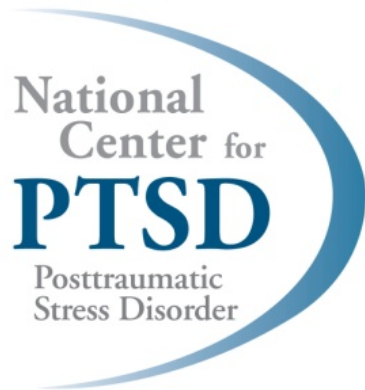




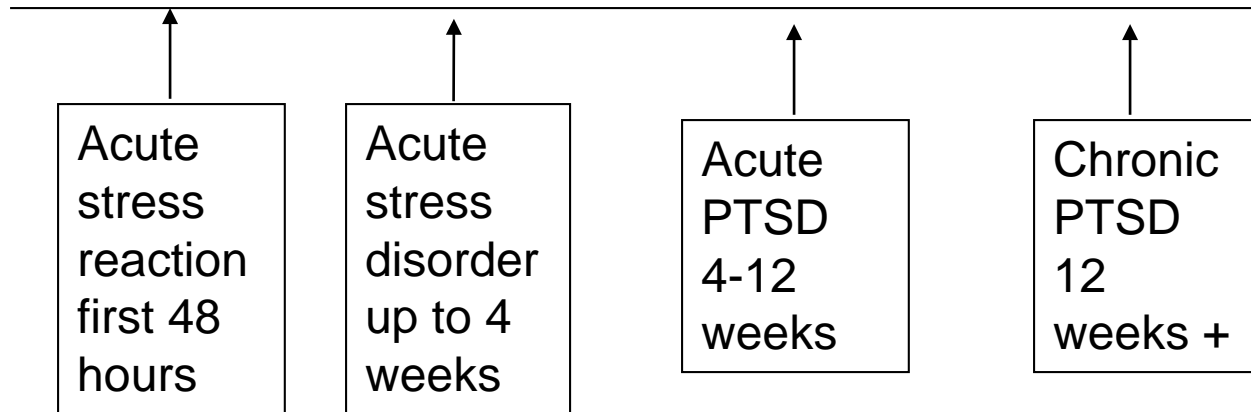
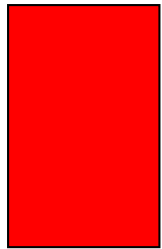
# Posttraumatic Stress Disorder: Neurophysiology of Trauma



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**UC Davis School of Medicine**

# Time course of reactions

**Traumatic event**

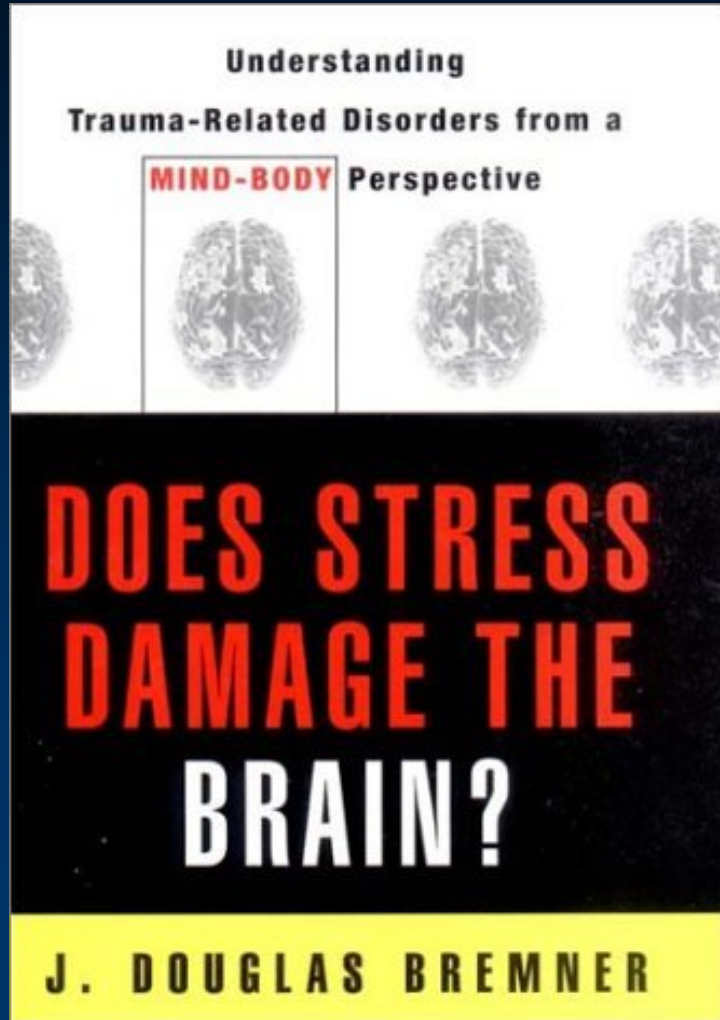
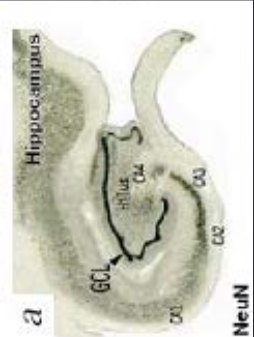
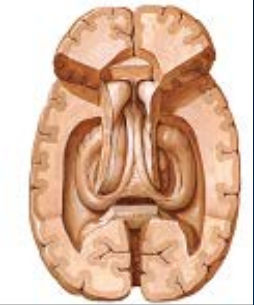


# Post-Traumatic Stress Disorder (PTSD)

Bremner hypothesized that hippocampal damage represents the anatomical basis for the psychological effects of stress. (mind-body perspective)

