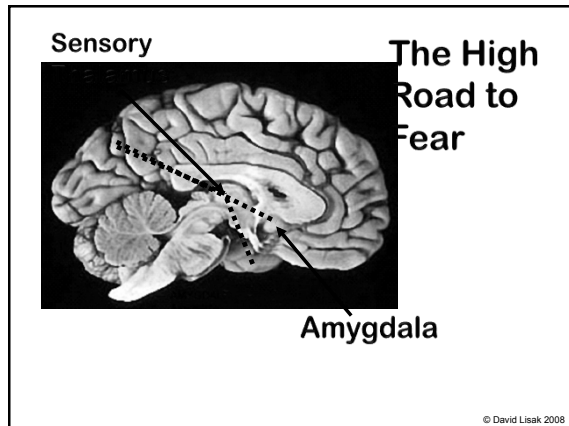
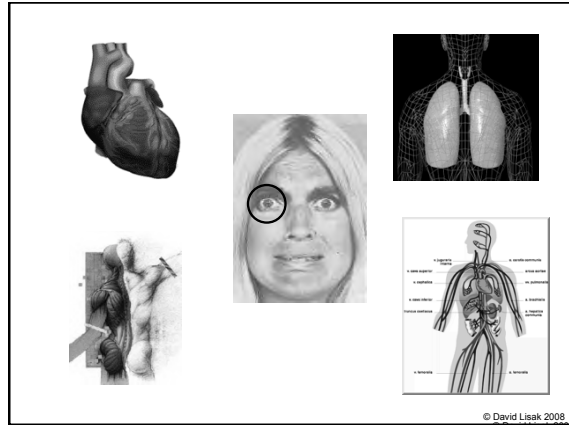


Sensory


The Fear Pathway

Adrenals Pituitary Amygdala Hypothalamus

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Problem: The sub-cortical sensory sponge effect




Amygdala

The Low Road Pathway

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Problem: The sub-cortical sensory sponge effect



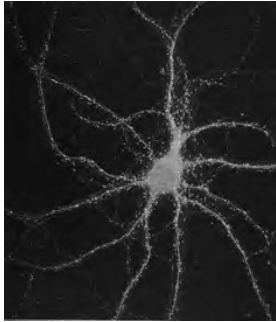
Sounds Smells
Tastes
Touch
Amygdala

The Low Road Pathway

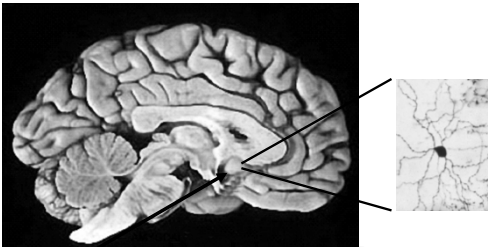
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When we say "encoded" what do we mean?



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Amygdala

Post-trauma, Amygdala-based Fear Network

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Post-trauma, Amygdala-based Fear Network



A Case Study

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Longevity of Fear Networks

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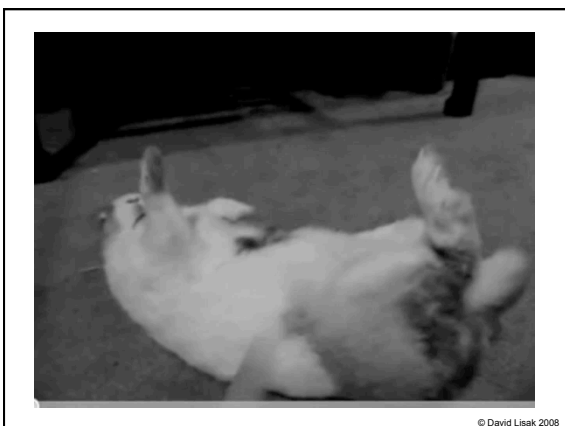
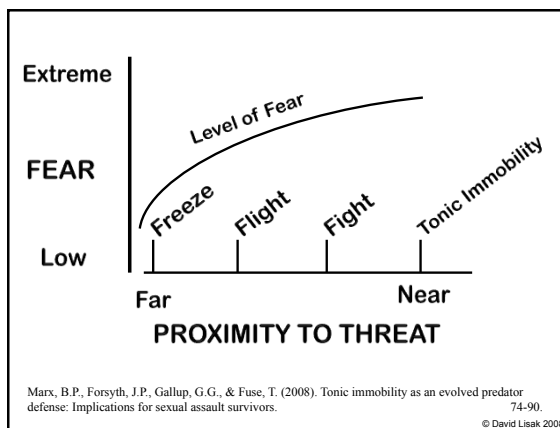
Fear network triggered by molecules of lemon grass

Anatomy of a 25-year Old Memory

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Tonic Immobility & the Freeze Response: Understanding Victim Behavior

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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


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.

