



# Post-Traumatic Stress Disorder?



“In her dreams she hears calls for help from people trapped in the offices of Cantor Fitzgerald, the bond firm that lost more than 600 employees, and in the Windows on the World restaurant, which occupied the top floors of the north tower.”

From Wikipedia:

“**Posttraumatic stress disorder** (PTSD) is the term for a severe and ongoing emotional reaction to an extreme [psychological trauma](#).<sup>[1]</sup> The latter may involve someone's actual death or a threat to the patient's or someone else's life, serious physical injury, or threat to physical and/or psychological integrity, to a degree that usual [psychological defenses](#) are incapable of [coping](#). It is important to make a distinction between PTSD and [Traumatic stress](#), which is a similar condition, but of less intensity and duration.”

## From Wikipedia:

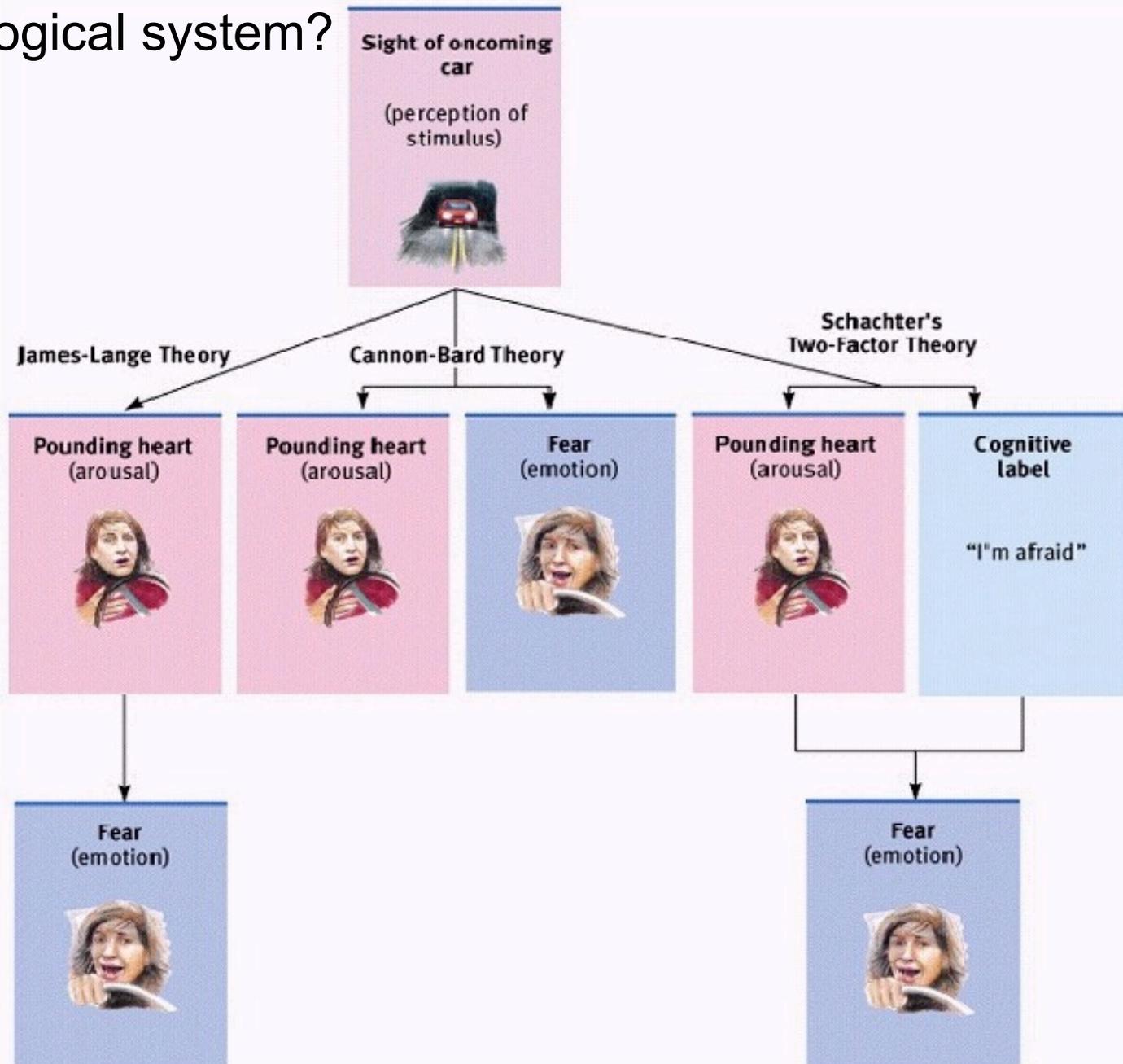
“PTSD symptoms may include: [nightmares](#), [flashbacks](#), [emotional detachment](#) or numbing of feelings (emotional self-mortification or [dissociation](#)), [insomnia](#), avoidance of reminders and extreme distress when exposed to the reminders ("triggers"), loss of appetite, [irritability](#), [hypervigilance](#), [memory loss](#) (may appear as difficulty paying attention), excessive [startle response](#), [clinical depression](#), and [anxiety](#).

A person suffering from PTSD may also exhibit one or more [comorbid](#) psychiatric disorders. These may include clinical depression (or [bipolar disorder](#)), [general anxiety disorder](#), and a variety of [addictions](#).”

# How is an emotional event coded by the neural system?

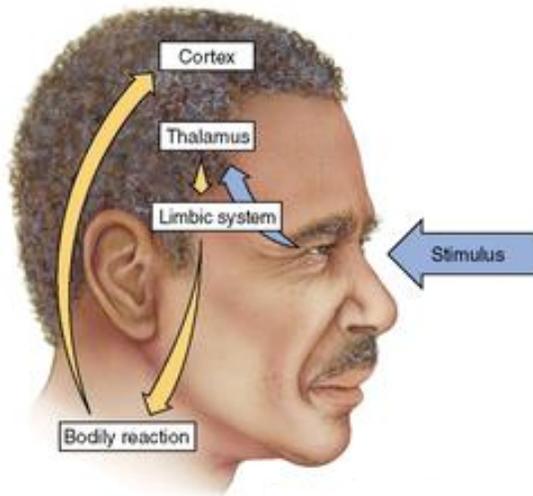
- How are neural and physiological signals integrated?
- What systems are key to integrating/processing information under conditions of arousal and emotion?

How is it that an “emotional” response emerges from the physiological system?