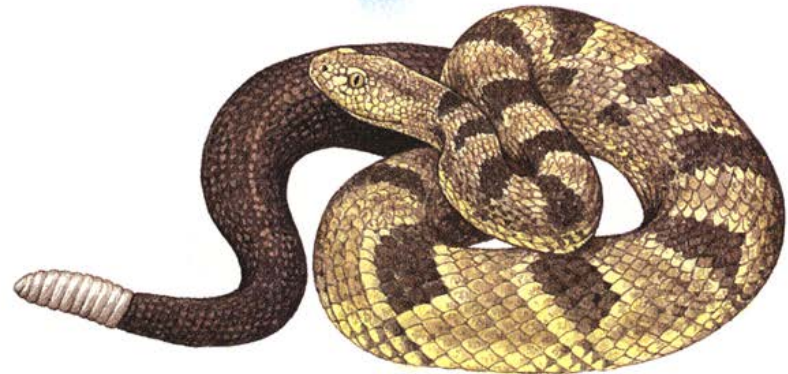
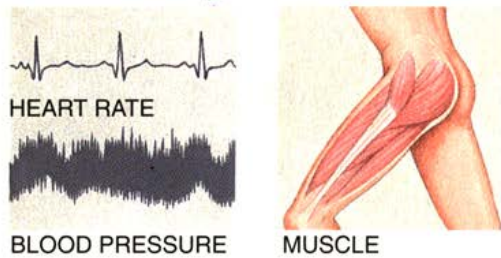
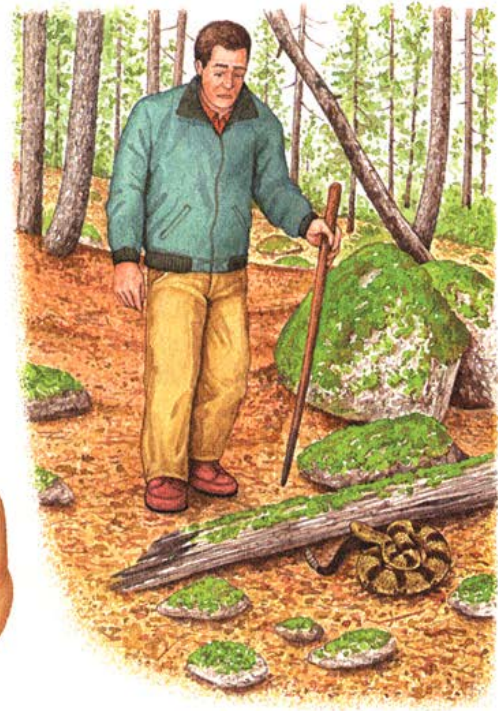
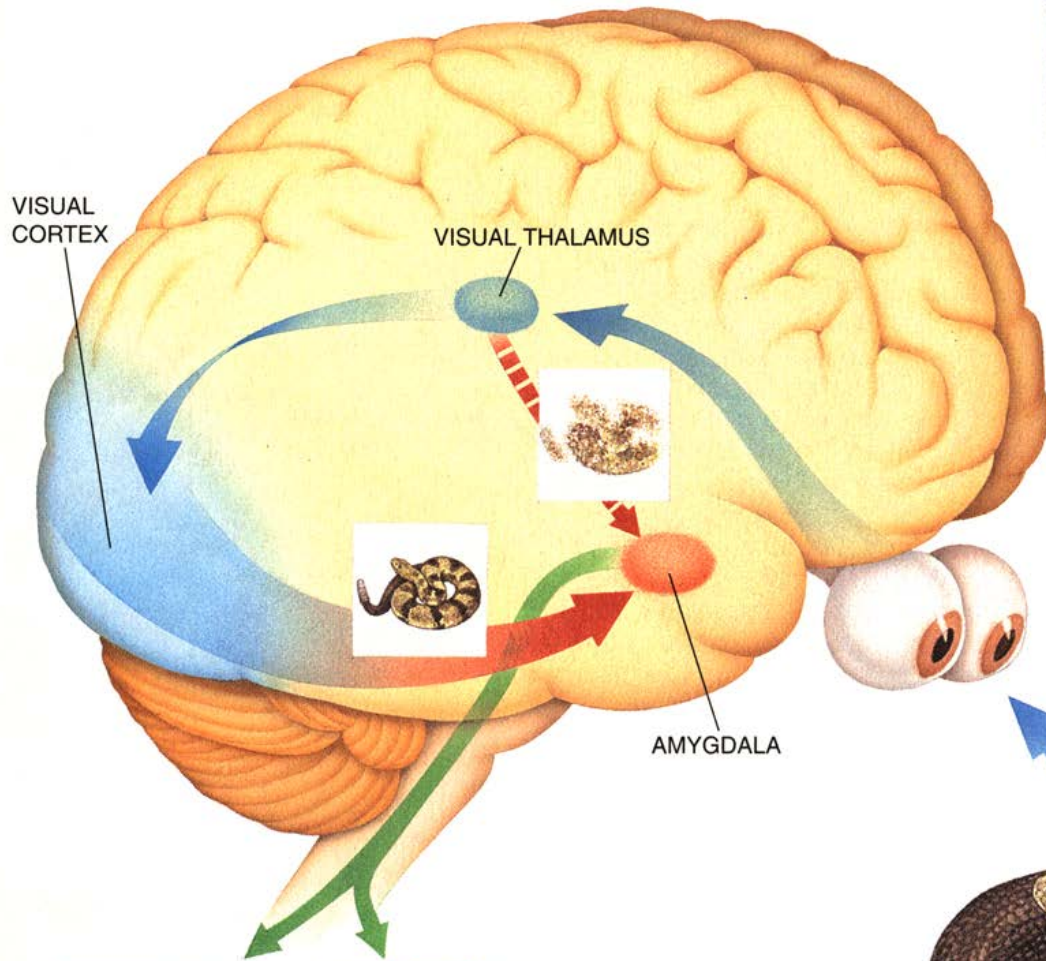


Hippocampus and Fornix  
Superior Dissection

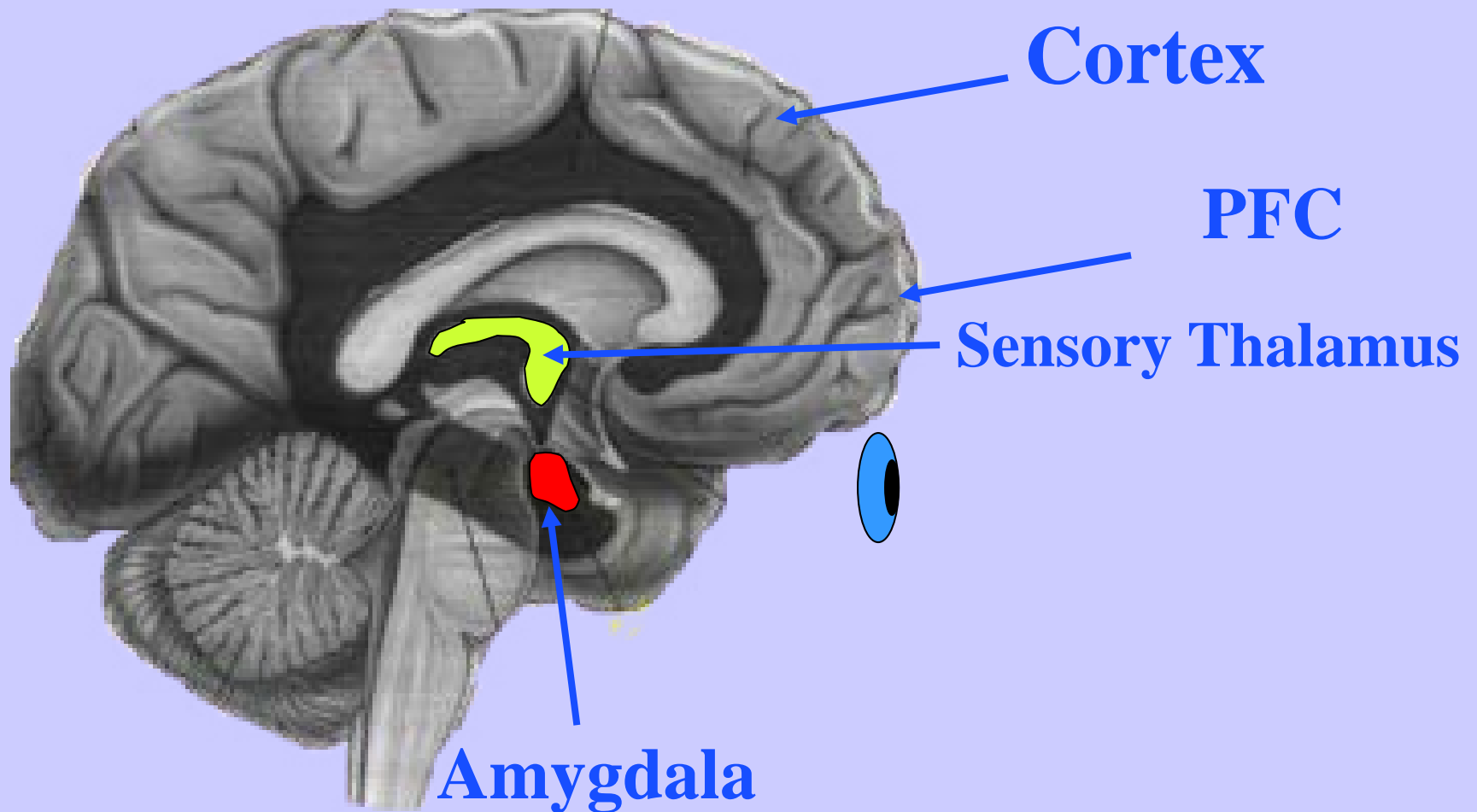


Data from MRI studies showed an 8% reduction of left hippocampal volume in Vietnam vets and similar decreases in the right sides of physically and sexually abused women.