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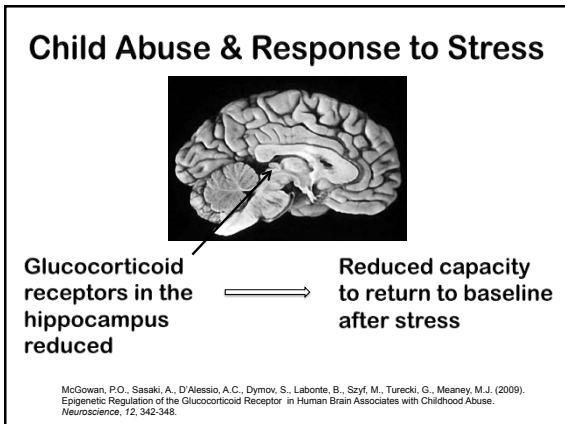
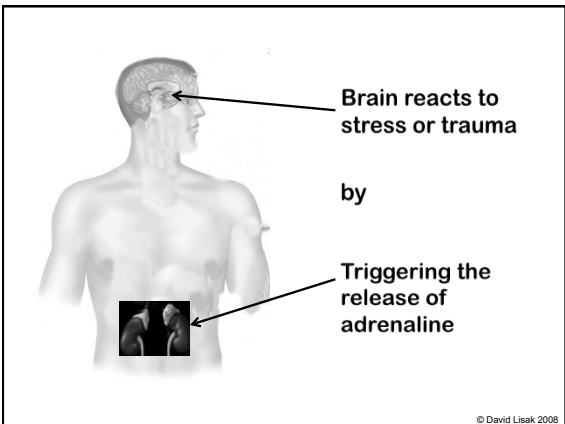
Trauma and Neurodevelopment

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



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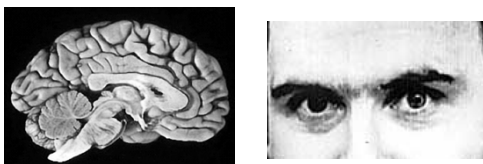
Effects of Chronic Trauma on the Developing Brain



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

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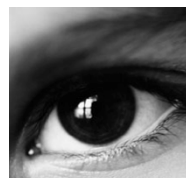
Effects of Chronic Trauma on the Developing Brain



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

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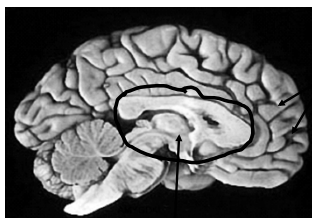
Effects of Chronic Trauma on the Developing Brain



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

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Combined Effects of Chronic Trauma & Neglect



Frontal cortex: Source of impulse control & emotion regulation

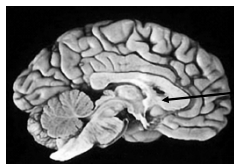
Limbic area: Source of intense emotions and impulses

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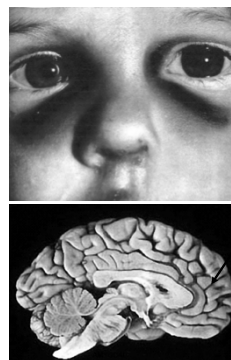
How Cortical Inhibition Develops

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

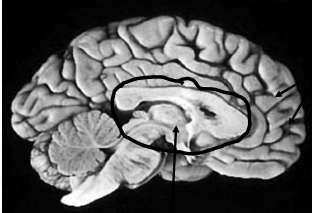
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Child neglect delays the development of cortically based networks that inhibit and channel intense emotions and impulses

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Combined Effects of Chronic Trauma & Neglect



Frontal cortex:
Weakened capacity for impulse control

Limbic area: Intensified emotions & impulses

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The Cycle of Violence

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


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From Victim to Victimizer


Abused



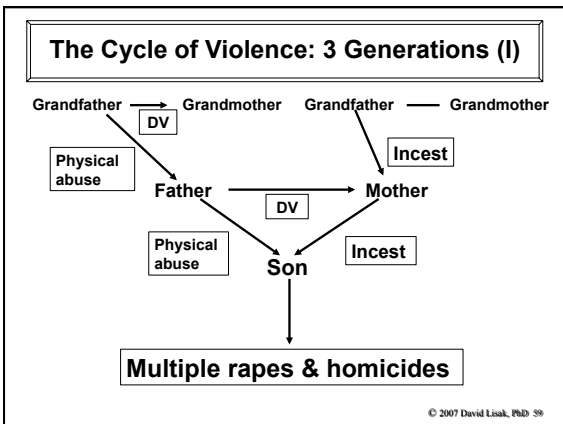
Learns to be tough



Hardened



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Neurobiology of Healing

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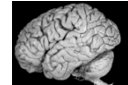
Neural Plasticity



