Transforming Traumatic Memory with EMDR:

Insights into how and why EMDR may work

Ruth Lanius, MD, PhD
Harris-Woodman Chair
Professor of Psychiatry
University of Western Ontario
Canada

Collaborators

- PTSD Research Team: Matt Brown, Maria Densmore, Sherain Harricharan, Anne Joynt, Chantelle Lloyd, Nancy Mazza, Andrew Nicholson, Stephanie Nevill, Isadora Olive, Daniela Rabellino, Suzy Southwell, Janine Thome, Barbara Whelan

- Others: Paul Frewen, Robyn Bluhm, Wendy D'Andrea, Rosi Kluetsch, Margaret McKinnon, Tomas Ros, Caro Steuwe, Greg Siegle, Mischa Tursich, Bessel van der Kolk

Objectives

- Describe the effects of trauma on psychopathology, attachment, and the self
- Discuss the nature of traumatic memory
- Discuss the neural circuitry of eye movements
- Describe the effects of eye movements on the neural circuitry underlying emotion regulation and the sense of self

The Attachment Relationship Shapes How We Perceive Our Internal and External Worlds

How We Process Internal & External Sensory Experience When

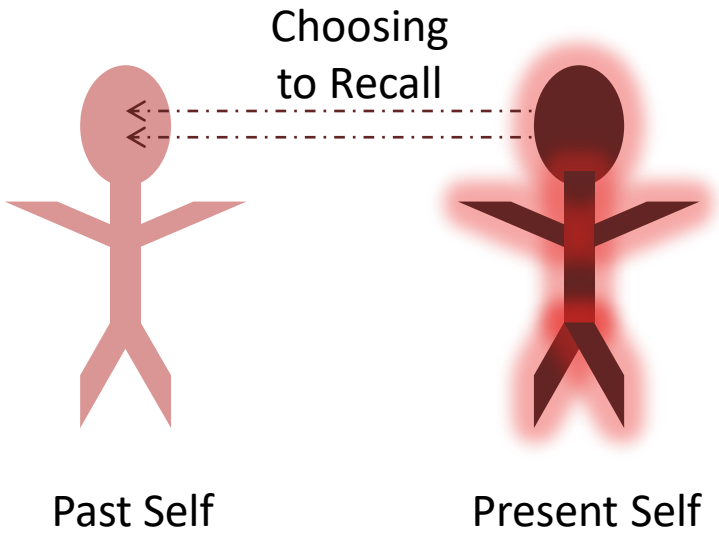
Feeling

Safe and Unsafe

The more repetitive the traumatic experience or the attachment dysregulation, the greater likelihood of experiencing poor sensory integration and developing severe emotion dysregulation, dissociation, and self dysfunction…

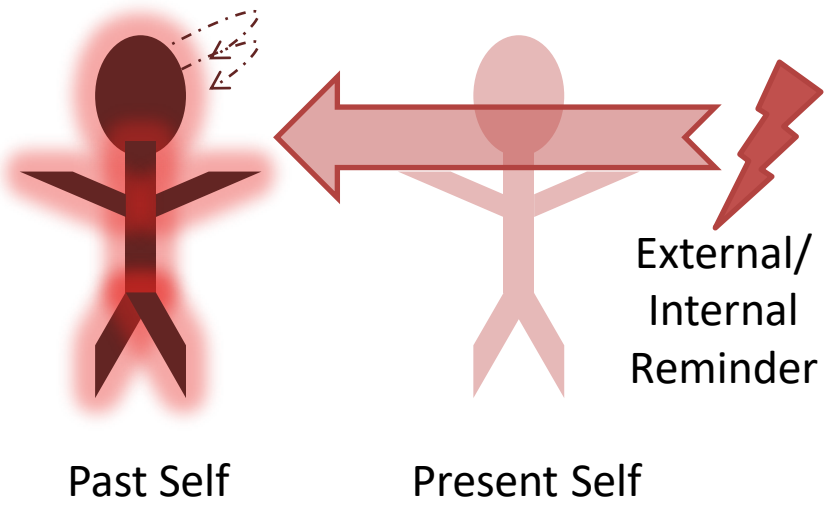
Liotti, Putnam

Remembering



Mental Time Travel and Absorption in Recall is 'Partial'. The "I"-Ego resides in the Present Self. Attention is directed, *by choice*, from Present Self to Past Self. The experience is of being in the present, and remembering the past (autonoesis). Awareness of Present Self is thus maintained; the representation of the Present Self outweighs that of the Past Self. Referring to 'mental time travel', in effect, the present self travels back to visit a past self. Considered part of normal waking consciousness.

Reliving



Mental Time Travel and Absorption in Recall is 'in Full'. Recall is not by choice but typically prompted by an external event matching a Past Self State and bypassing a weakened representation of Present Self. The "I"-Ego now resides as if *in* the Past Self, and attention is directed from Past Self to itself, with Present Self unattended. The experience is thus of *being in* the past. Awareness of Present Self is reduced; the representation of the Past Self outweighs that of the Present Self. In effect, referring to mental time travel, *"there can be no travel without a traveler".*

Frewen & Lanius, 2015

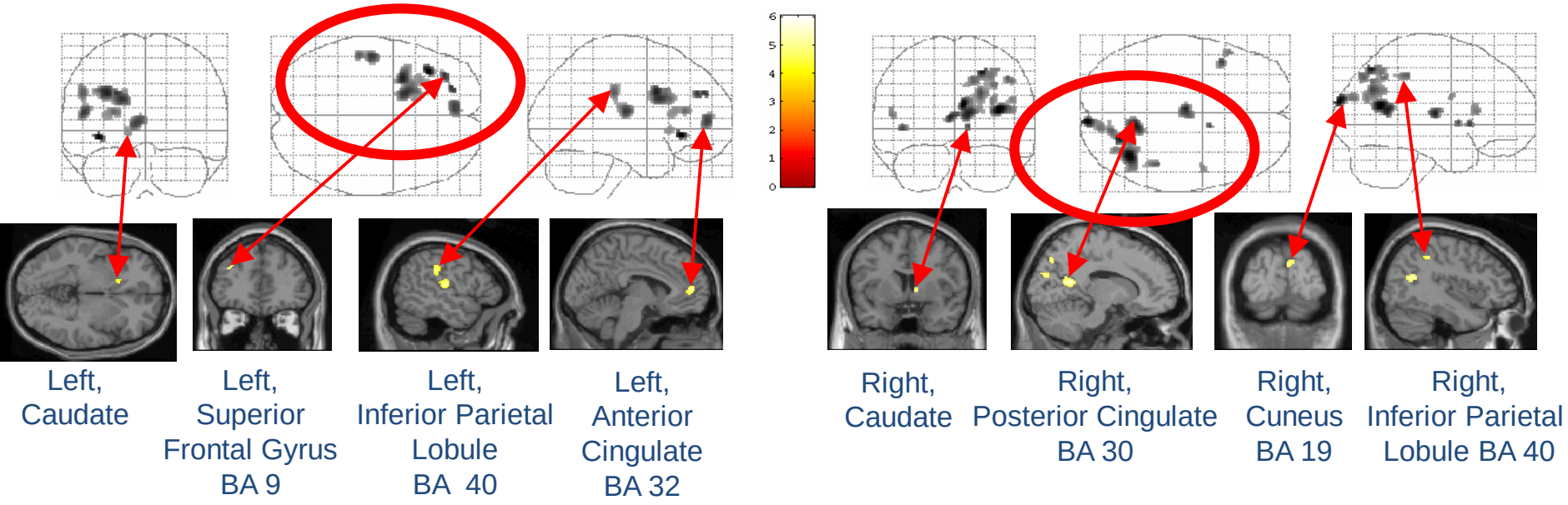
Traumatic Memories are Relived in Form of Sensations

The Neurobiology of Flashbacks: Timeless, Sensory Fragments

Van der Kolk & Fisler, 1995; Brewin et al., 1996

Functional Connectivity Analyses [-14 -16 4] CONTROL (n=11) versus Flashback/Reliving (n=13)