# LeDoux, Scientific American, 1994



# The Neurophysiology of PTSD



# TWO PATHWAYS OF FEAR

- When the brain receives a sensory stimulus indicating a **danger**, it is routed first to the **thalamus**.
- From there, the information is sent out over two parallel pathways:
  1. the thalamo-amygdalic pathway (“low road”)
  2. the thalamo-cortico-amygdalic pathway (“high road”).

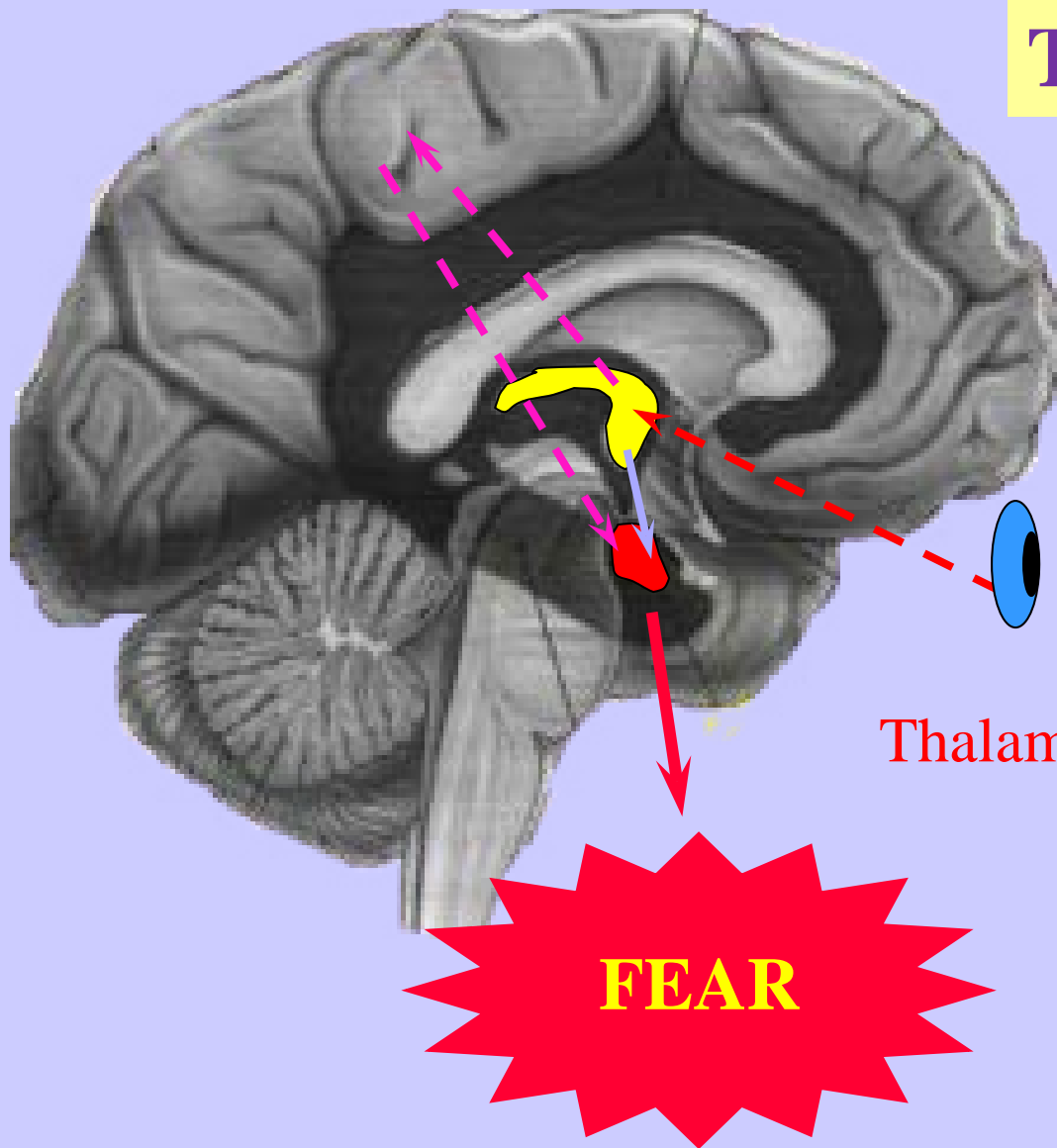


Thalamo-cortico-amygdalic pathway

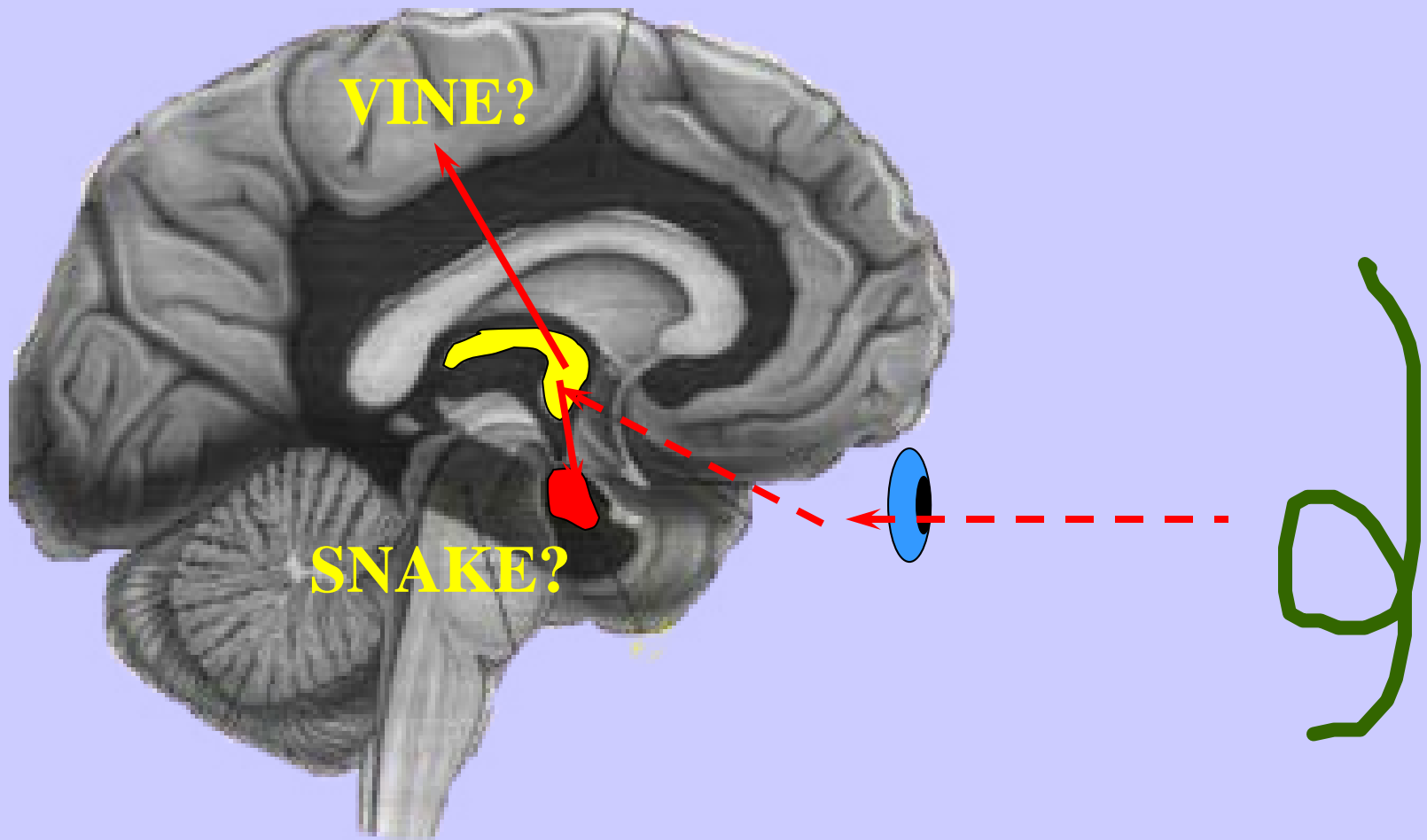
**The “high” road**

**The “low” road**

Thalamo-amygdalo-fugal pathway



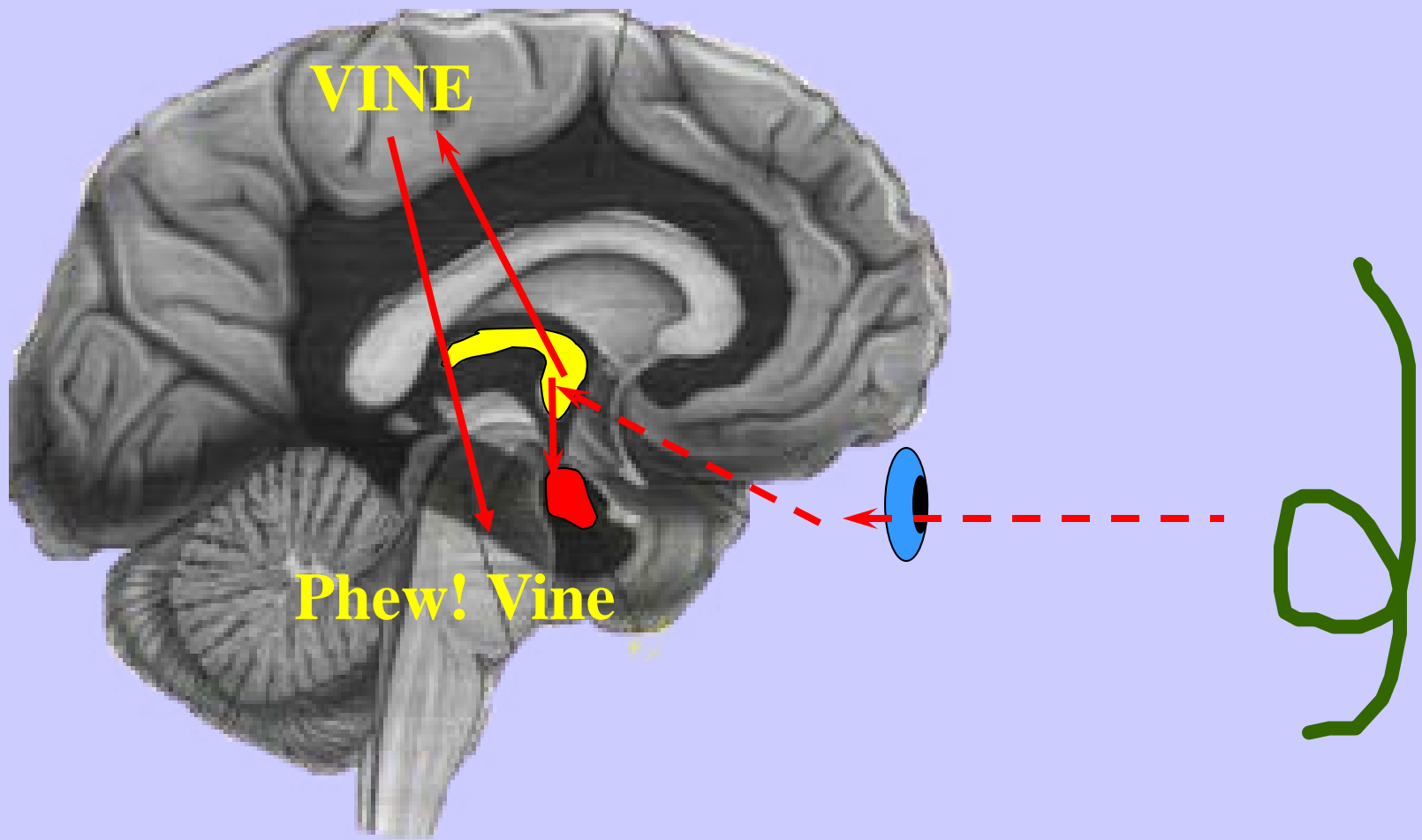
**FEAR**

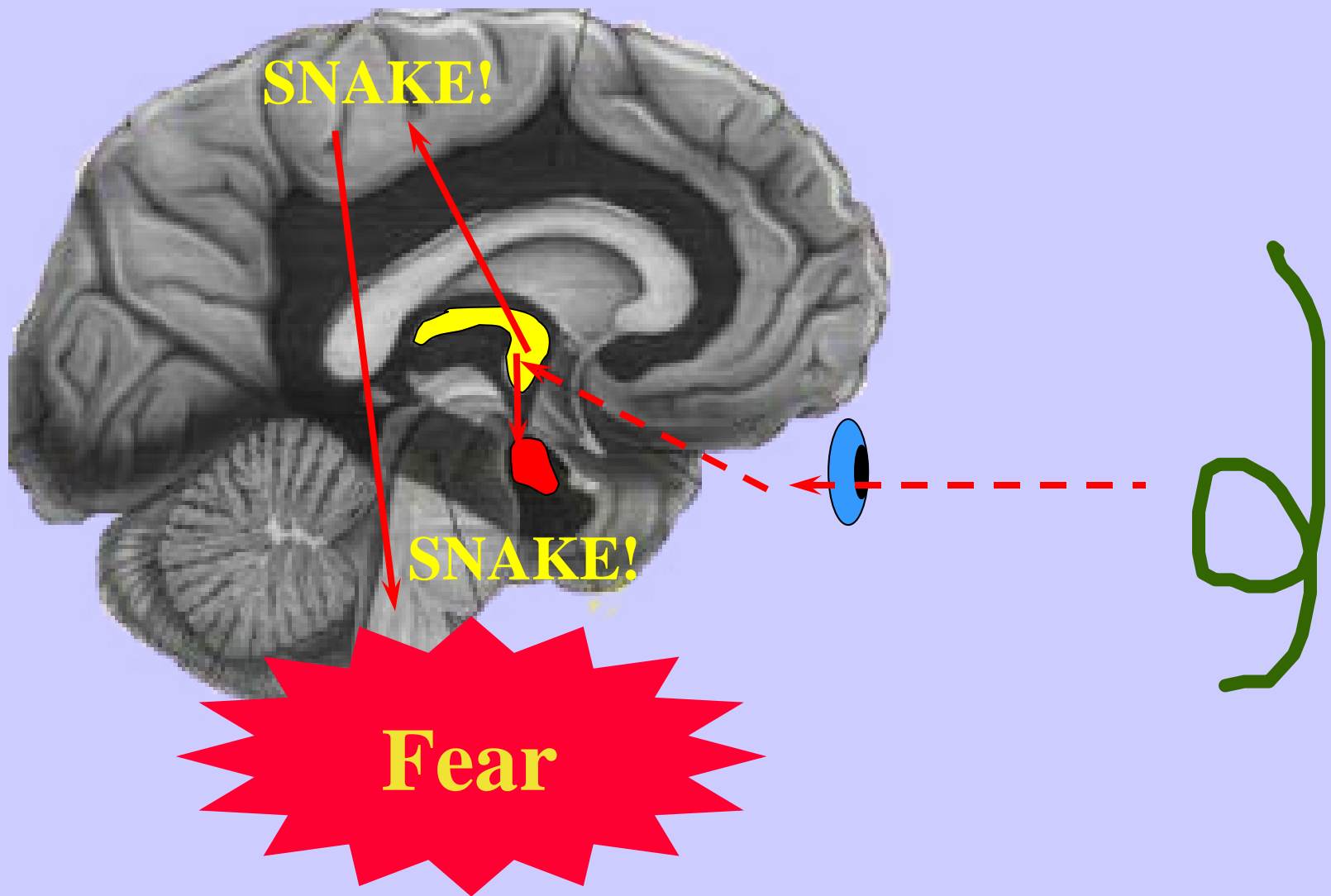


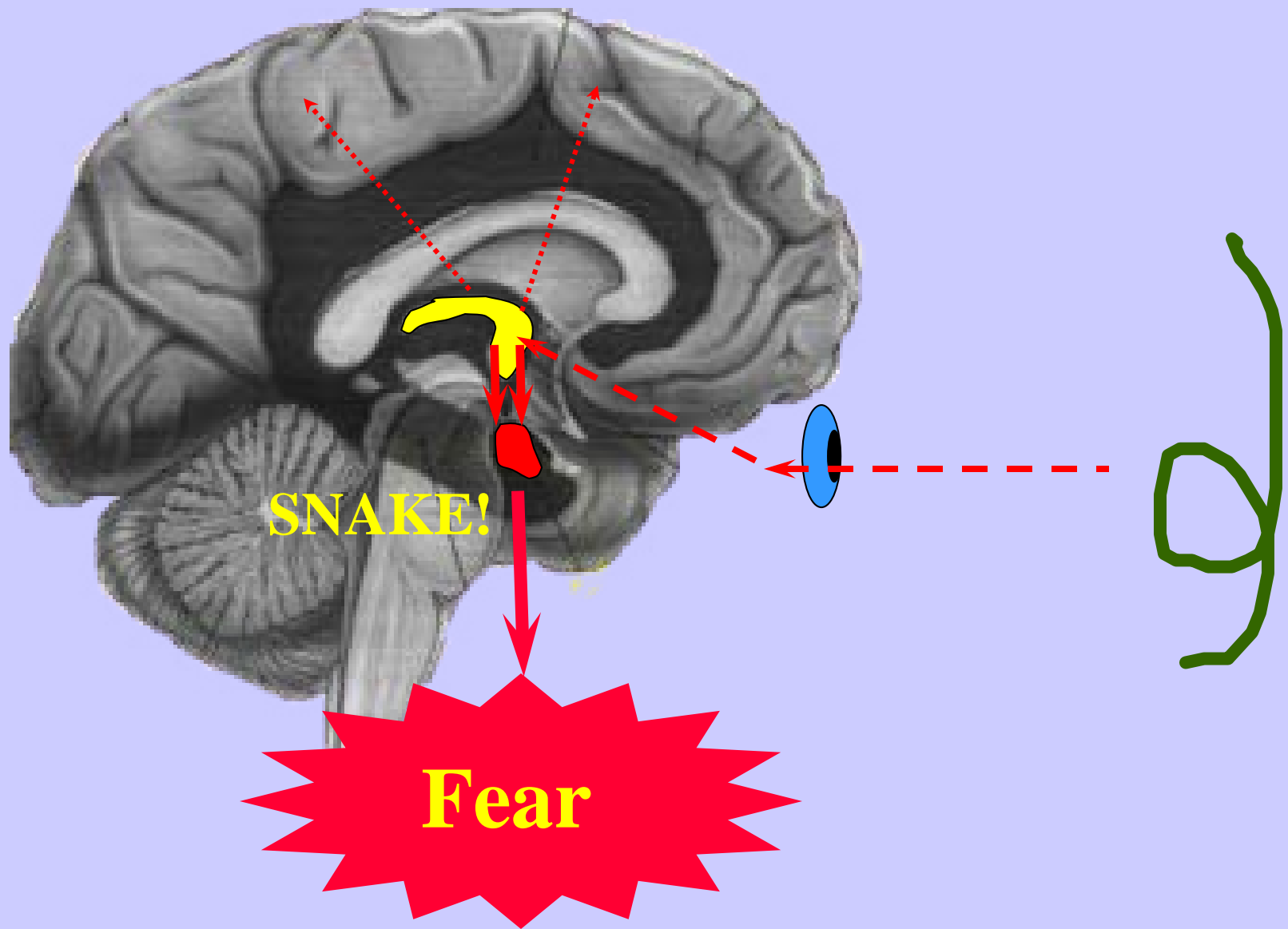


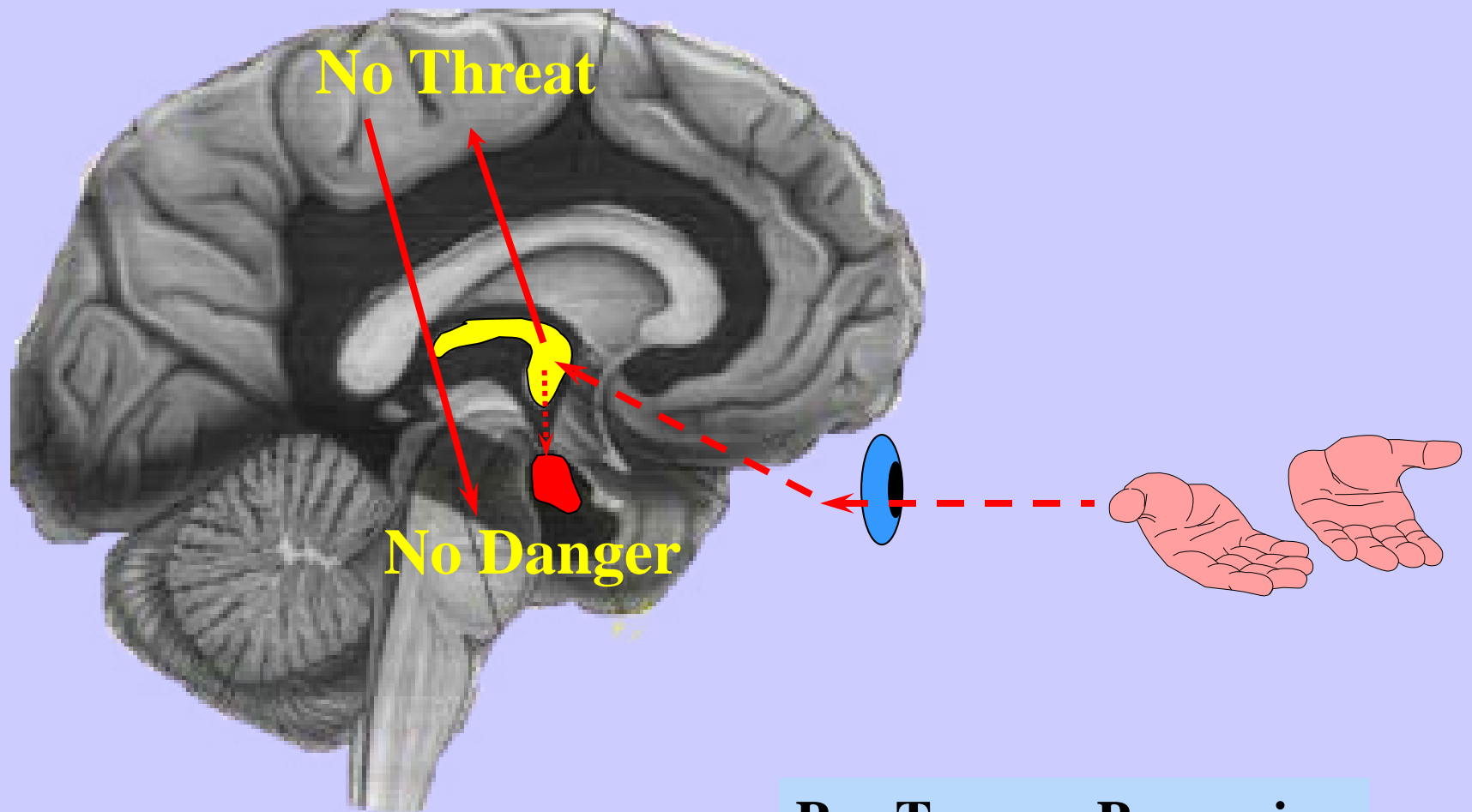
# The Low Road

- conveys a fast, rough impression of the situation, because it is a sub-cortical pathway in which no cognition is involved.
- this activates the amygdala which, through its central nucleus, generates emotional responses before any perceptual integration has even occurred and before the mind can form a complete representation of the stimulus.

