

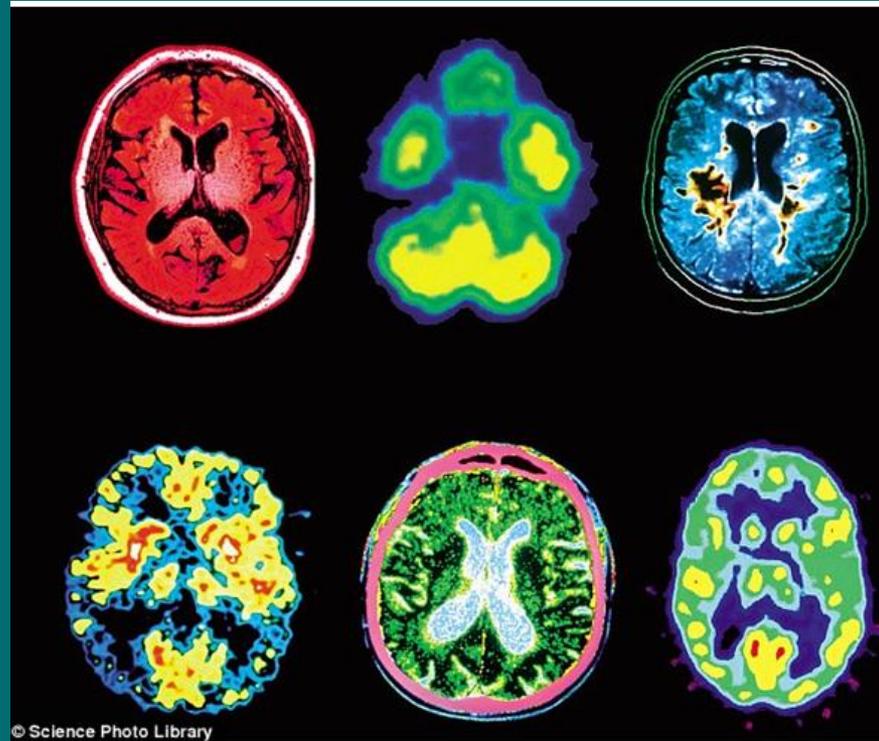
BRAIN ACTIVATION IN RESPONSE TO EMOTIONAL FACIAL EXPRESSIONS IN CHILDREN AND ADOLESCENTS WITH A HISTORY OF MALTREATMENT

Amy Garrett, Ph.D., Victor Carrion, M.D., and Allan Reiss, M.D.
Stanford University School of Medicine
Department of Psychiatry

Center for Interdisciplinary Brain Sciences Research
and
Stanford Early Life Stress Research Program

Dr. Garrett has had no personal or financial relationship in the last 12 months with the manufacturer of the products or services that will be discussed in this CME presentation.”

What does brain imaging research have to do with helping kids?



Ways that we can use brain imaging research to help abused children

- Clarify heterogeneity and subtypes of posttraumatic stress
- Identify biological risk factors/markers
 - Identify susceptible individuals at early stage
 - Develop more targeted interventions
- Track treatment-related changes
- Assess resilience

Case Study - Initial Presentation

Sammy, an 11 year-old boy, was brought to our clinic because of increased aggression toward his siblings. Mom reported that this was very uncharacteristic of Sammy's previous demeanor. She also reported decreased academic performance. Feeling guilty and confused, she reported to the authorities that Sammy's father had regularly abused her and the children physically and emotionally for several years. Sammy had been hit numerous times with metal bars, wooden rods and bamboo sticks. Sammy's mother felt the boy's behavior was directed at her for "breaking the family up"; mom and kids were now living in a new apartment after the father had been arrested and deported. Sammy had nightmares and difficulty sleeping. He scored 32 on the PTSD Reaction Index (moderate PTSD).