Sense of Time



Left, Caudate

Left, Superior Frontal Gyrus BA 9

Left, Inferior Parietal Lobule BA 40

Left, Anterior Cingulate BA 32

Right, Caudate

Right, Posterior Cingulate BA 30

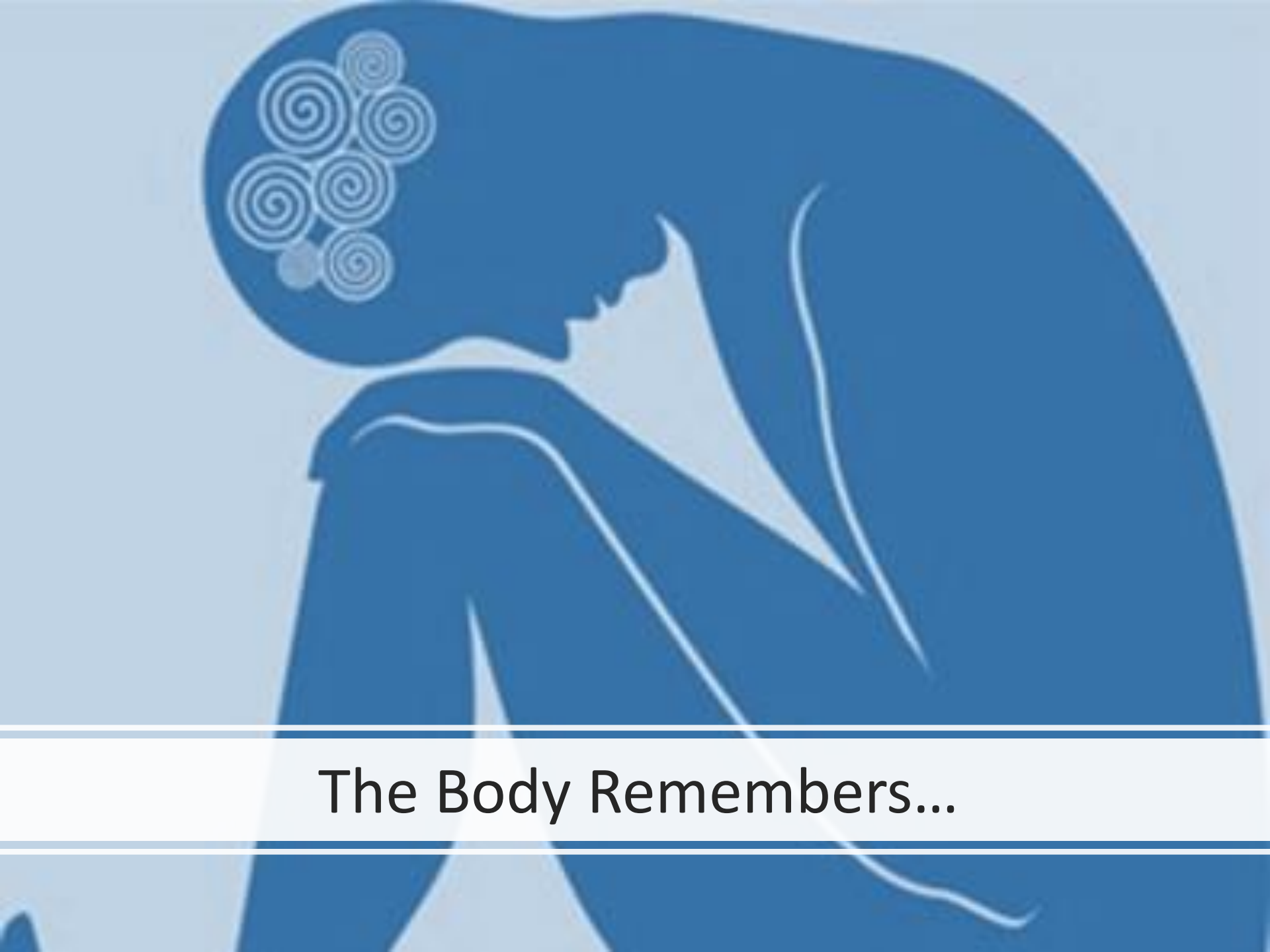
Right, Cuneus BA 19

Right, Inferior Parietal Lobule BA 40

Control > PTSD

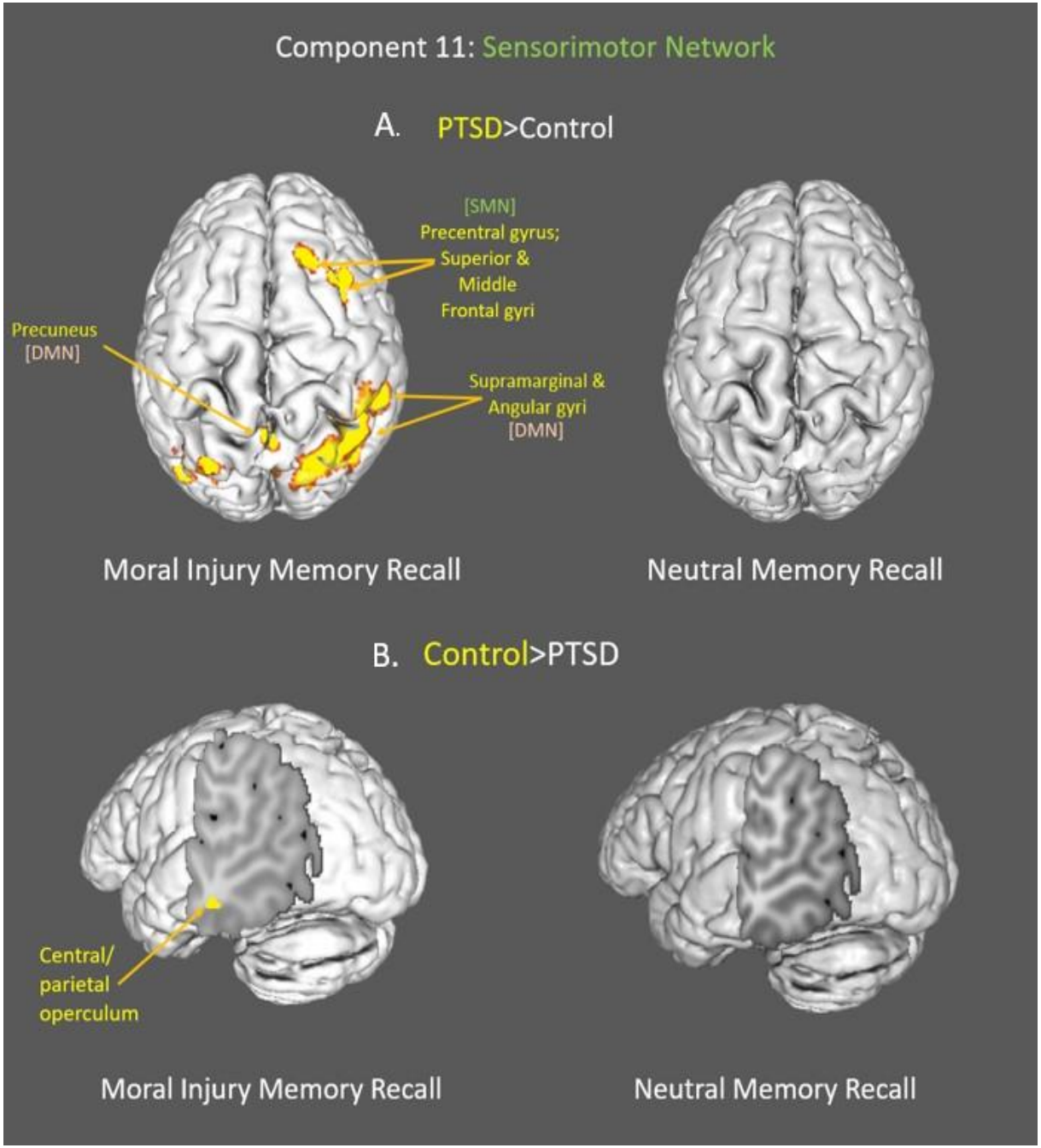
PTSD > Control

Lanius et al., AJP, 2004



The Body Remembers…

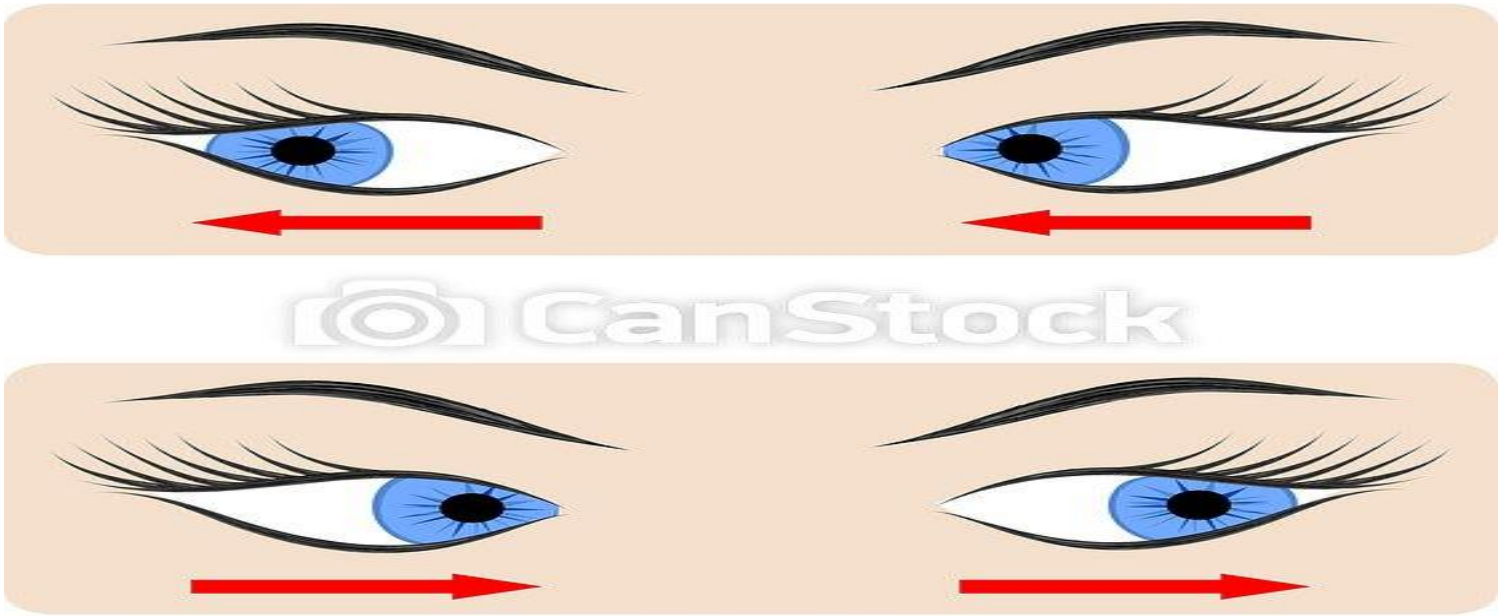
But how?