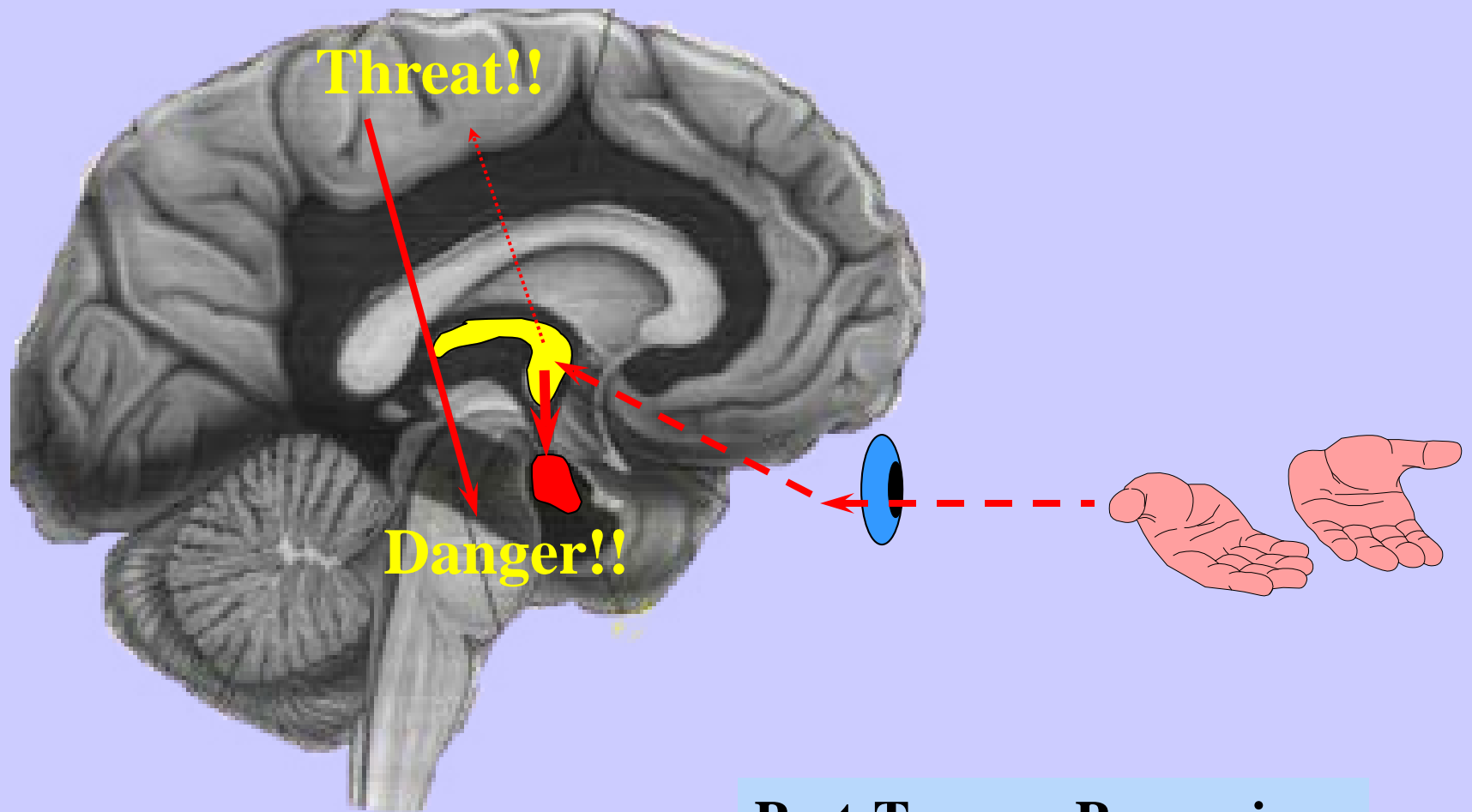




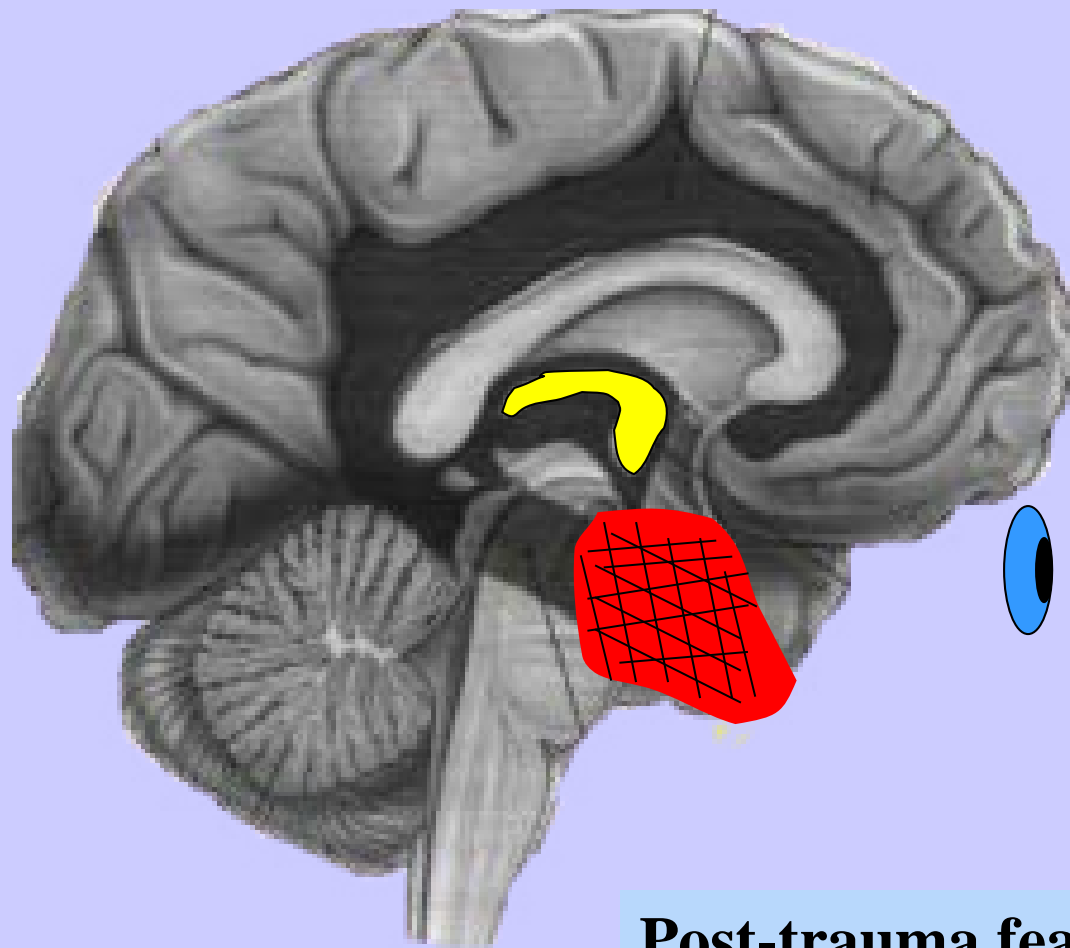




**Pre-Trauma Processing  
of “ordinary” stimulus**



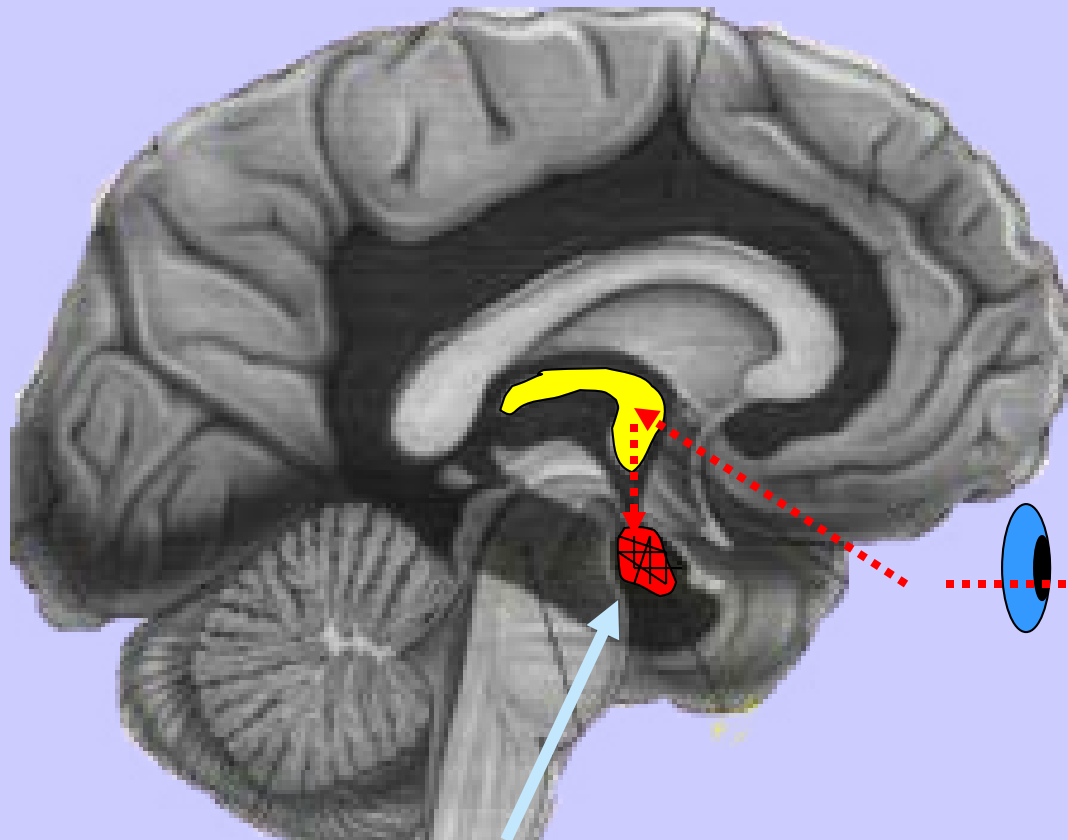