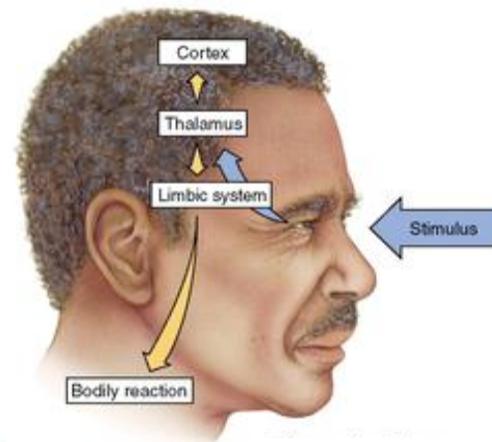


# Traditional Psychological Theories of emotion and affect:

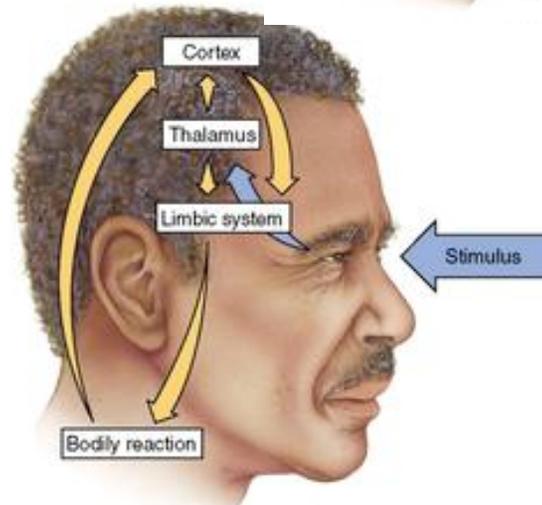
James – Lange



Cannon - Bard

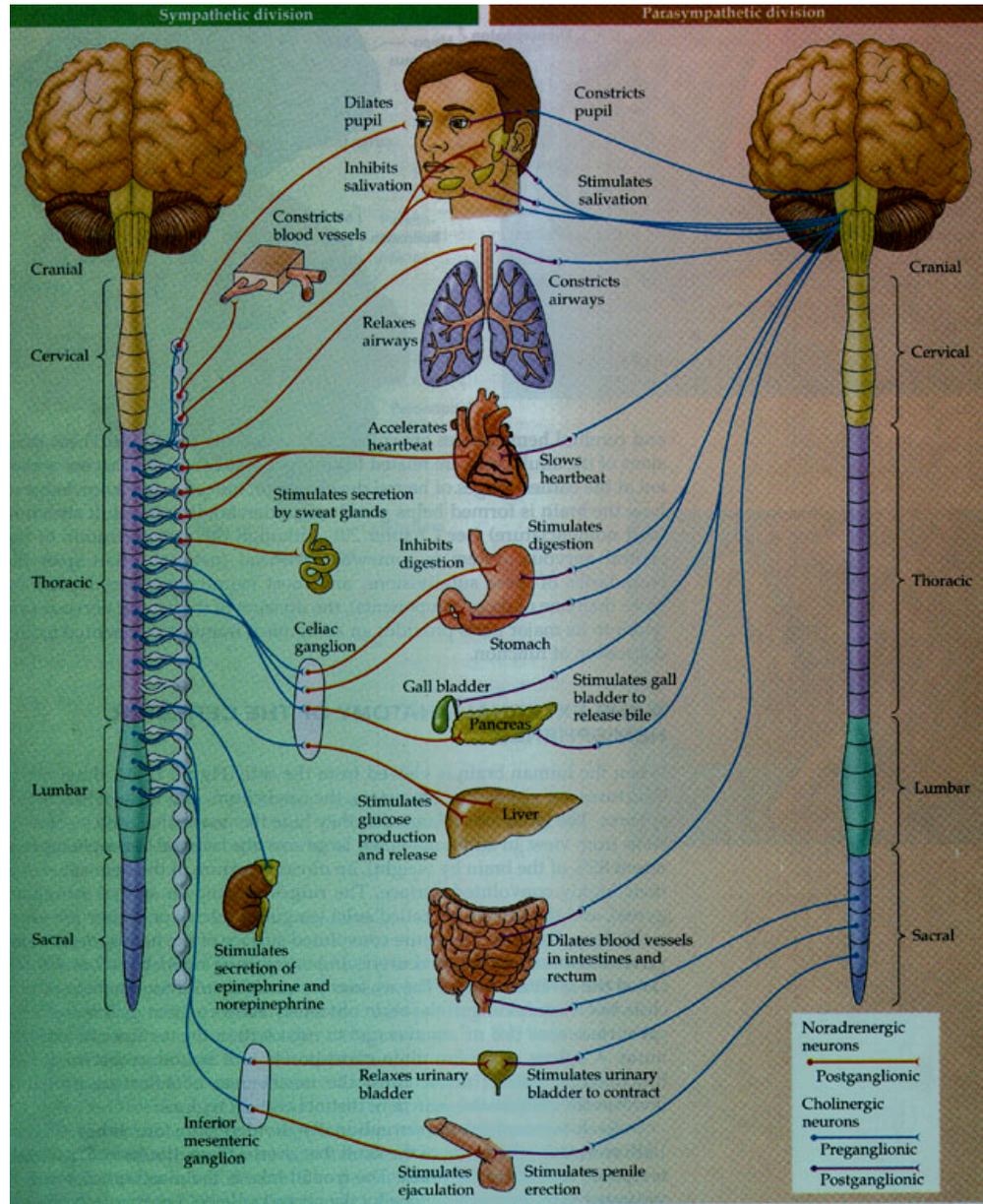


Cognitive Appraisal Theory:

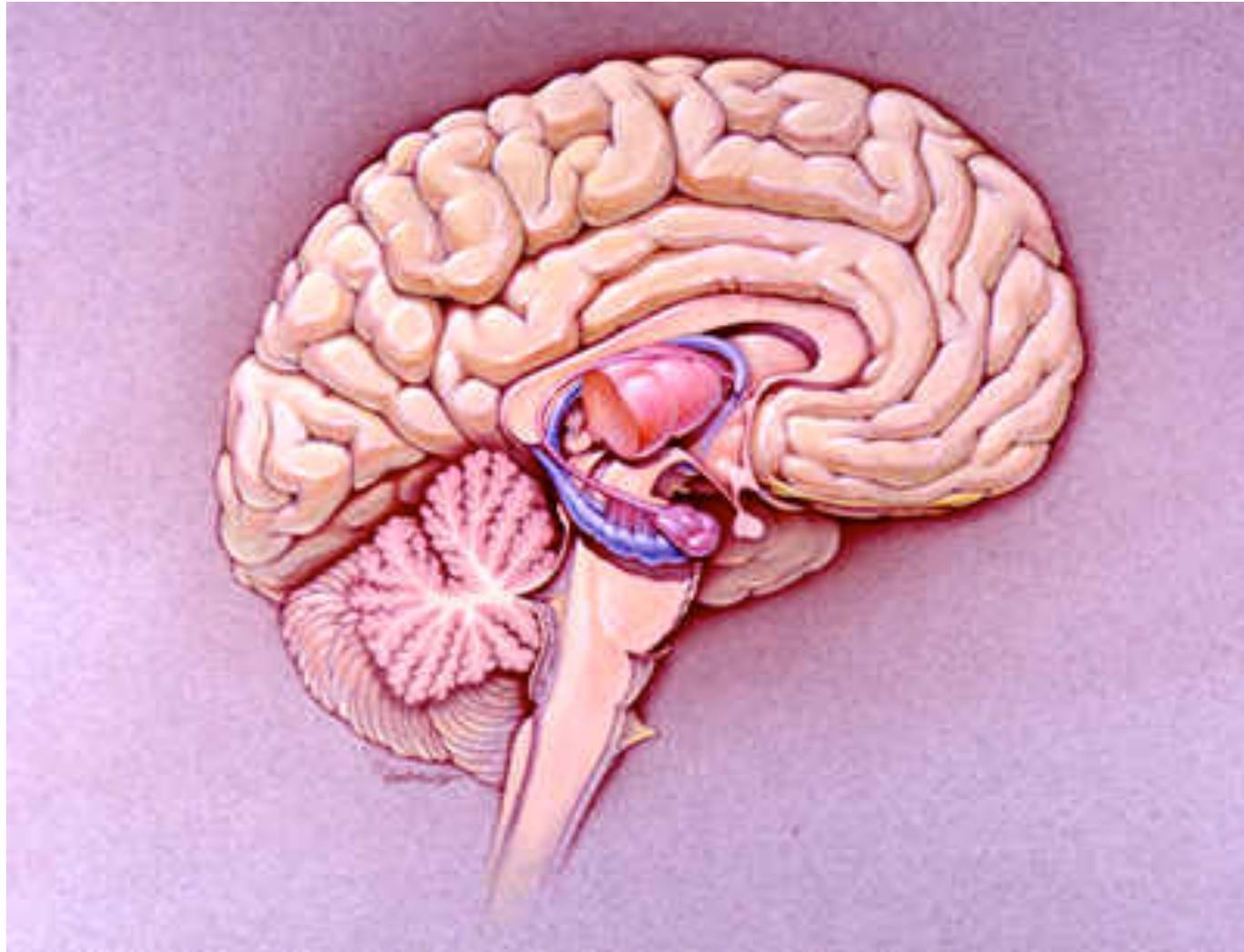


# Some Key Players in Emotional Learning...

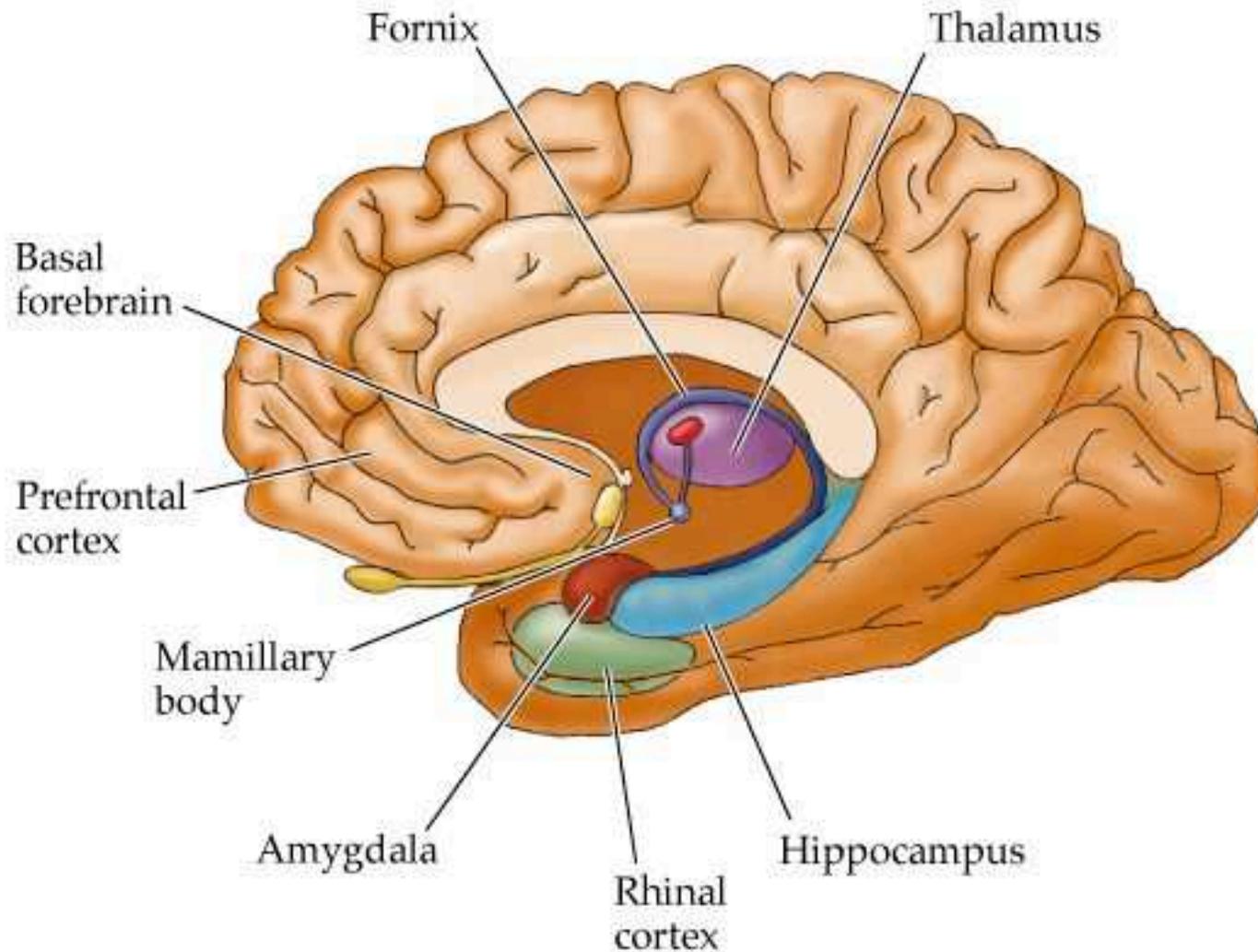
# Autonomic Nervous System



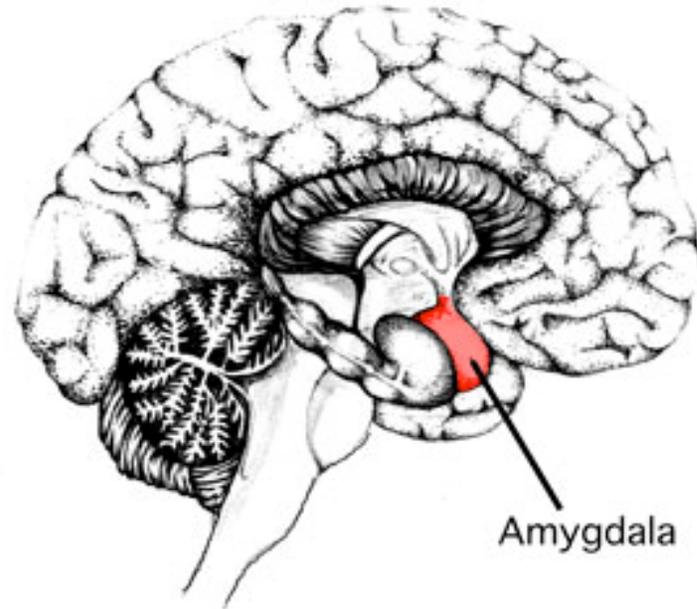
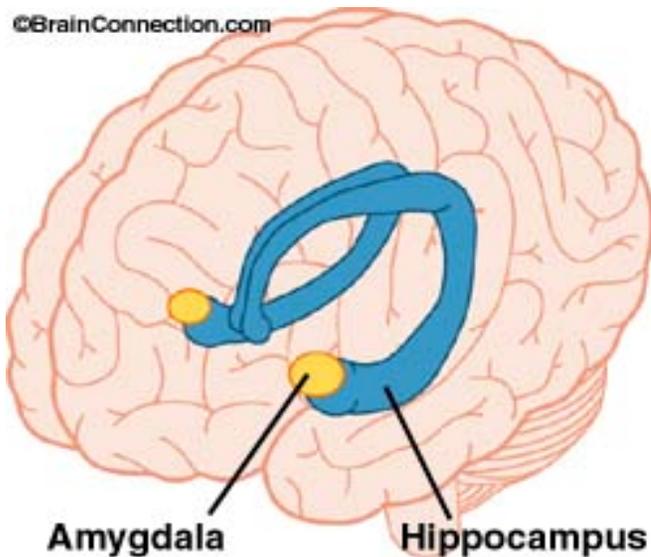
The Thalamus sends sensory information to other parts of the brain.