Kearney et al., 2023

How can we transform traumatic memories with EMDR?

Brain Correlates of Horizontal Eye Movements While Recalling a Traumatic Memory…

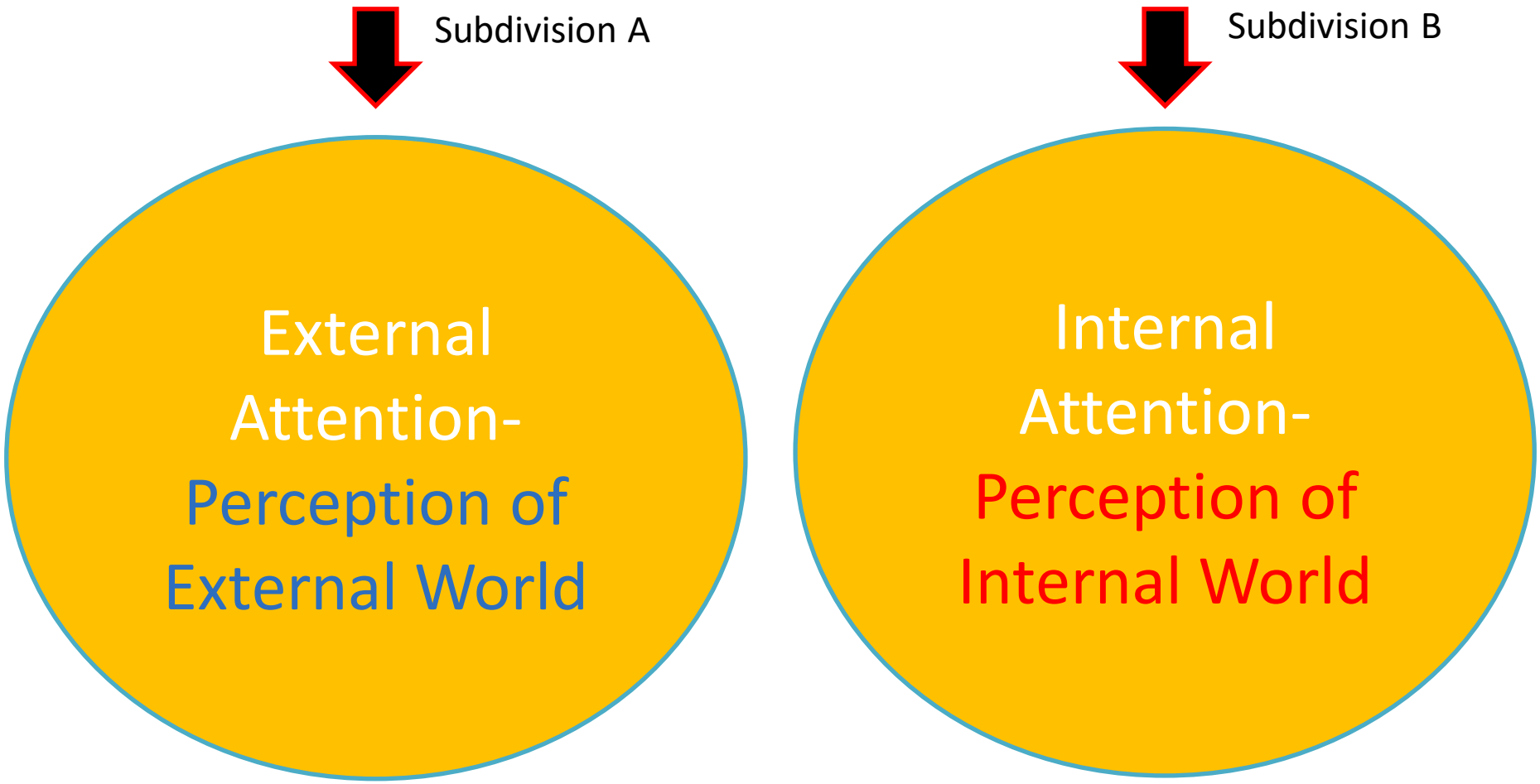


The frontoparietal control brain network has 2 subdivisions:

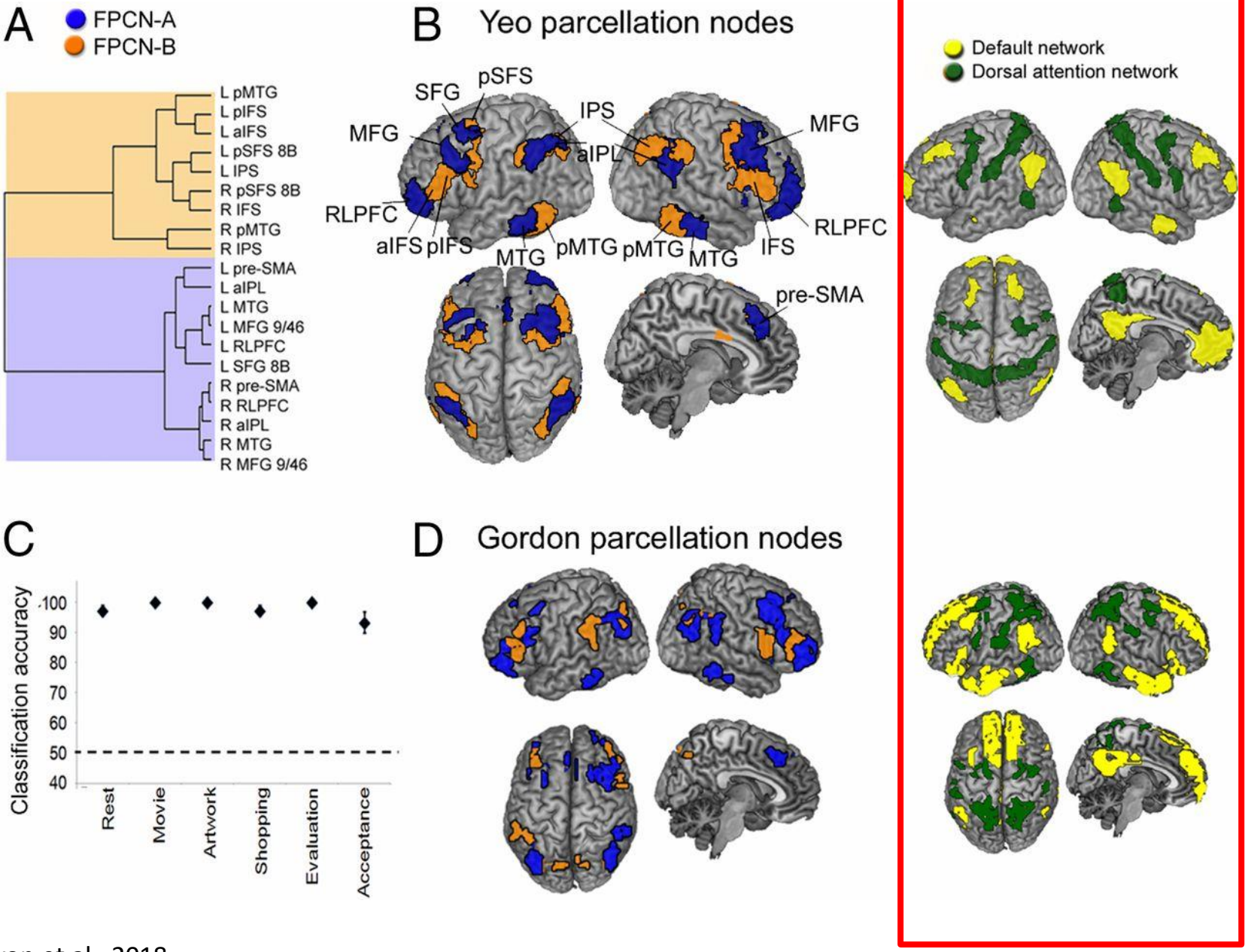
a) connected to brain networks involved in external attention