**Post-Trauma Processing  
of “ordinary” stimulus**



**Trauma  
produces an  
anatomical  
change in the  
brain**

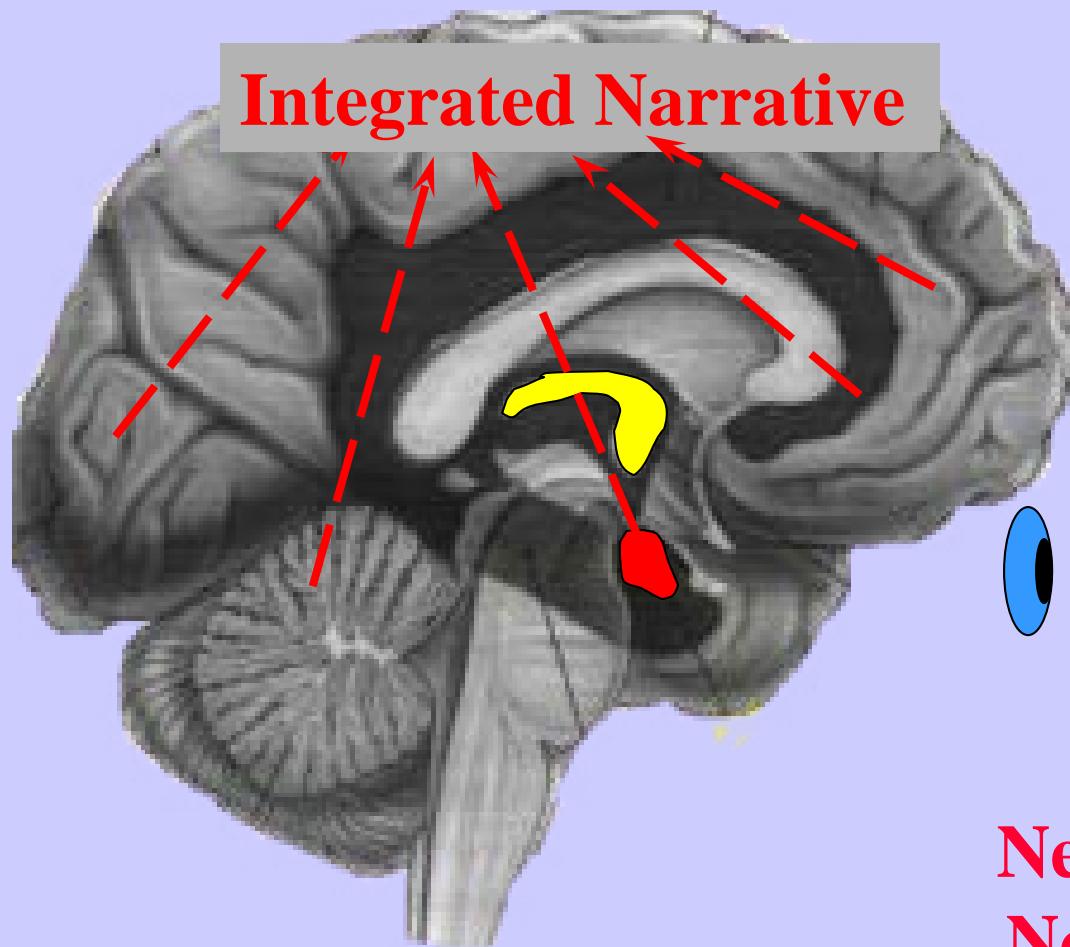
**Post-trauma fear  
network in Amygdala**