# Neural Structures traditionally deemed important in Emotion:

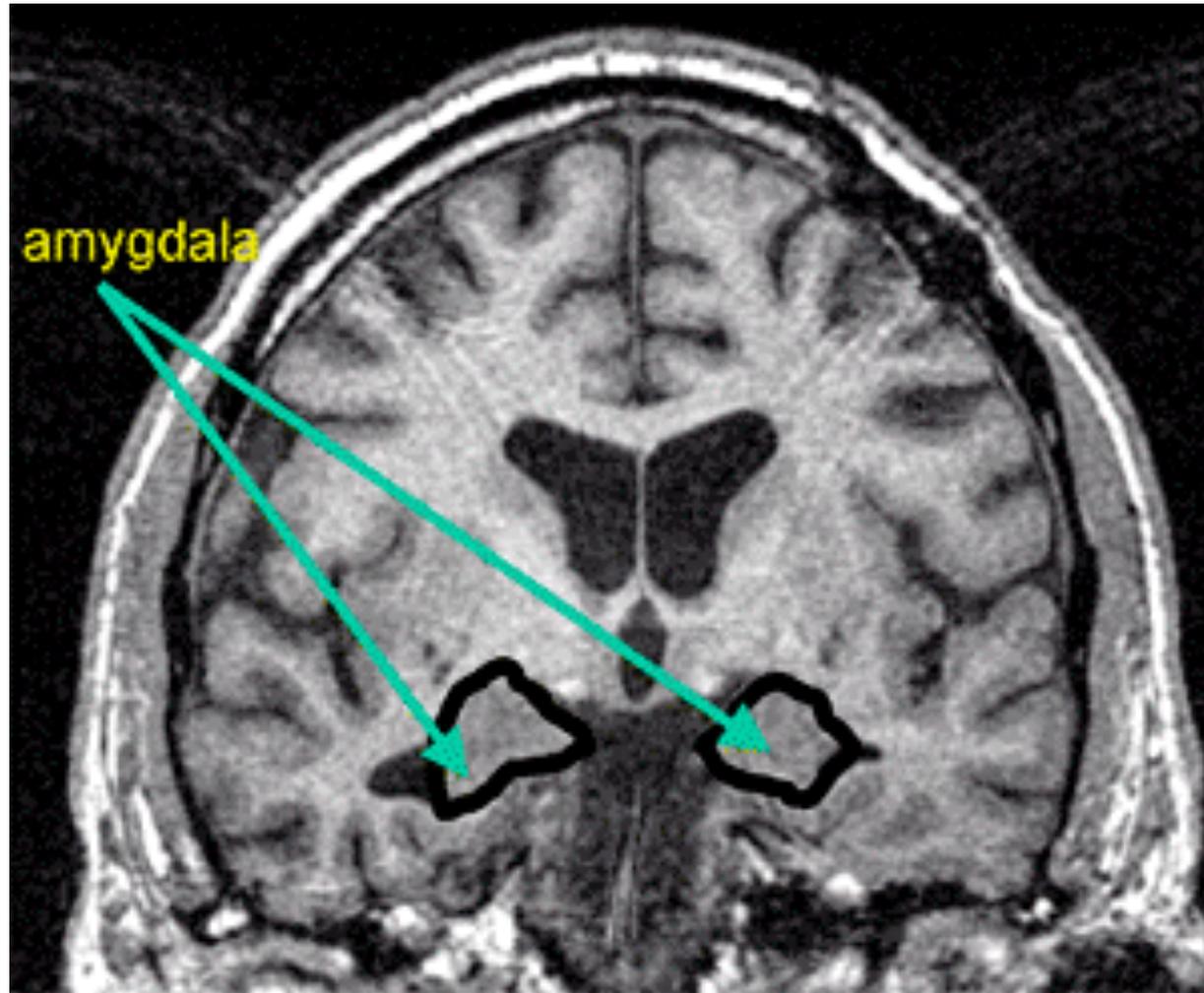


# The amygdala: Privileged Role in Emotional Learning?



# Host of Research Implicating the Amygdala in Affect or Emotion:

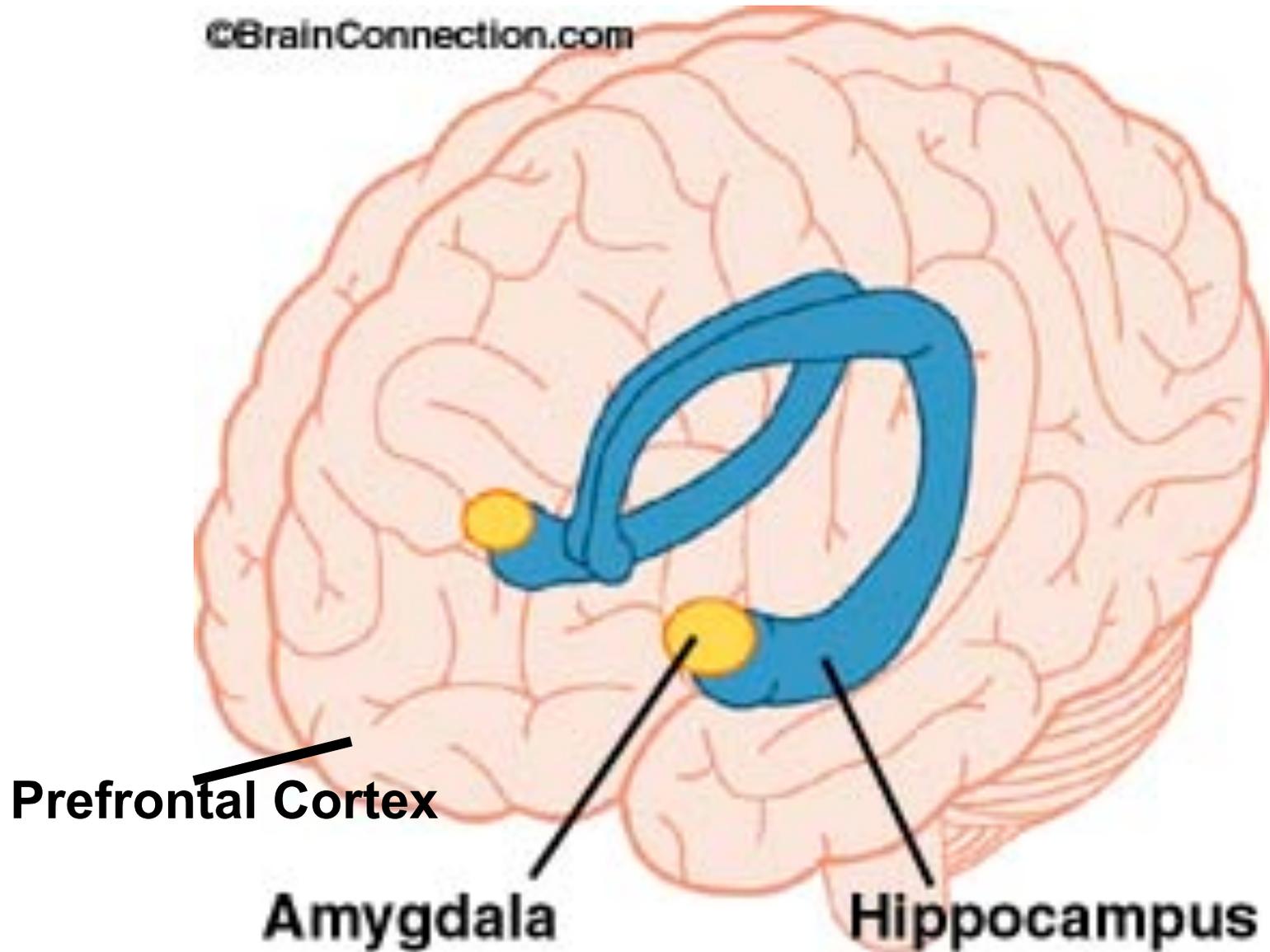
- Fear Conditioning (rat, monkey, human)
- Enhancement of emotional memories
- Recognition of emotional facial expressions (human studies)
- Psychopaths have altered responses
- Sex and Addictions...



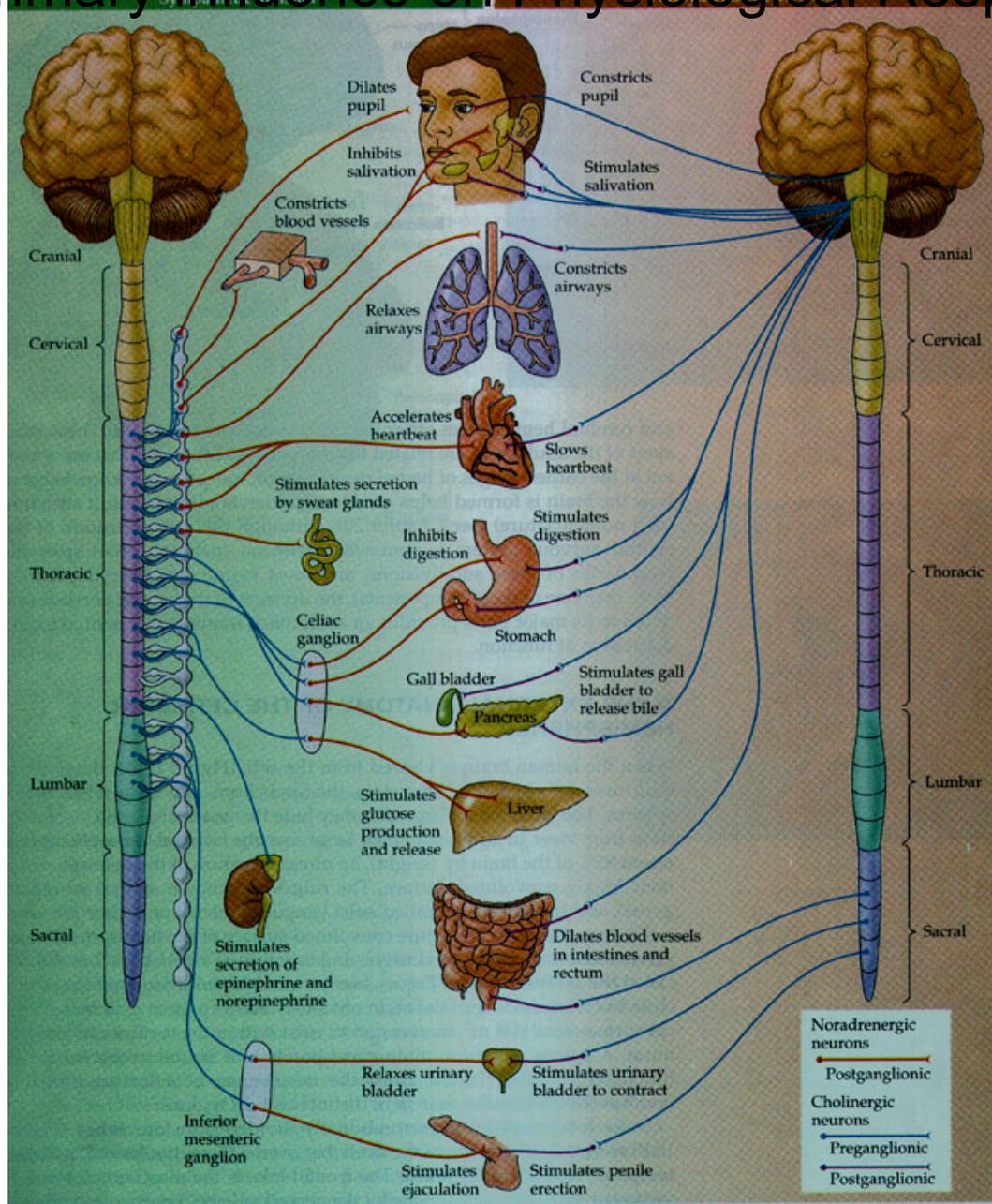
Coronal MRI of a human brain at the level of the amygdala