b) connected to brain networks involved in internal attention

Frontoparietal Control Brain Network



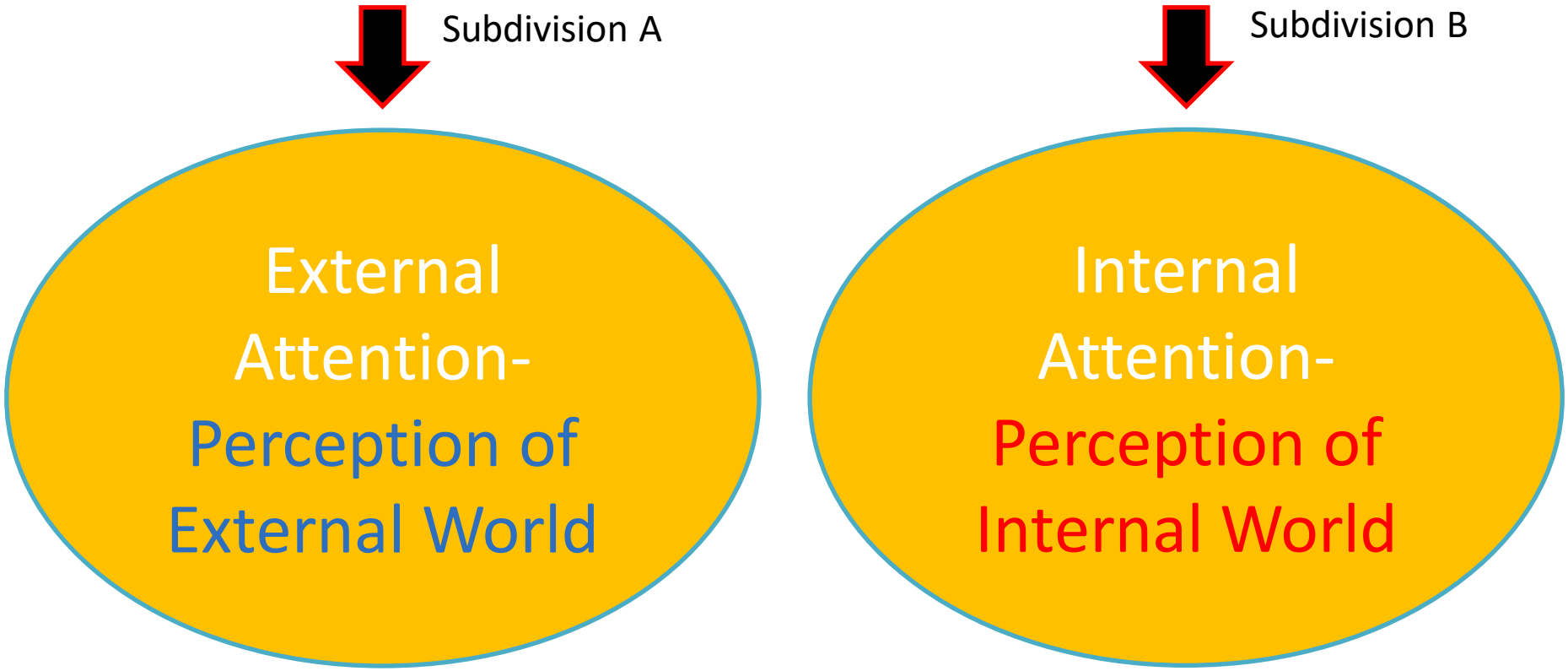
Dixon et al., 2018



Dixon et al., 2018

Eye movements engage

Frontoparietal Control Brain Network

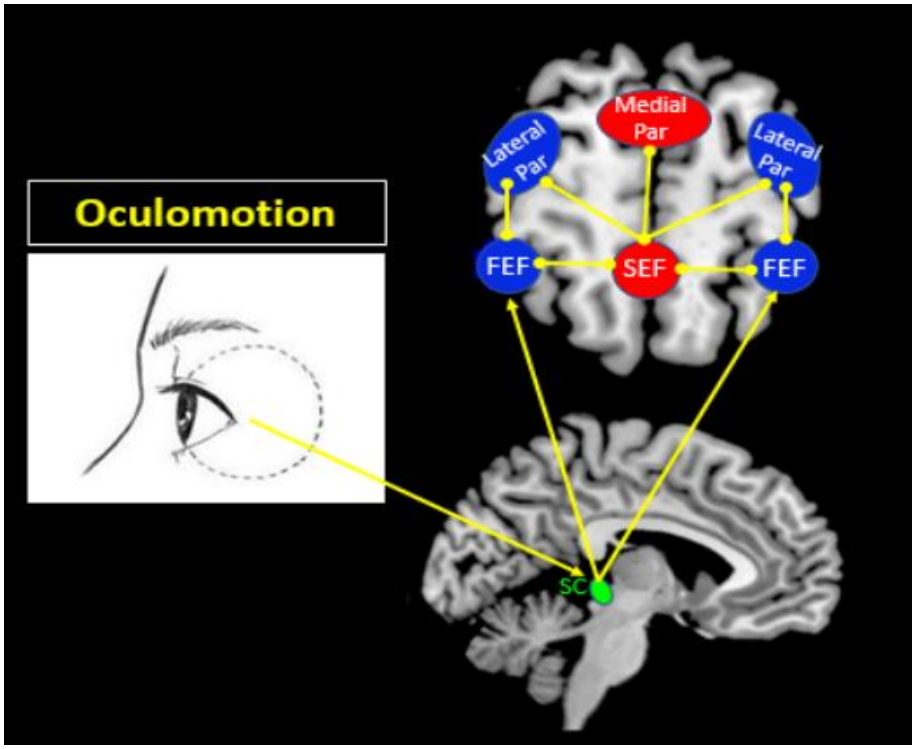


Two subdivisions may work in tandem to facilitate top down emotion regulation

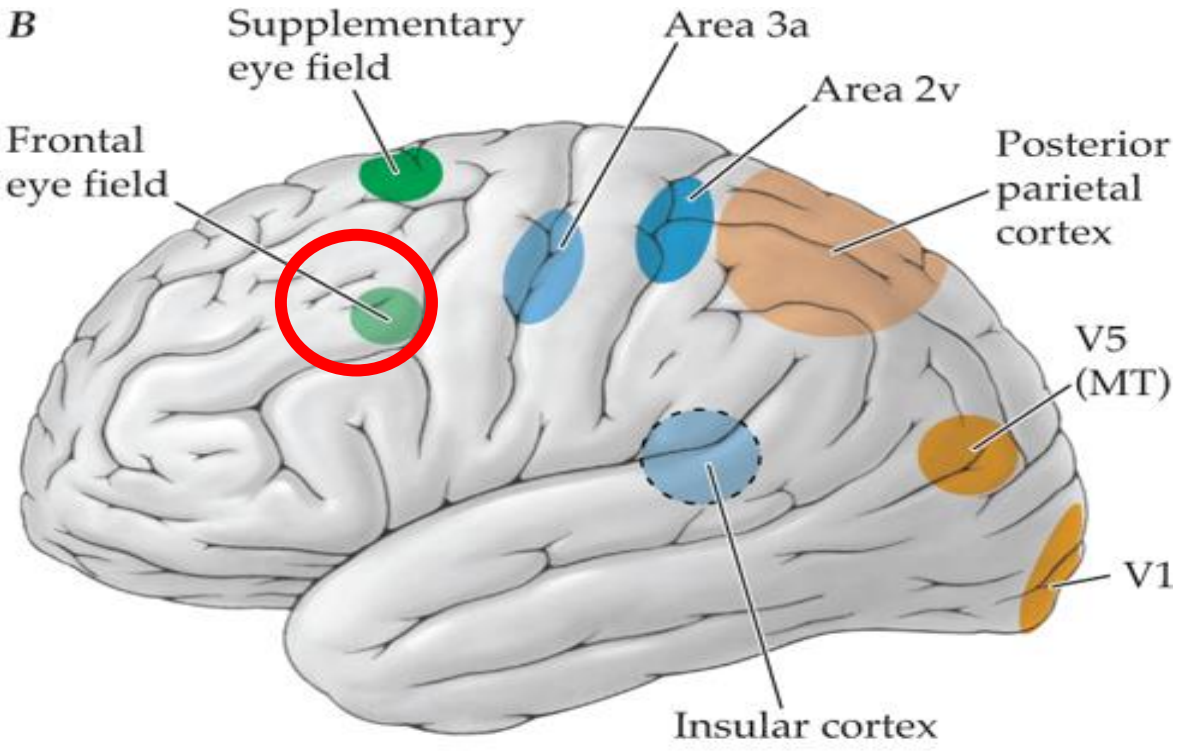
Brain Connectivity of Two Regions in the Frontoparietal Network:

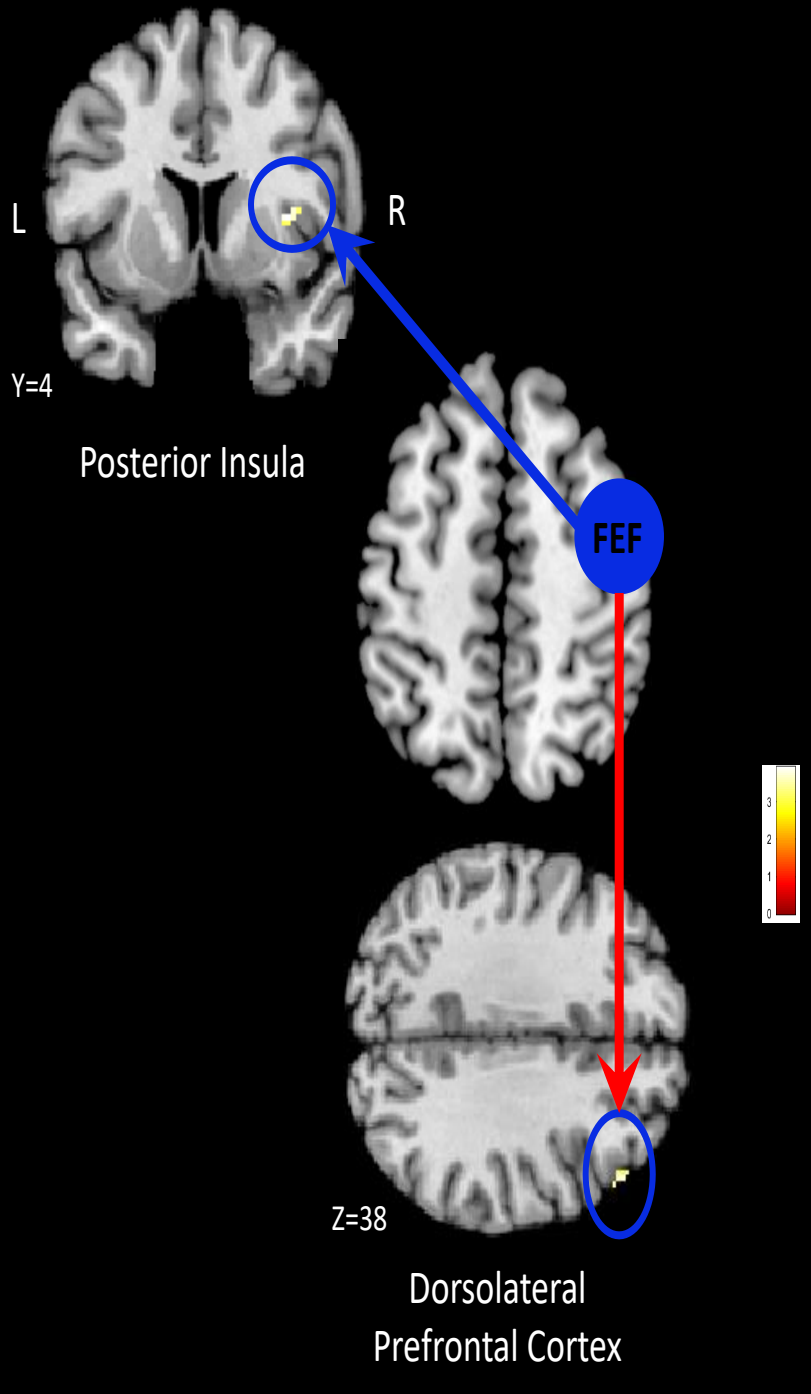
1) Frontal Eye Field

2) Supplemental Eye Field



Frontal Eye Field Connectivity During Horizontal Eye Movements





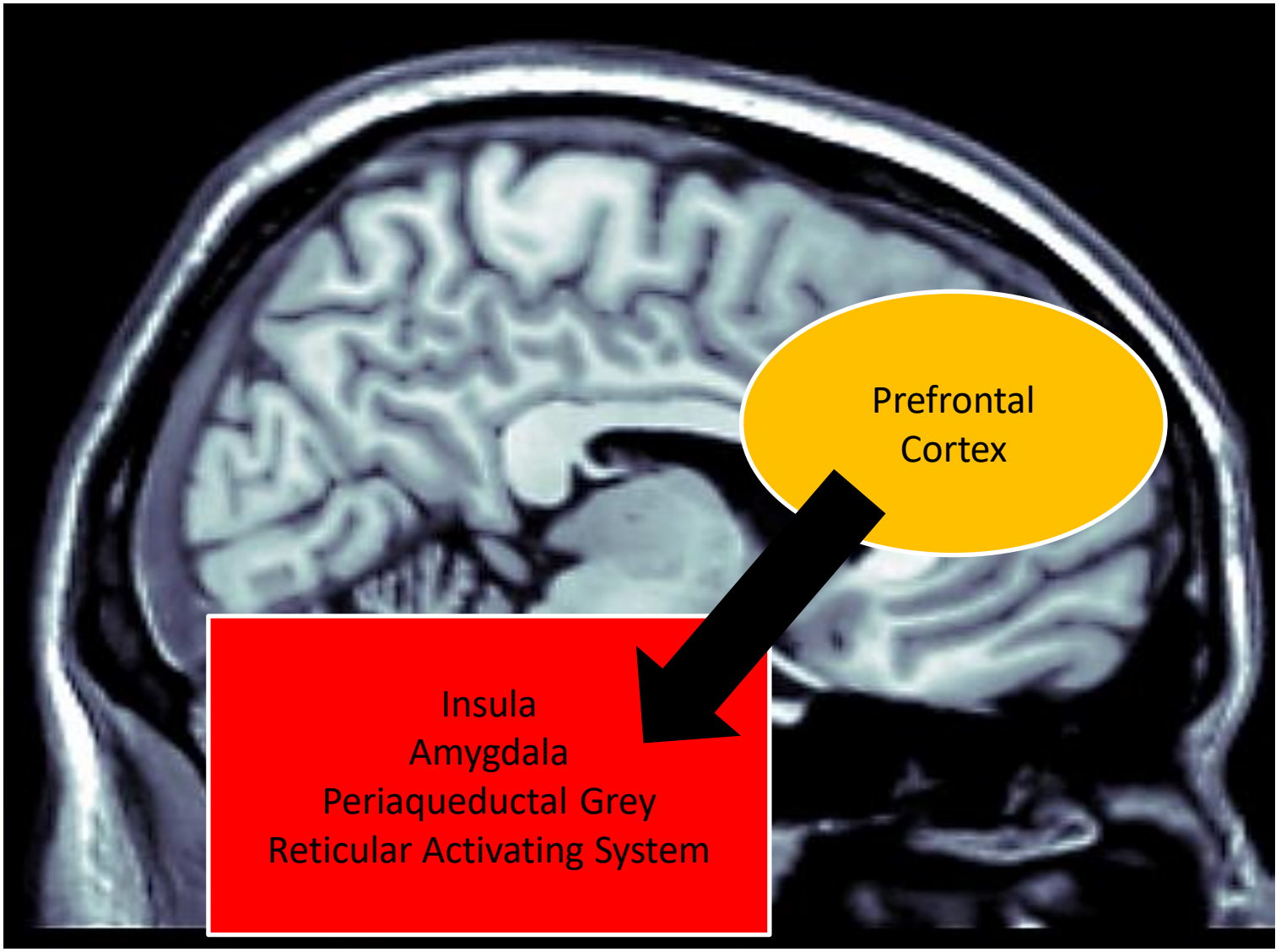
Traumatic/Stressful Memory Recall

Control>PTSD
Smooth Pursuit Eye Movements

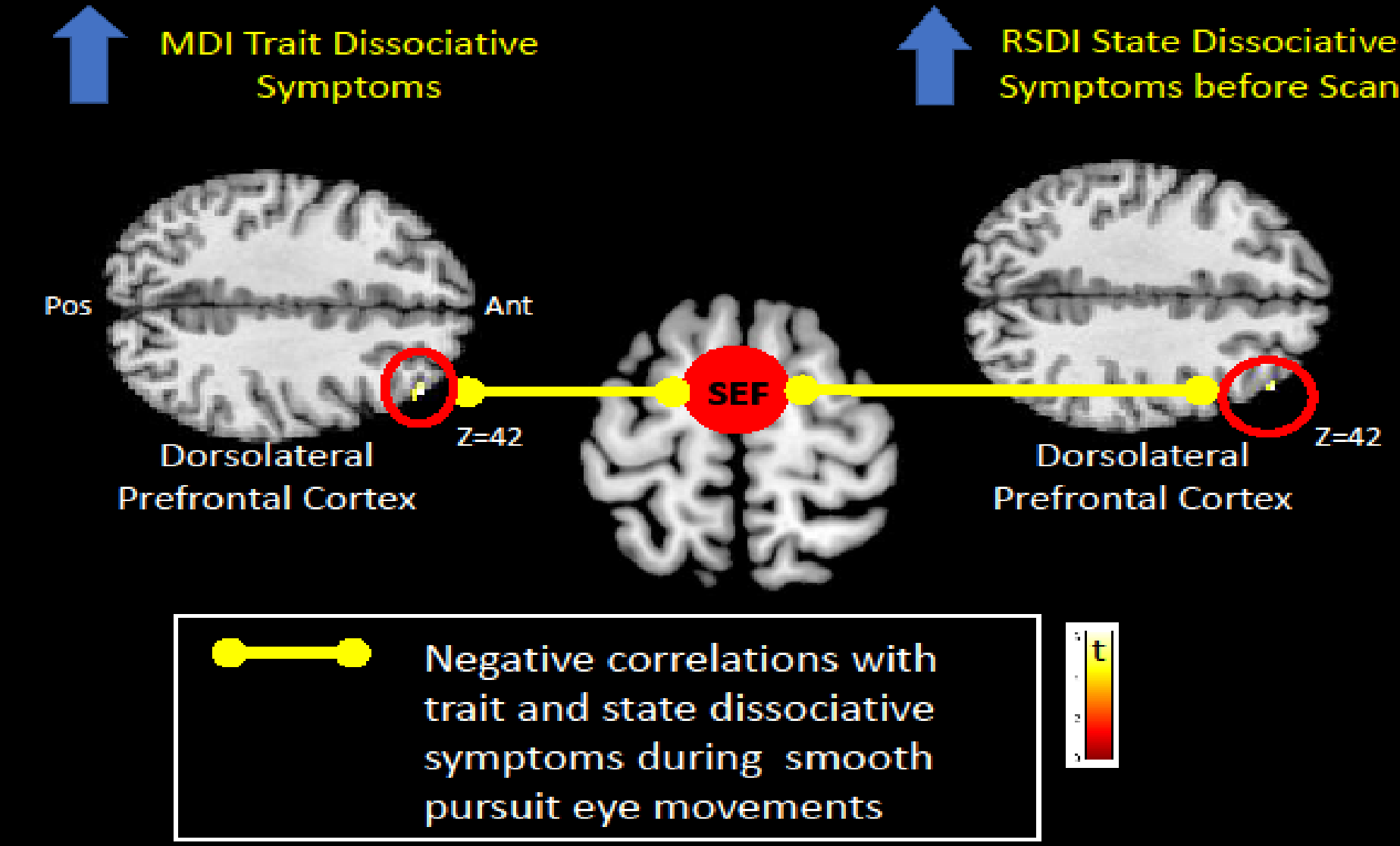
PTSD>Control
Smooth Pursuit Eye Movements

*Results are based on comparisons to no oculomotor stimuli (implicit baseline).