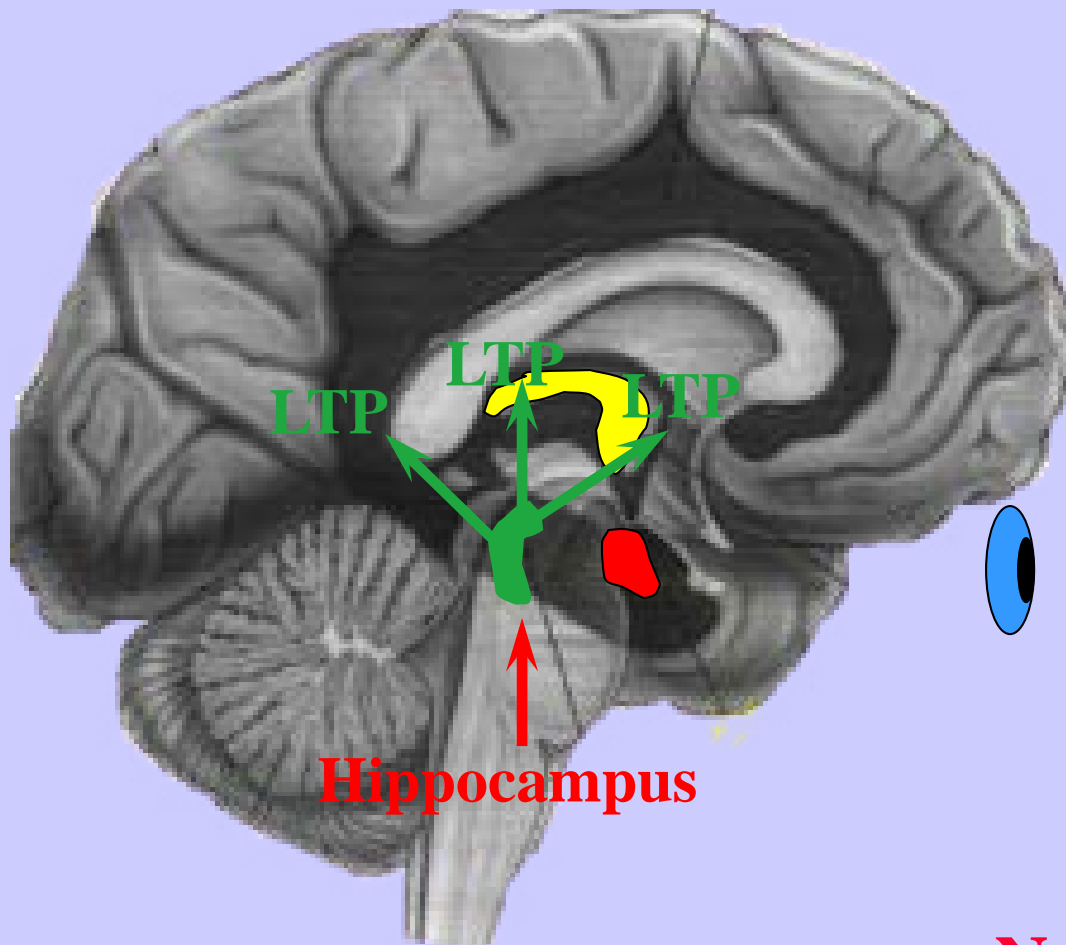
**Post-trauma fear  
network in Amygdala**

**A landscape of  
fear-inducing  
cues**



**Neurobiology of  
Non-Traumatic  
Memory**

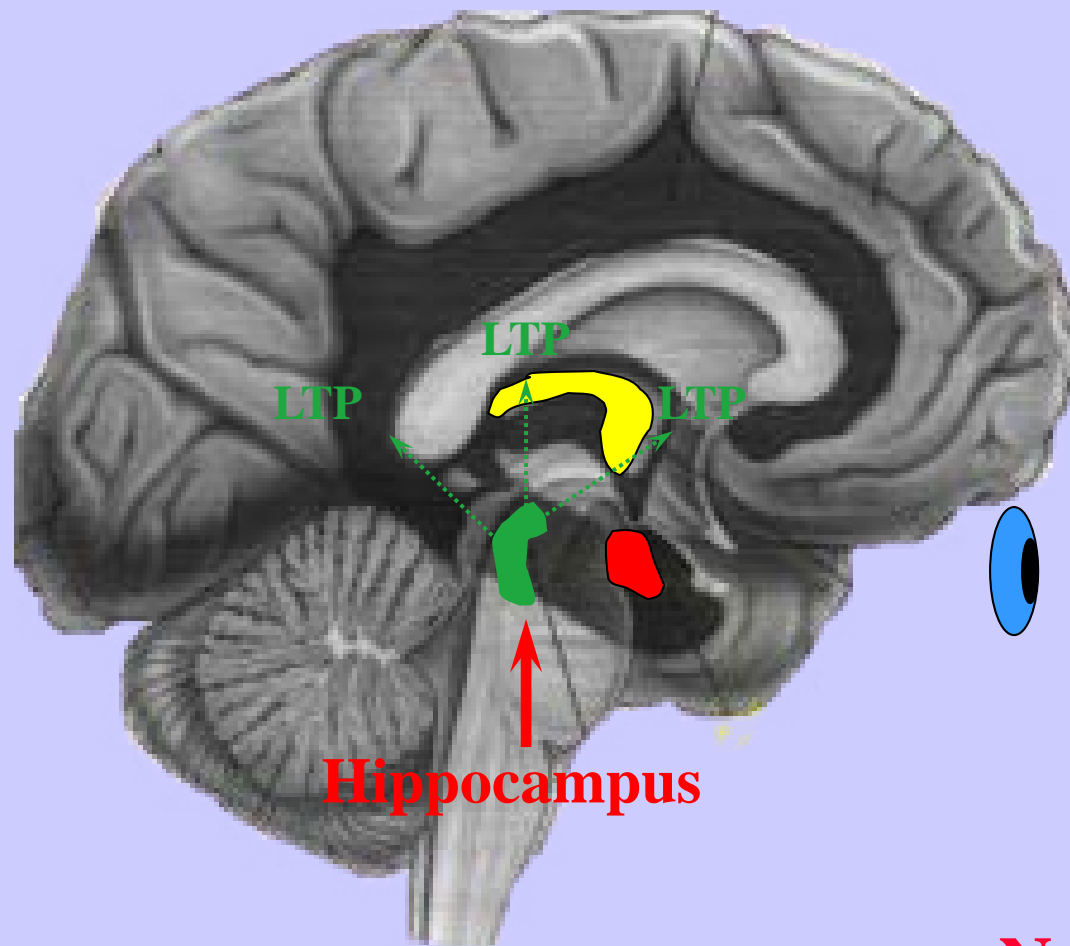
**LTP builds the neural networks that create new memories**



**Neurobiology of  
Traumatic Memory**

**Trauma interferes  
with LTP  
functioning**

**Results in loss &  
fragmentation of  
memories**



**Neurobiology of  
Traumatic Memory**

# Failure of Extinction in PTSD

- Extinction: Decrease in conditioned response due to nonreinforcement
- PTSD:
  - » Inability to extinguish conditioned fear responses
  - » Inability to distinguish between dangerous and safe situations

# Battlemind: Dys-coordination of Threat Response & Dissociation