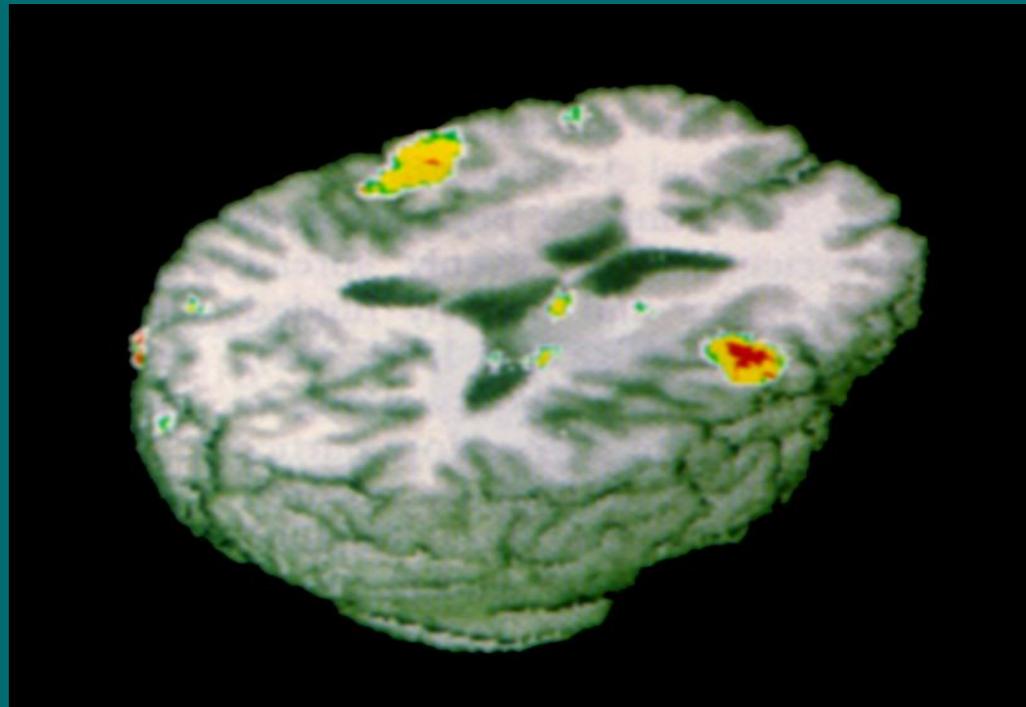
Case Study-Treatment Notes

- ❑ Despite initial resistance, Sammy found relaxation exercises gave him a sense of control and a feeling of calmness. During the aggressive episodes he felt confused, as in a daze and his heart rate would accelerate. After taking out his feelings on his siblings, he would feel guilty and ashamed.
- ❑ Sammy and his mother were introduced to the concept of Traumatic Cues. His father's violence was explored as a fearful event. Cues surrounding this event were most commonly neutral (not good or bad), but were reminders to his brain of the traumatic event. Sammy stated that when mom came home, the slamming of the car door reminded him of his father coming home. His brain associated these cues with aggression, and when exposed to this cue, he would react aggressively
- ❑ Treatment concentrated on changing this association as a means to develop appropriate responses.

PTSD And Abnormal Emotional Responses

- ▣ Heightened autonomic arousal and hypersensitivity to trauma-related cues suggest increased emotional response to some stimuli
- ▣ Restricted range of affect and numbing suggest decreased emotional response to other stimuli
- ▣ Both together suggest problems regulating emotional responses

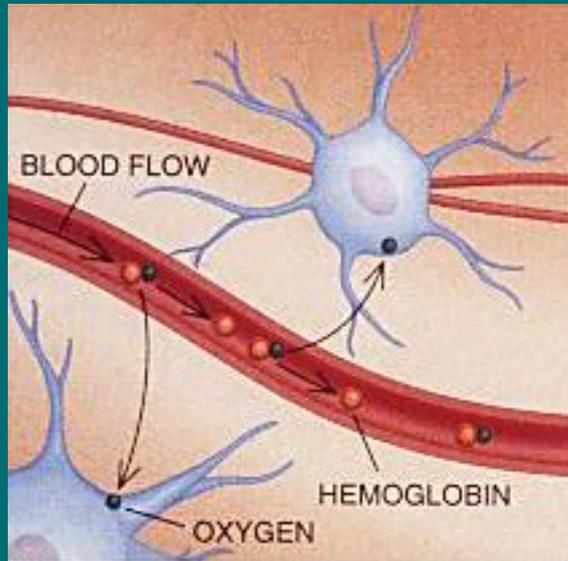
Functional Magnetic Resonance Imaging: Brain activity in response to specific tasks and stimuli