# The Amygdala does not function alone!!

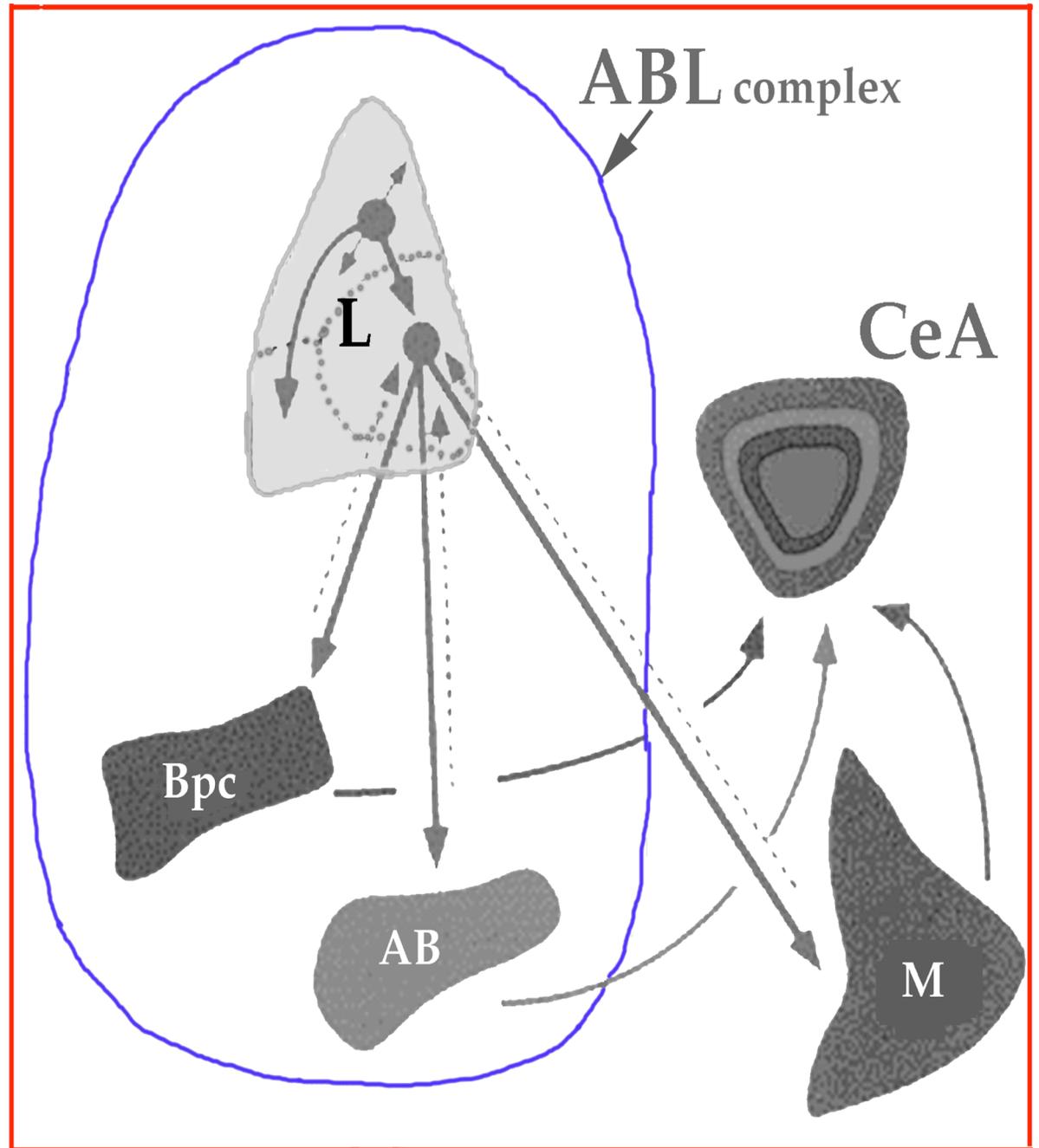
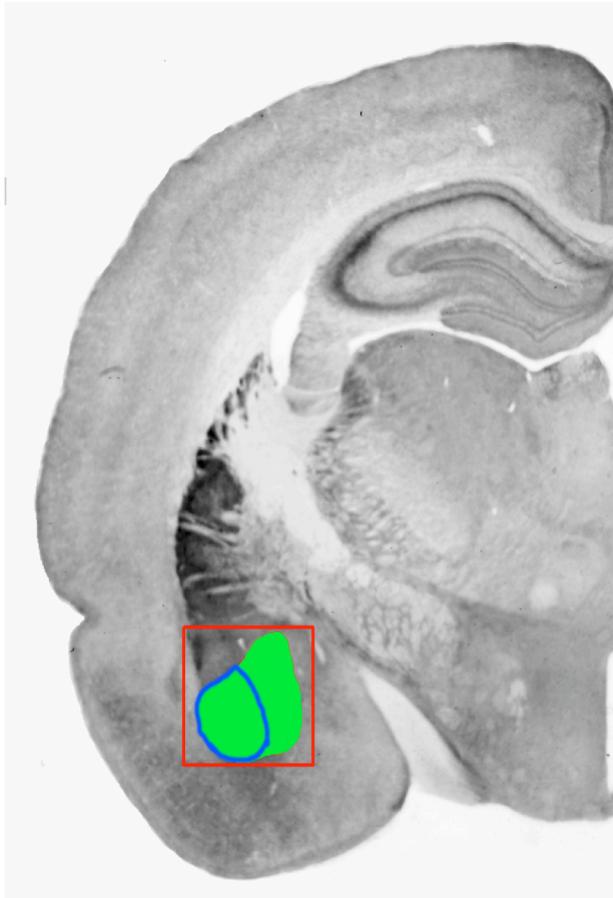
©BrainConnection.com