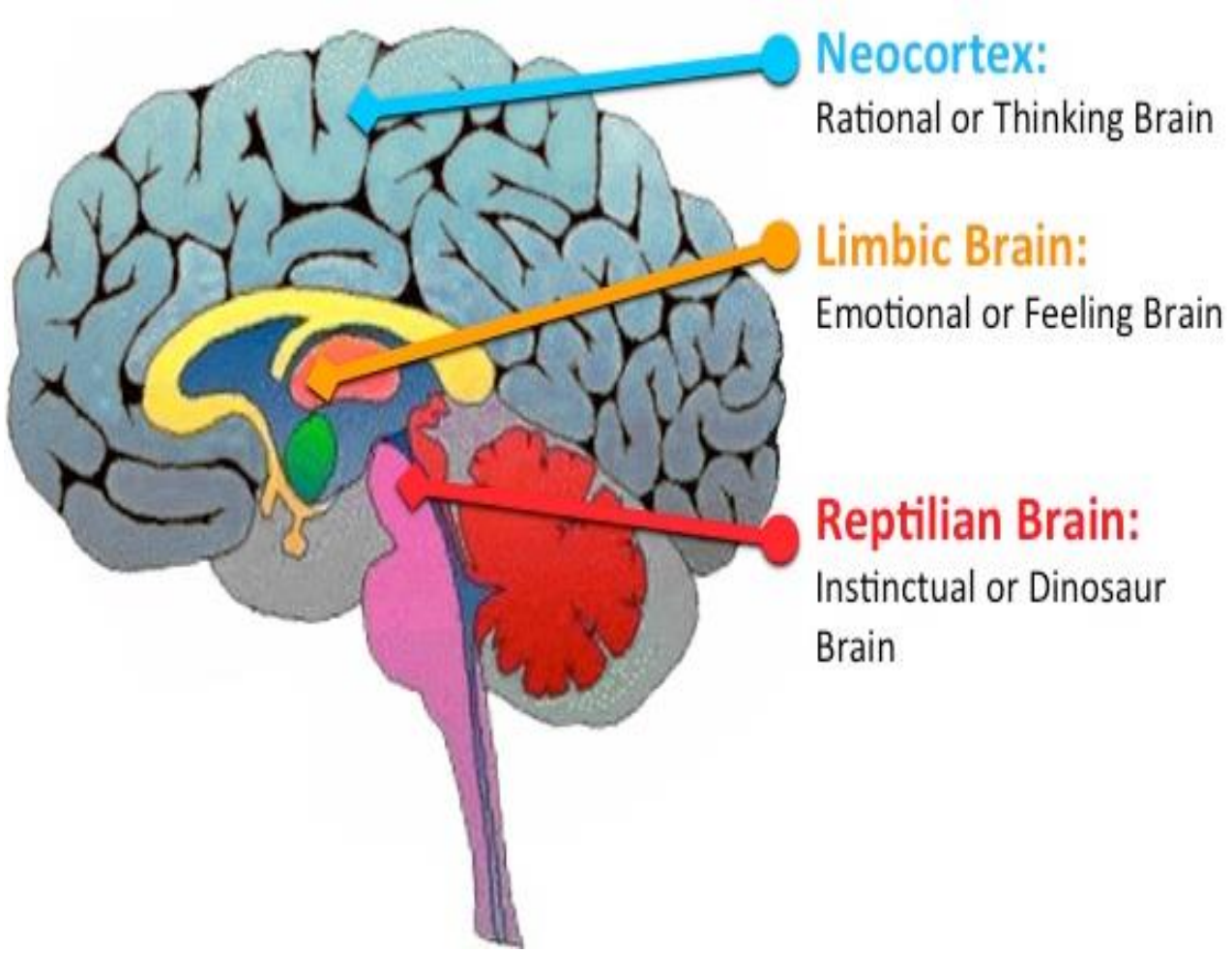
Top-Down Emotion Regulation



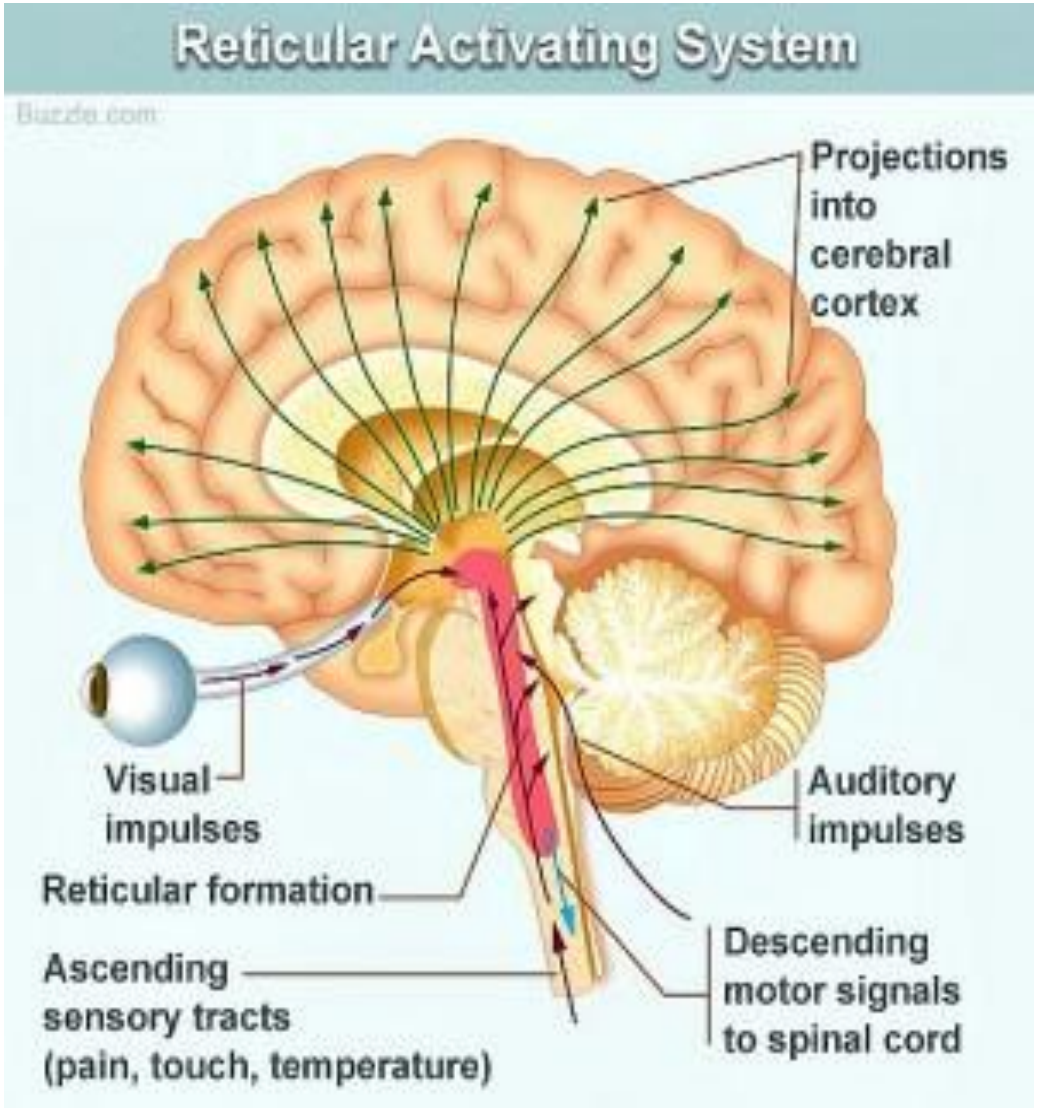
The Effects of Dissociation…


MDI Trait Dissociative Symptoms
RSDI State Dissociative Symptoms before Scan
Pos
Ant
SEF
Z=42
Z=42
Dorsolateral Prefrontal Cortex
Dorsolateral Prefrontal Cortex
Negative correlations with trait and state dissociative symptoms during smooth pursuit eye movements
t