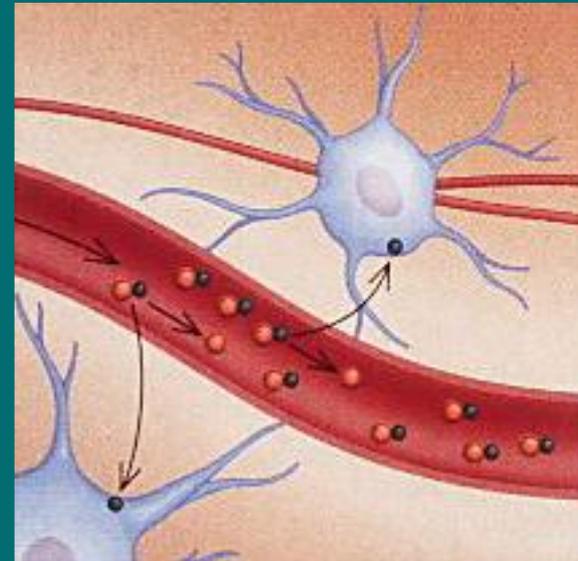


Neurophysiology of fMRI: Blood Oxygenation Level Dependent (BOLD) Contrast

Resting State

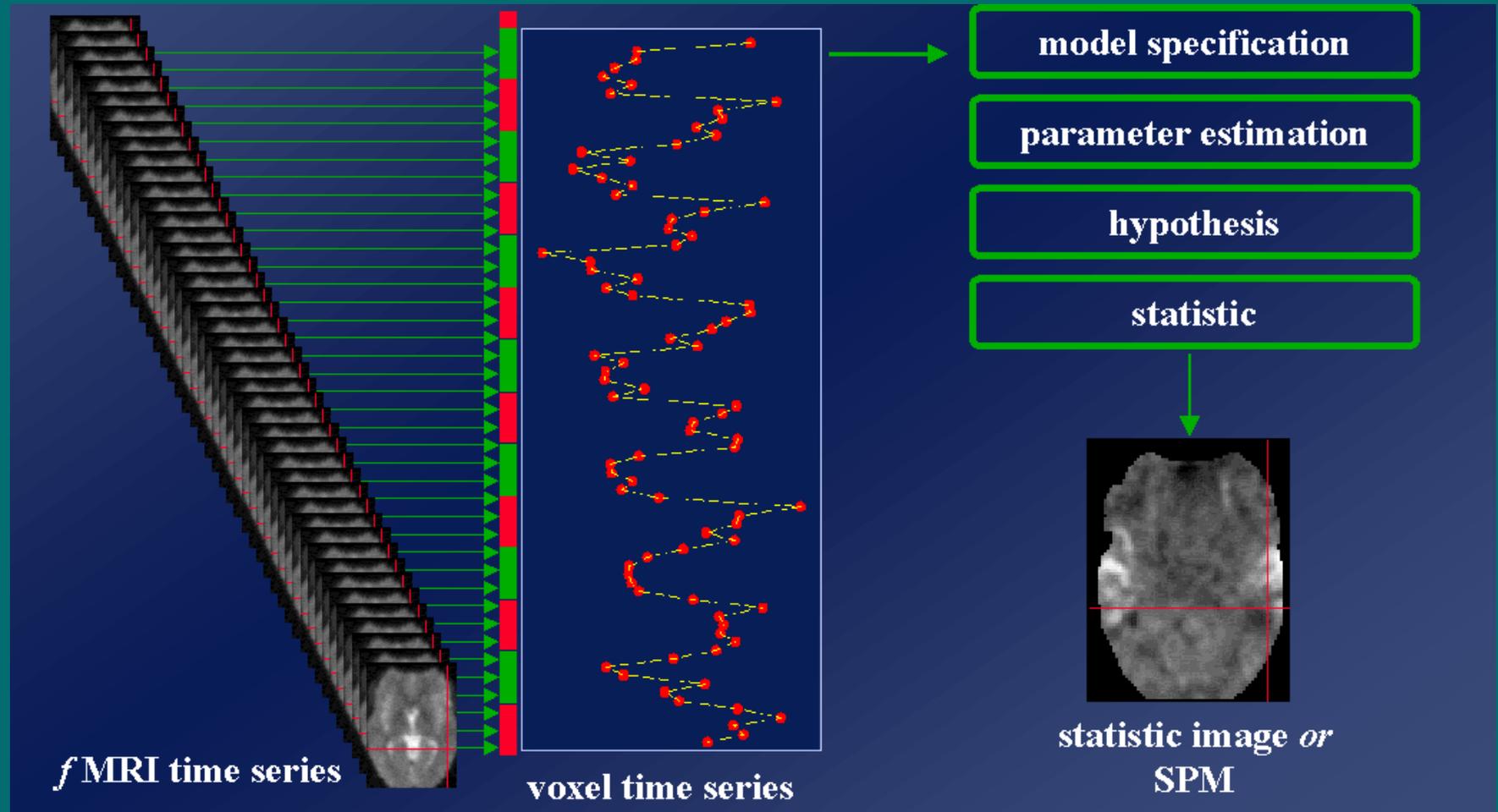


Activated State



During periods of neuronal activity, local blood flow and volume increase with a relatively small change in oxygen