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Neural Plasticity

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



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Neural Plasticity



Learning



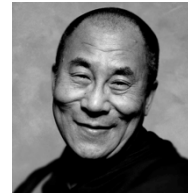
Adaptation



Rehabilitation

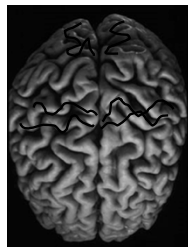
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Neural Plasticity and the Dalai Lama



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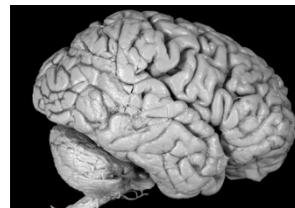
"It happened when I was..."



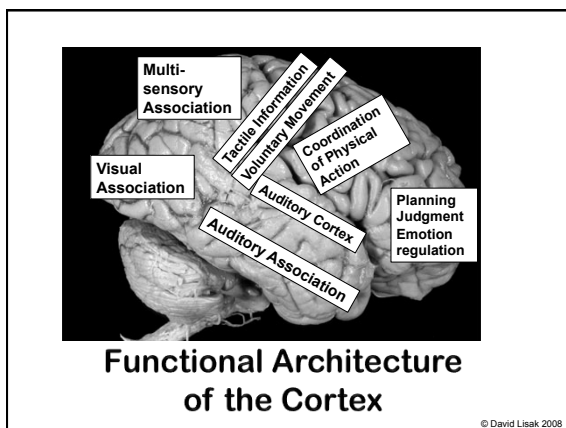
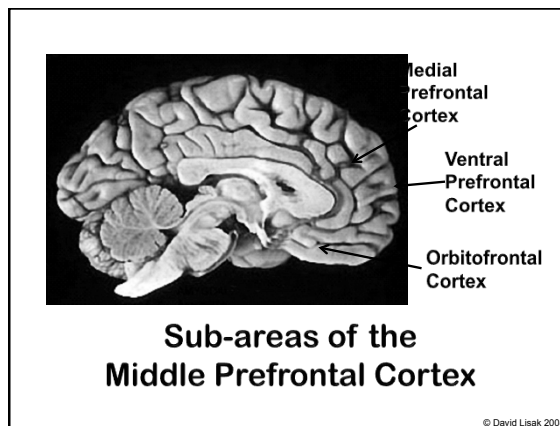
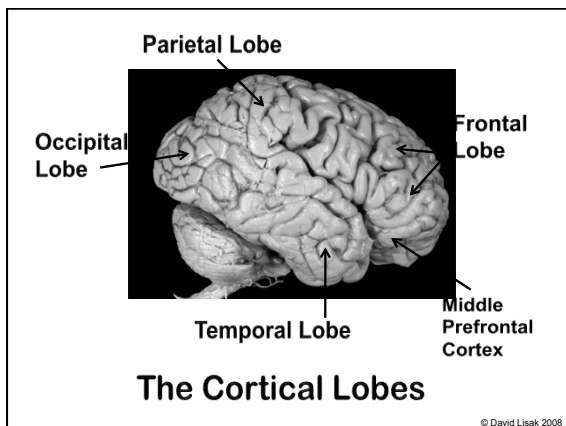
The Neurobiology of Healing

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Cortical Anatomy



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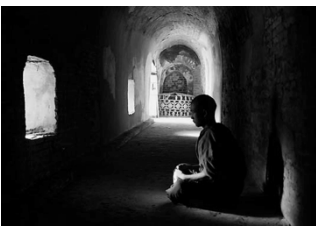
Mindfulness Meditation and the Neurobiology of Healing

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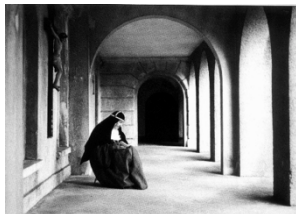
Meditation is a form of mental training

Train focus on breath/image/idea

Clear consciousness of distracting "mind chatter"



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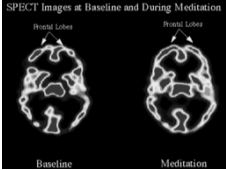


Brain imaging studies indicate common neural states across diverse traditions of meditation.

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Does meditation change the brain?

Yes



SPECT Images at Baseline and During Meditation

Frontal Lobes Frontal Lobes


Baseline Meditation

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2006 Psych Bull Review


Neurobiological Effects of Meditation 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.

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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.

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

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Bodily regulation

Attuned communication

Emotional balance

Response flexibility

Empathy

Self insight

Fear modulation

Intuition

Morality

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