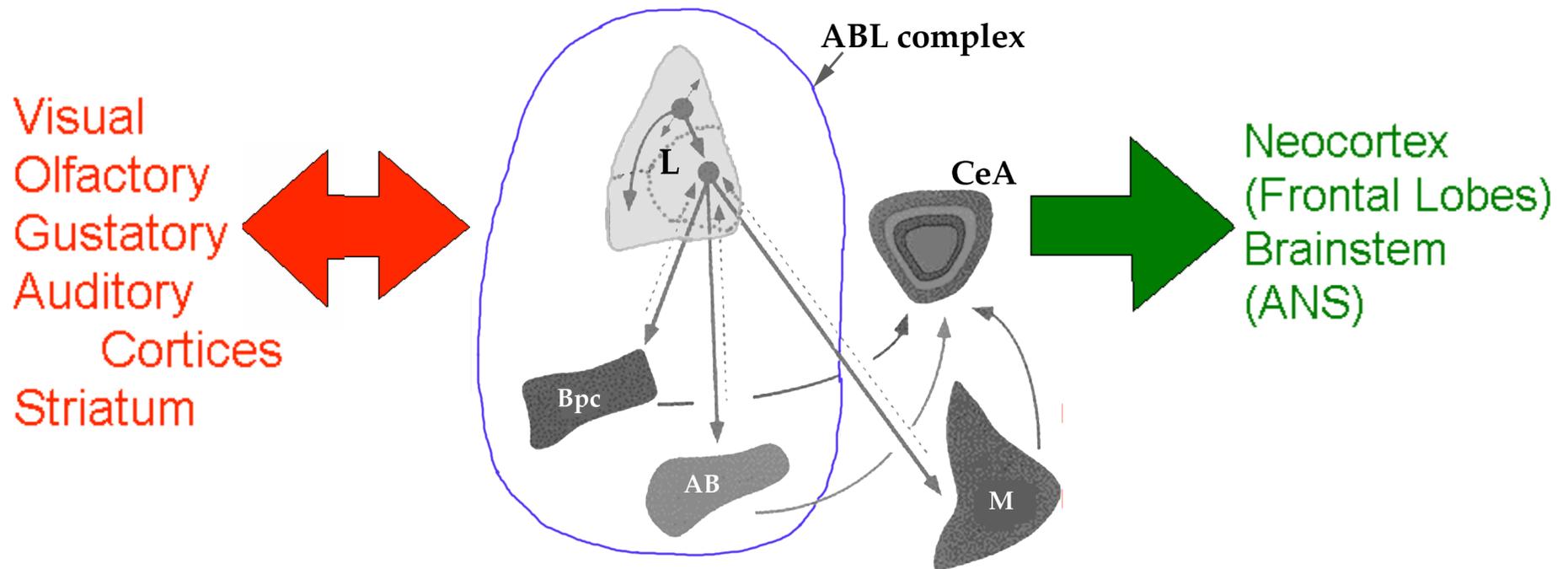
# The Amygdala can exert Primary influence on Physiological Responses



The Amygdala is actually a set of interconnected structures:



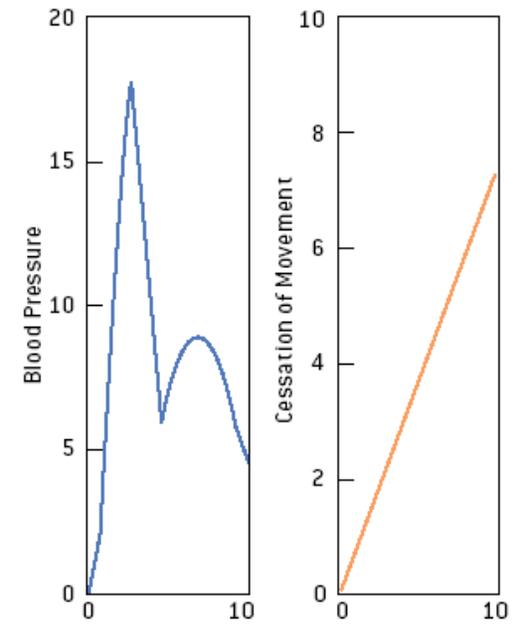
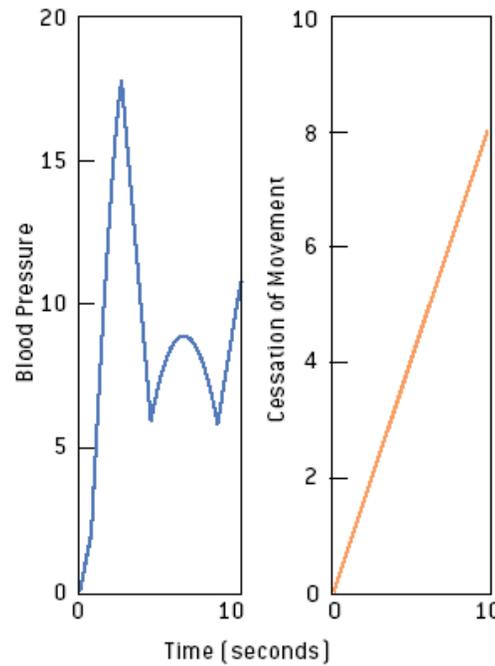
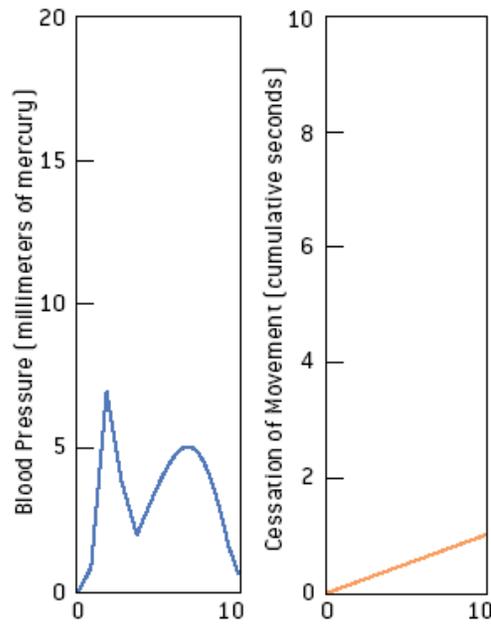
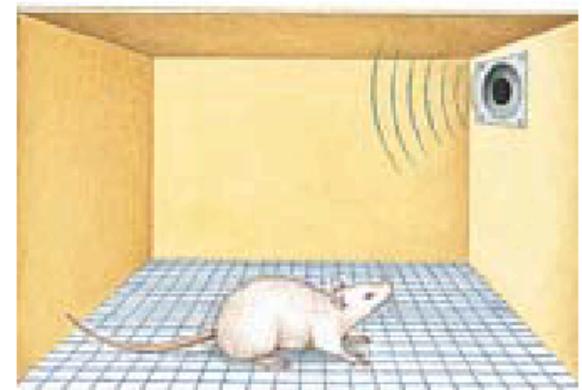
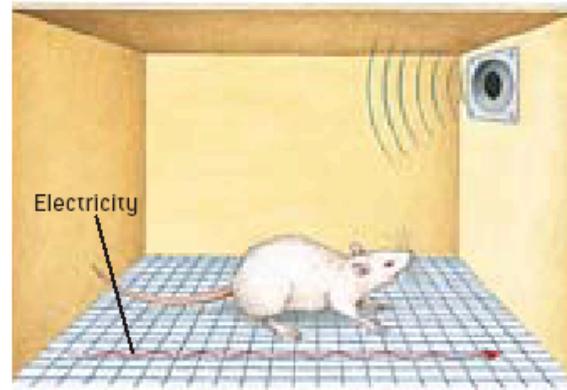
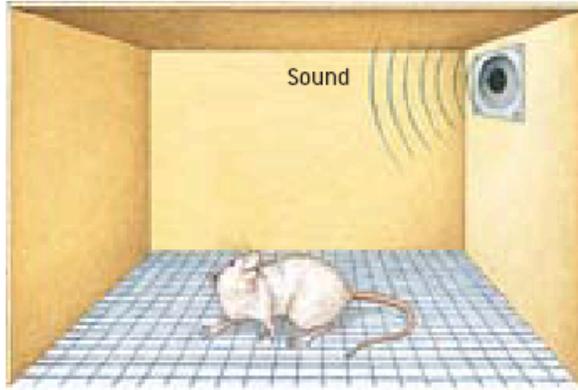
# (Some) **Inputs** and **Outputs** of the Amygdala