consumption. As a result, the oxygen content of the local venous blood is elevated, resulting in an increase in the MR signal.

fMRI Analysis and Interpretation

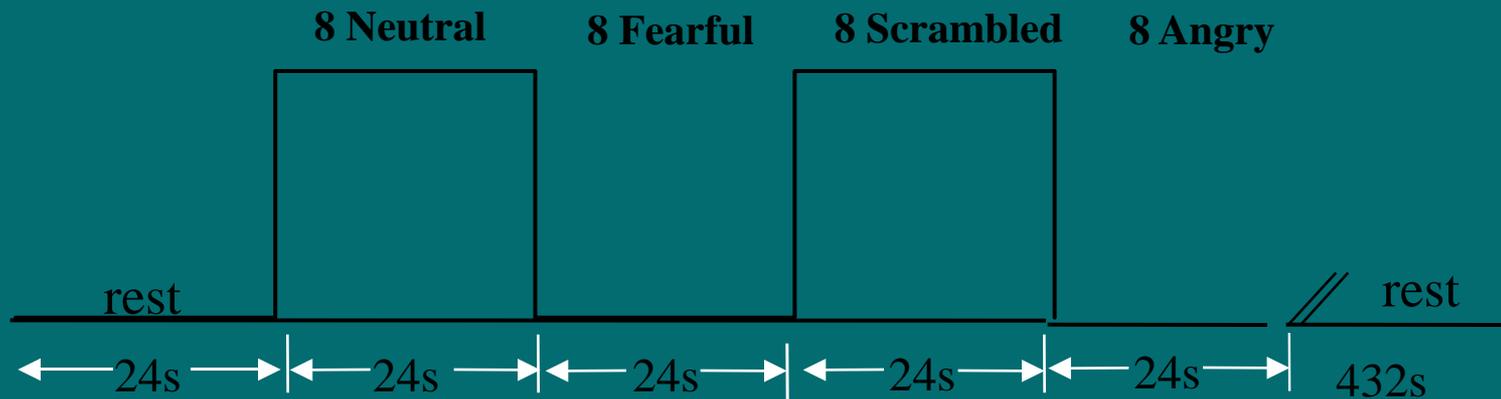


Gender Task

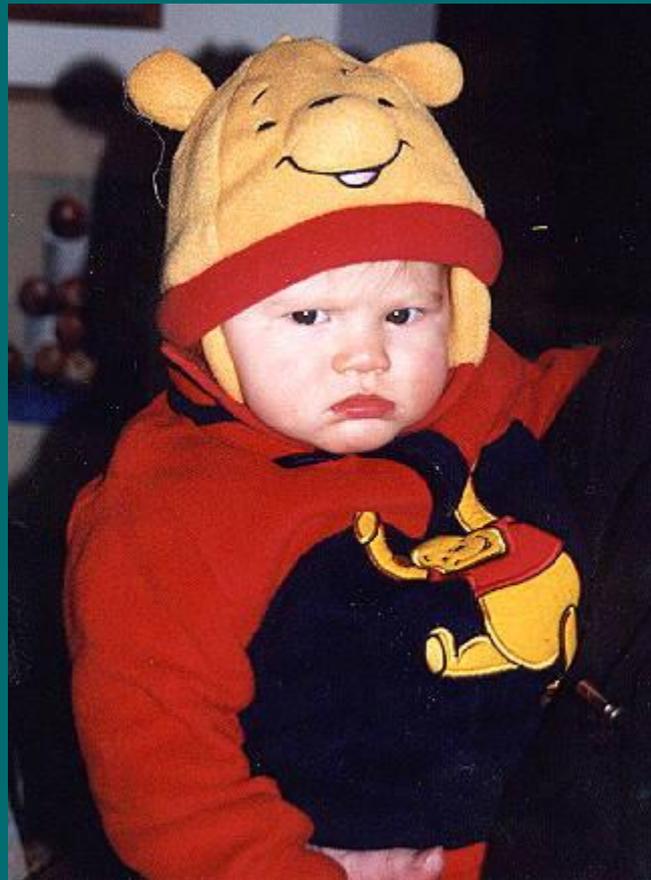
Is the person in the picture a girl or a boy?