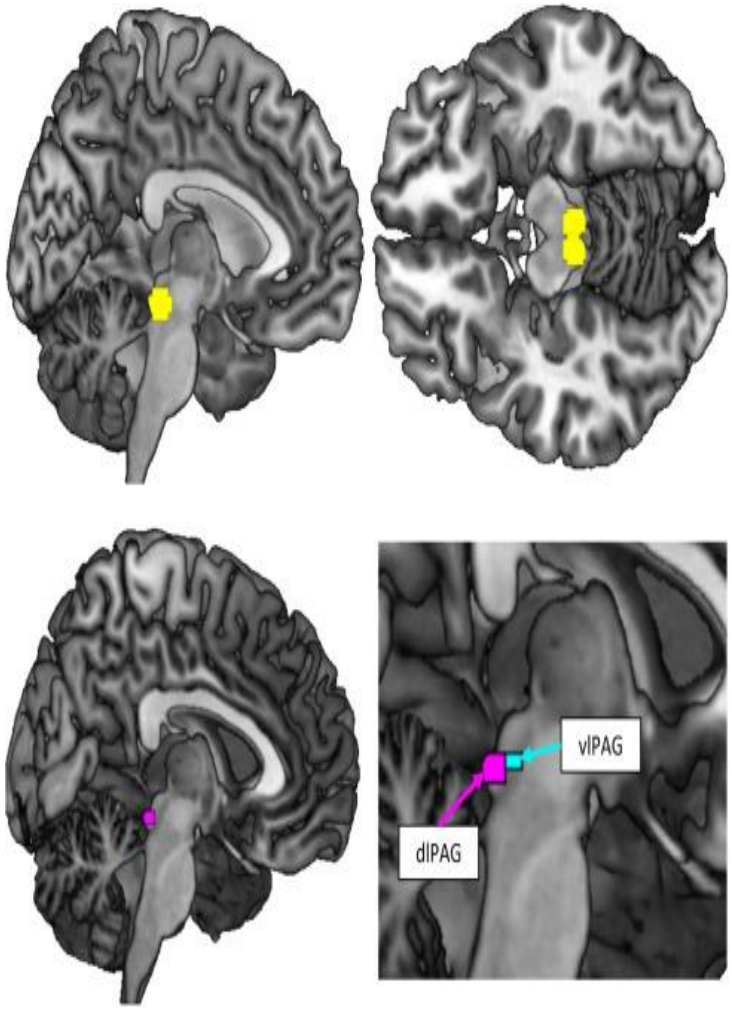
Top-down Regulation of Limbic and Survival/Reptilian Brain



Reticular Activating System



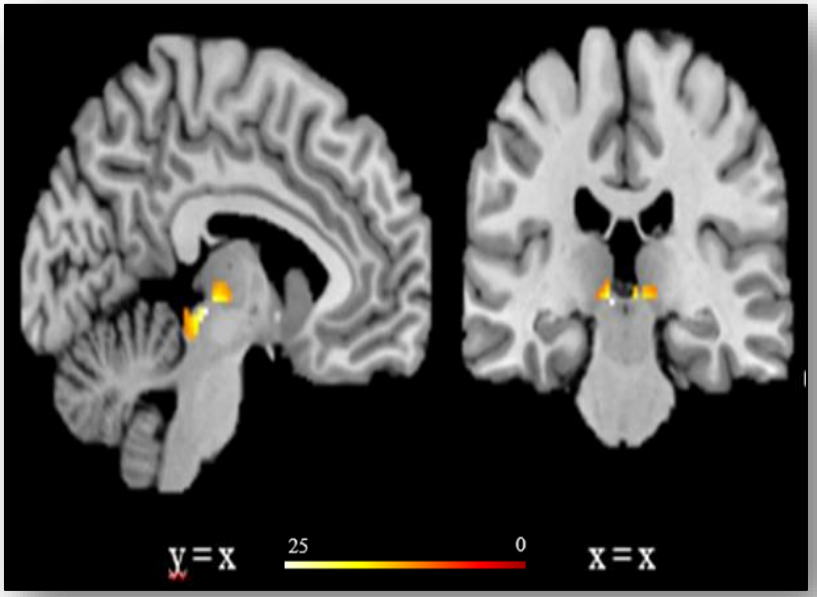
Periaqueductal Gray (PAG)



- Small tube-shaped region in midbrain
- Critical for autonomic regulation and for defensive responses
- Crucial role in basic emotional systems
- Comprised of multiple subdivisions that vary in function