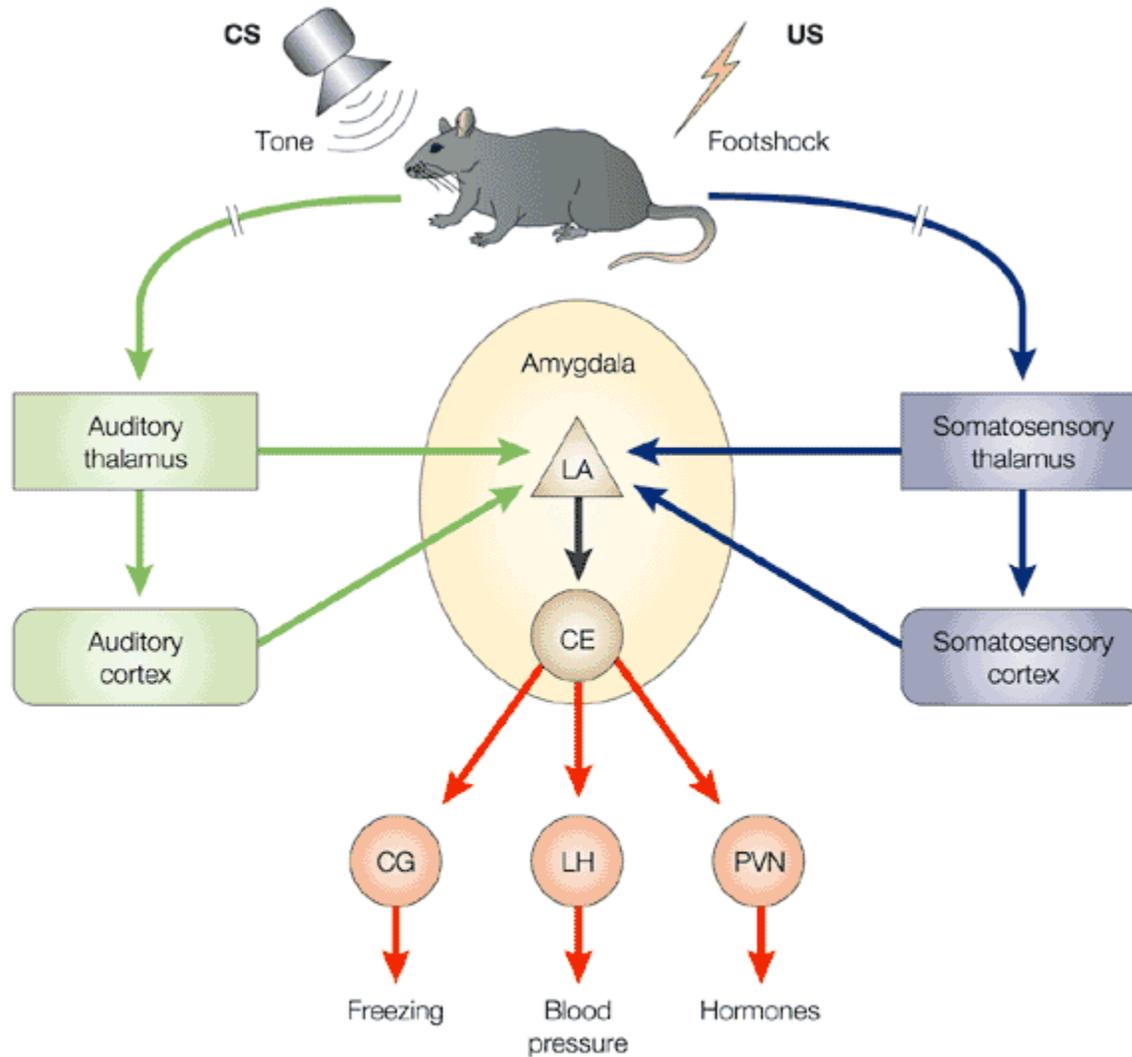
# Animal Models of Fear

- The Amygdala has been studied extensively with respect to its role in fear.
- The relationship of the amygdala to its constituent neural circuitry has been well examined with respect to fear.

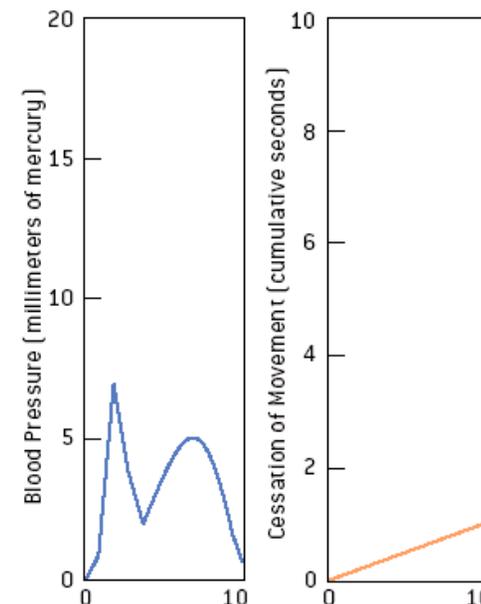
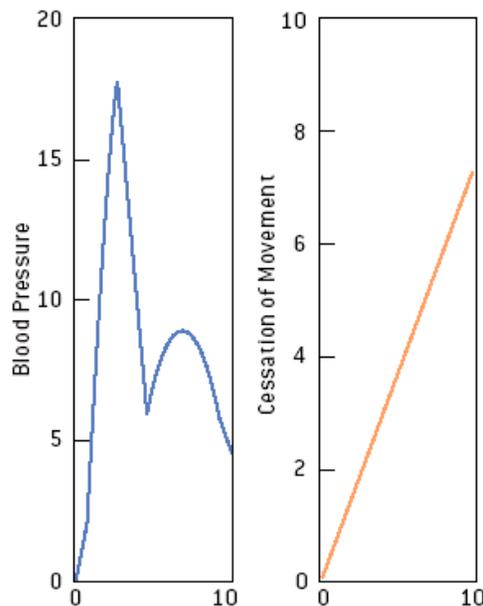
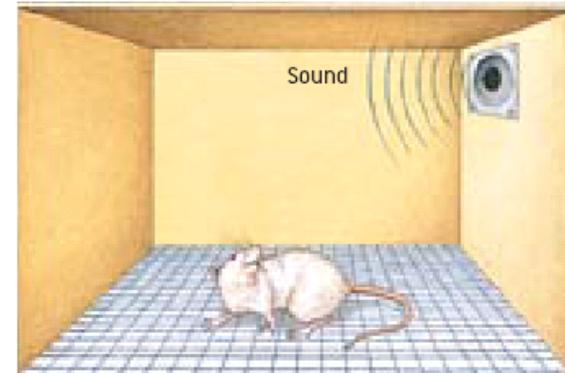
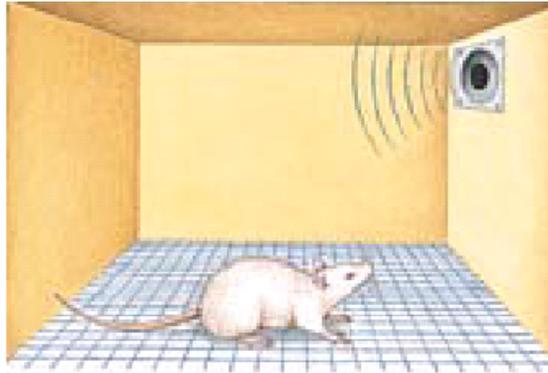
# Fear Conditioning



# Basic “Fear Circuitry”



# Fear responses do not typically persist once mappings between stimuli and outcomes are broken: Extinction



Several trials of the tone-alone (with no shock are given). Intact rats show normal blood pressure and movement to the tone. following this (extinction) training.

# Extinction of Fear Memories

- Extinction of fear represents either new learning or a reduction in the salience of old fear memories.
- Research from Quirk's lab demonstrates that extinction is likely mediated by the (infralimbic region) prefrontal cortex,
- This same line of work demonstrates that rats with reduced prefrontal cortex volume (in the infralimbic region) fail to extinguish fear memories.
- Also, neurons in this region demonstrate differential responding during learning and extinction, whereas neurons in the amygdala do not differentiate between these conditions.

## Is PTSD a Persistent State?

According to [DSM-IV](#), symptoms that appear within the first month of the trauma are not called PTSD but [Acute stress disorder](#). If there is no improvement of symptoms after a month, PTSD is diagnosed. PTSD is divided into three categories: *Acute* PTSD subsides within three months. If symptoms persist, the diagnosis is changed to *chronic* PTSD.

# Fear Learning and Extinction

- The anatomical relationship between the amygdala and the prefrontal cortex is critical in maintaining appropriate responding to stimuli associated with fearful outcomes. This appears to be true in rodents and in primates.

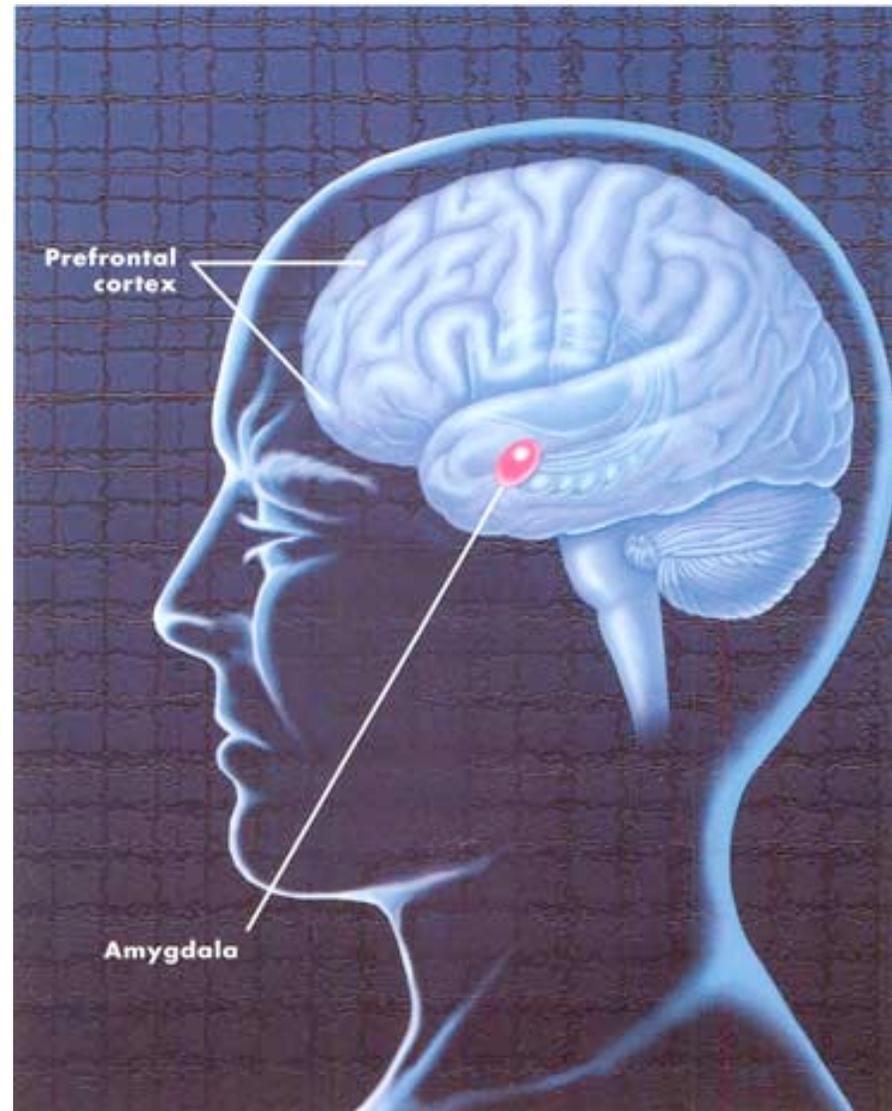
# What does this mean for PTSD?

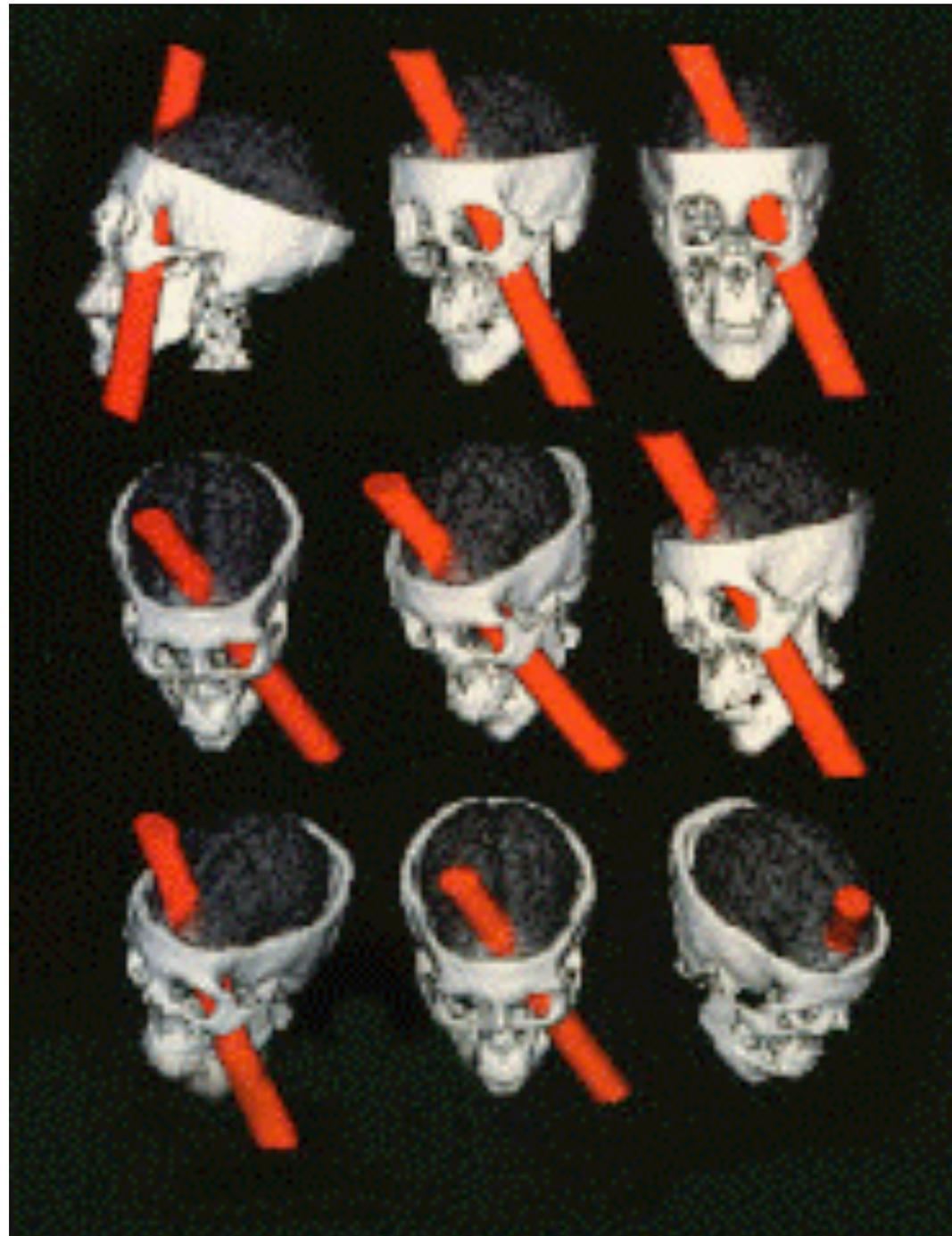
- Rather than only considering the amygdala and temporal lobe systems of patients with PTSD, it is critical to also examine the role of the prefrontal cortex in this disease.
- PTSD was formerly considered overlearning of Fear. This may be correct, but the addition of a failure to downregulate the fear response must also be considered.

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# Rage





# The Case of Phineas Gage

An explosion projected a tamping rod through his left cheek. Miraculously, he recovered and had “normal intelligence”.

Months later, however, Gage began to have startling changes in personality and in mood.

He became extravagant and anti-social, a fullmouth and a liar with bad manners, and could no longer hold a job or plan his future.

He was quick to anger and often got into fights.

"The equilibrium between his intellectual faculties and animal propensities seems to have been destroyed." - Harlow

# A Role for the Prefrontal Cortex in RAGE

- One recent study reports that children who received damage to their prefrontal cortex before age seven, developed abnormal social behavior, characterized by an inability to control their frustration, anger and aggression.
- A brain imaging study of murderers found evidence that, on average, the prefrontal cortex as well as some deeper brain areas, including the amygdala, functioned abnormally.
- Impaired activity in prefrontal cortex and the amygdala also appeared in a preliminary examination of psychopaths with extensive criminal records who, as a group, are generally prone to violence.

# Summary of Findings

- These findings reinforce the view that emotional self-regulation is normally implemented by a neural circuit comprising various prefrontal regions and subcortical limbic structures.
- This mirrors the importance of anatomical circuitry between the amygdala and prefrontal structures in other types of affect or emotion.