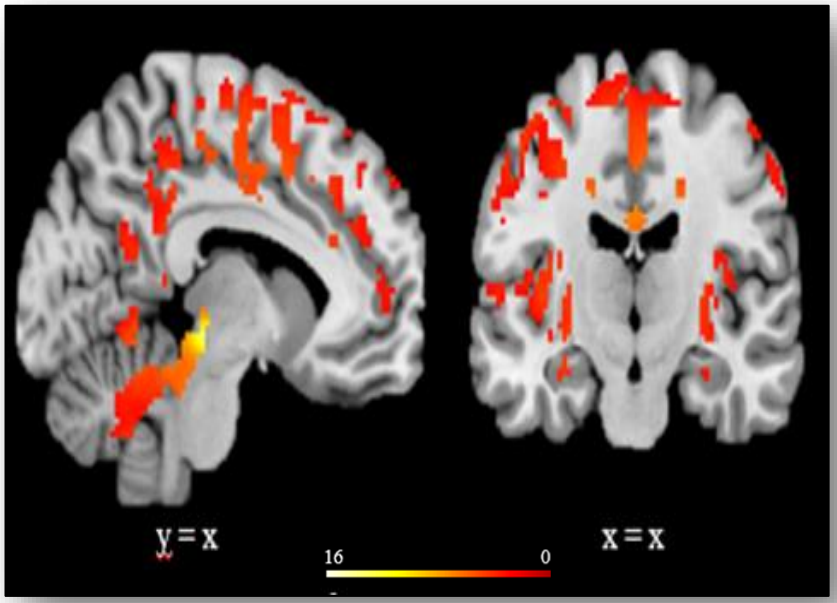
PAG Seed Region

Resting State Connectivity



Control

n = 41



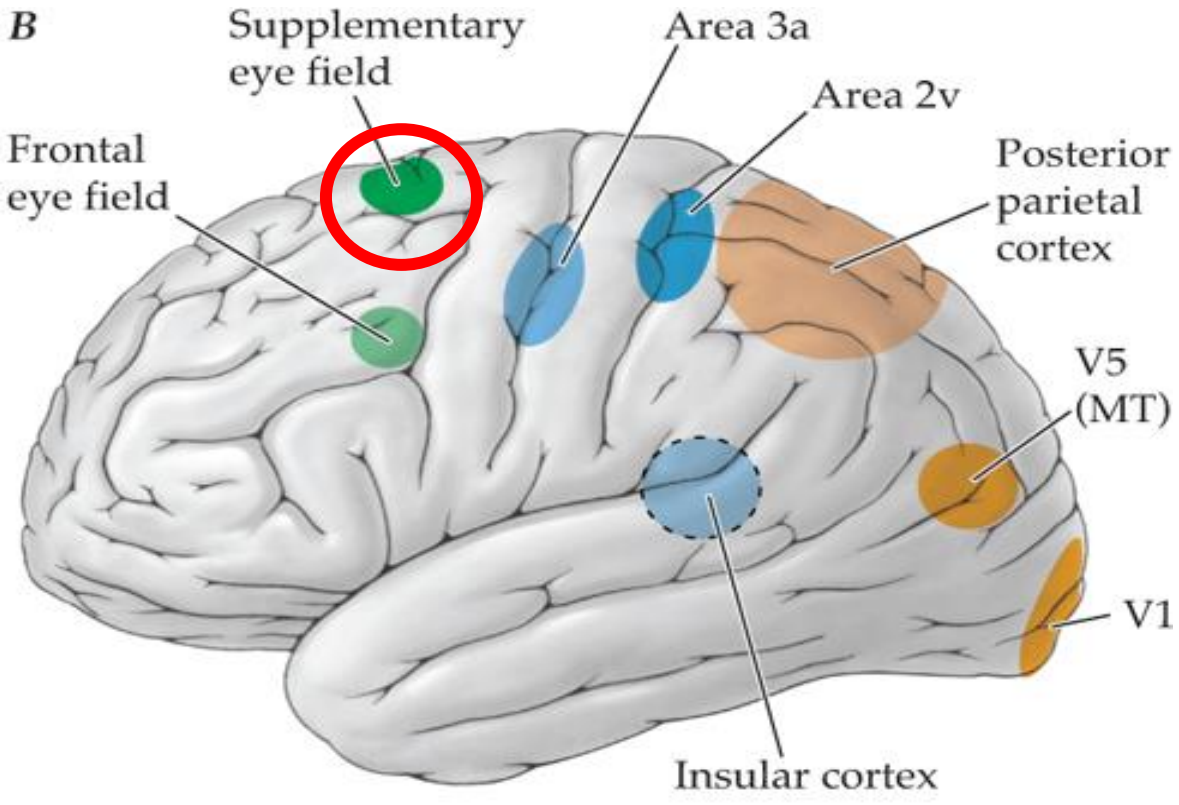
PTSD

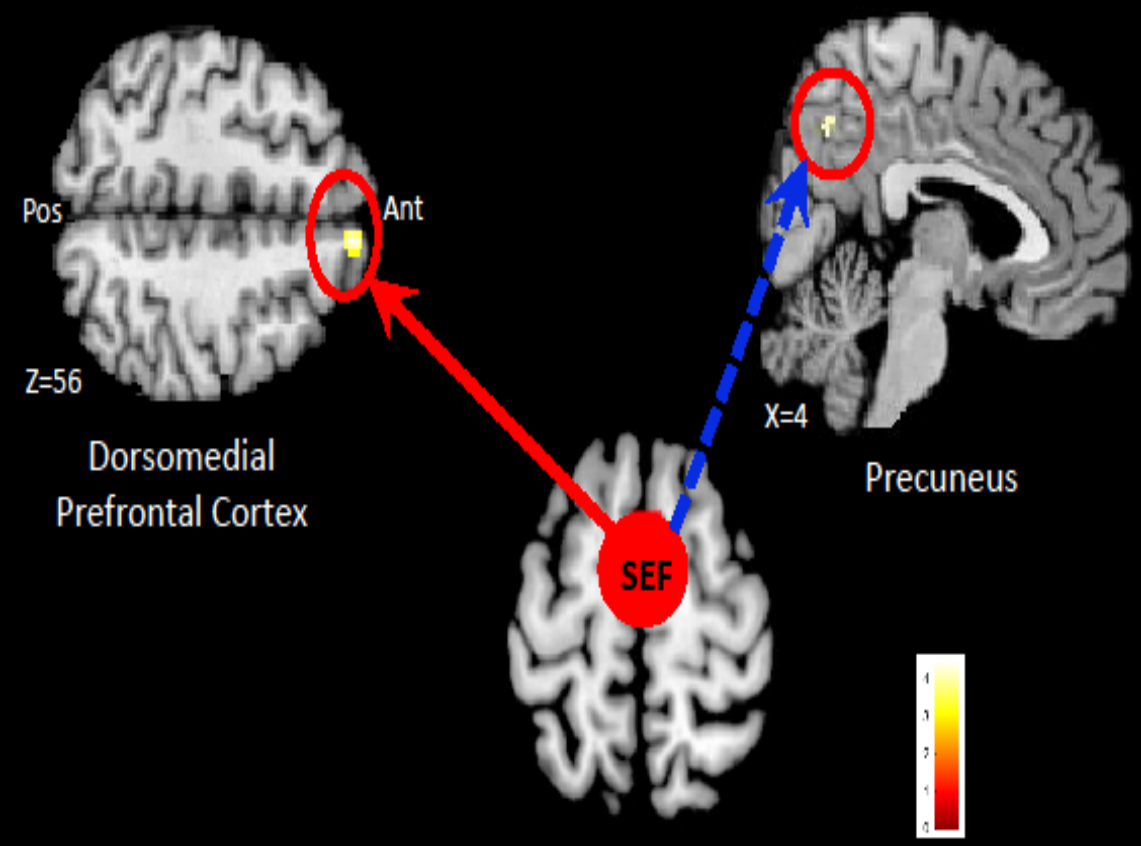
n = 57

- Increased connectivity in areas involving emotional reactivity such as **amygdala, anterior cingulate cortex, insula, cerebellum** (Adolphs et al., 1994; Bush et al., 2000; Stein et al., 2007; Turner et al., 2007)

Thome et al., *Human Brain Mapping*, 2016;
Harricharan et al., Brain & Behaviour, 2017

Supplementary Eye Field Connectivity During Horizontal Eye Movements





Traumatic/Stressful Memory Recall

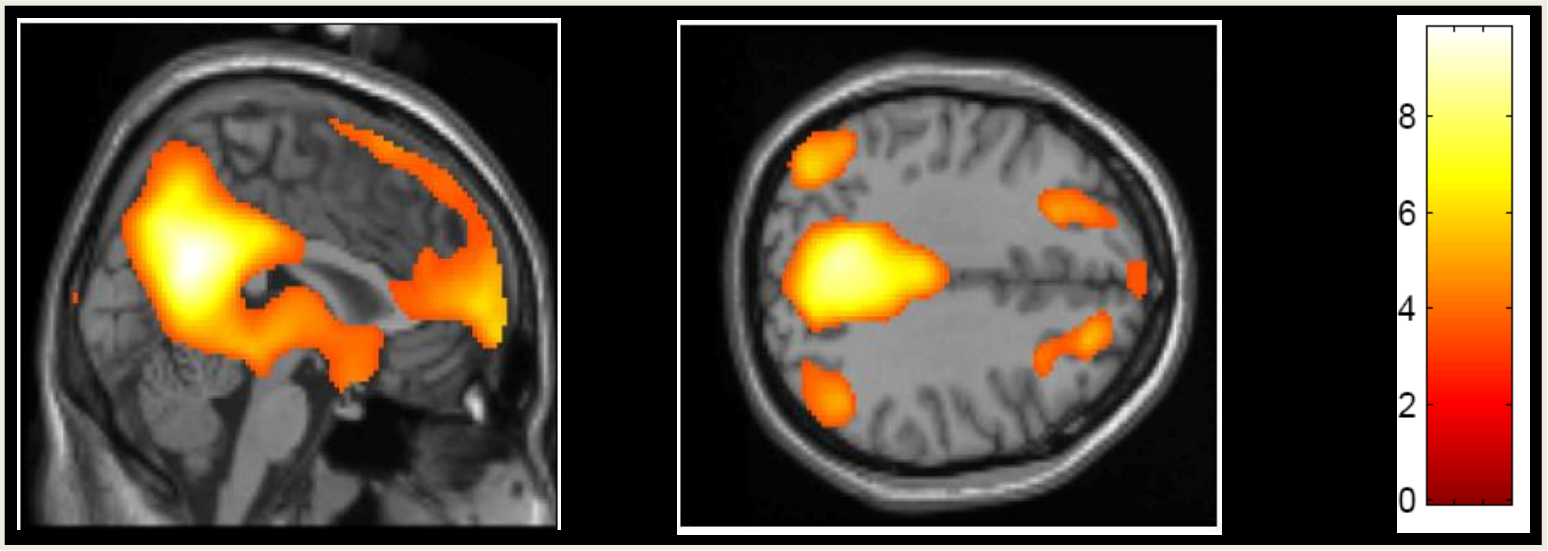
Control>PTSD
Saccadic Eye Movements

PTSD>Control
Smooth Pursuit Eye Movements

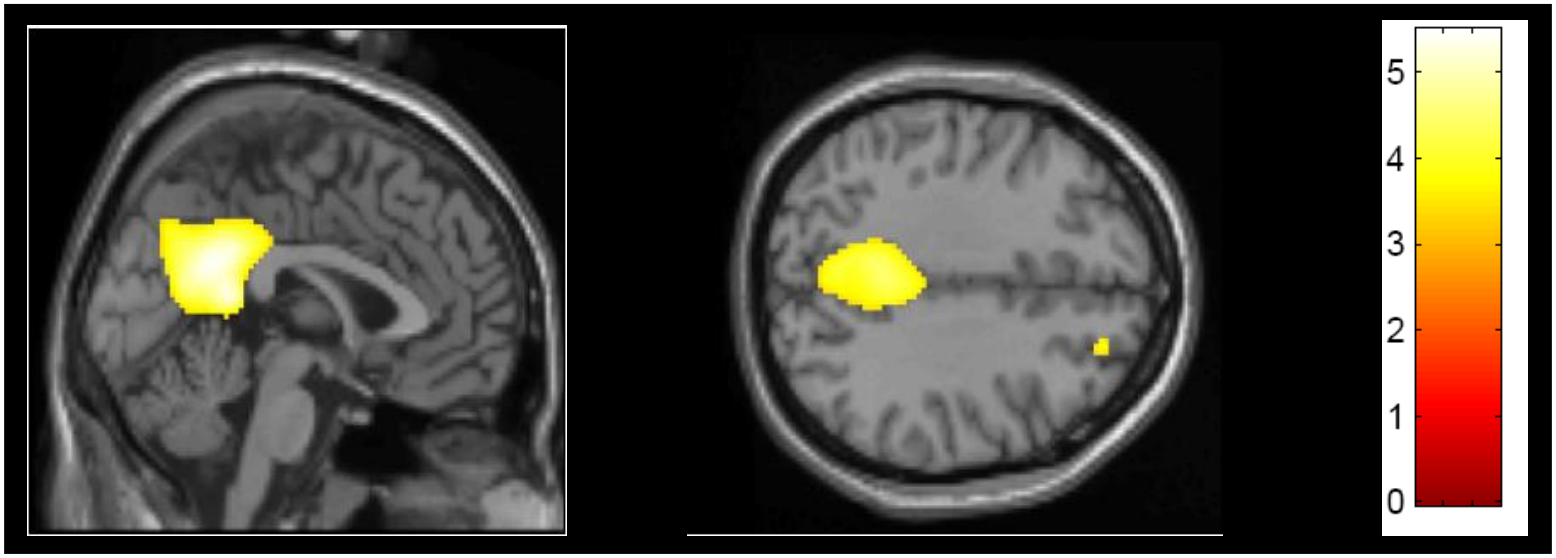
*Results are based on comparisons to no oculomotor stimuli (implicit baseline).

Bringing the Mental Time Traveler Online…

Controls (n=16): Positive Correlation

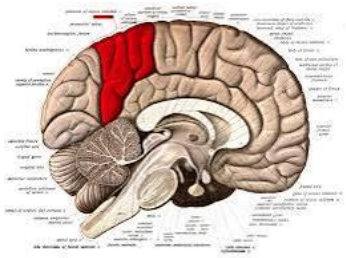


PTSD (n=18): Positive Correlation



Bluhm…Lanius J of Psychiatry & Neuroscience, 2009

Precuneus



- The precuneus is essential for retrieving visuospatial details from both the viewer and the observer perspectives of a memory and is thought to converge these perspectives to provide a combined ego and observer visual mental depiction of an autobiographical memory
- Helps to shape perspective of memory in time and space

Observer Perspective

Viewer Perspective