Press **1** if girl

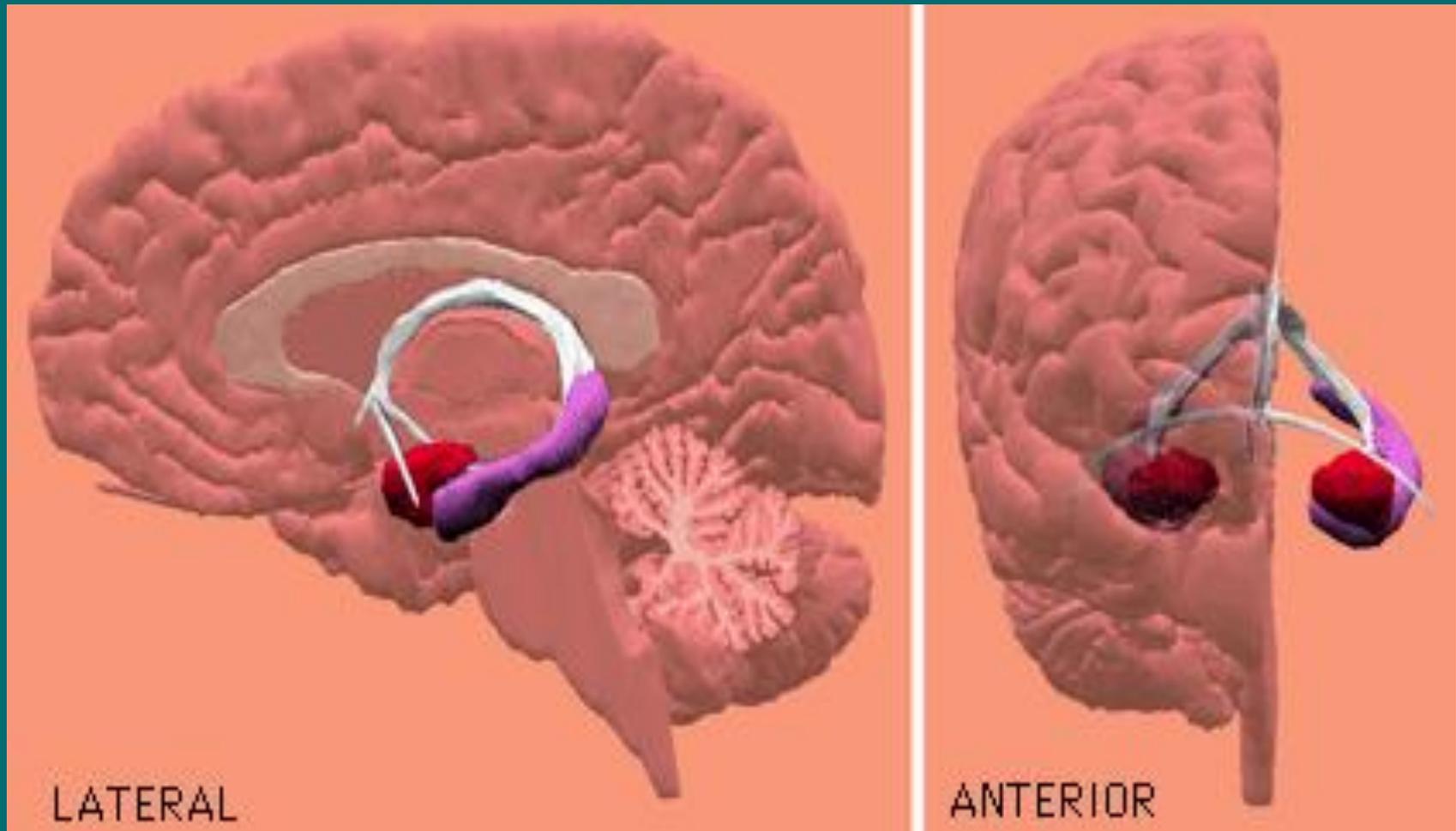
Press **2** if boy



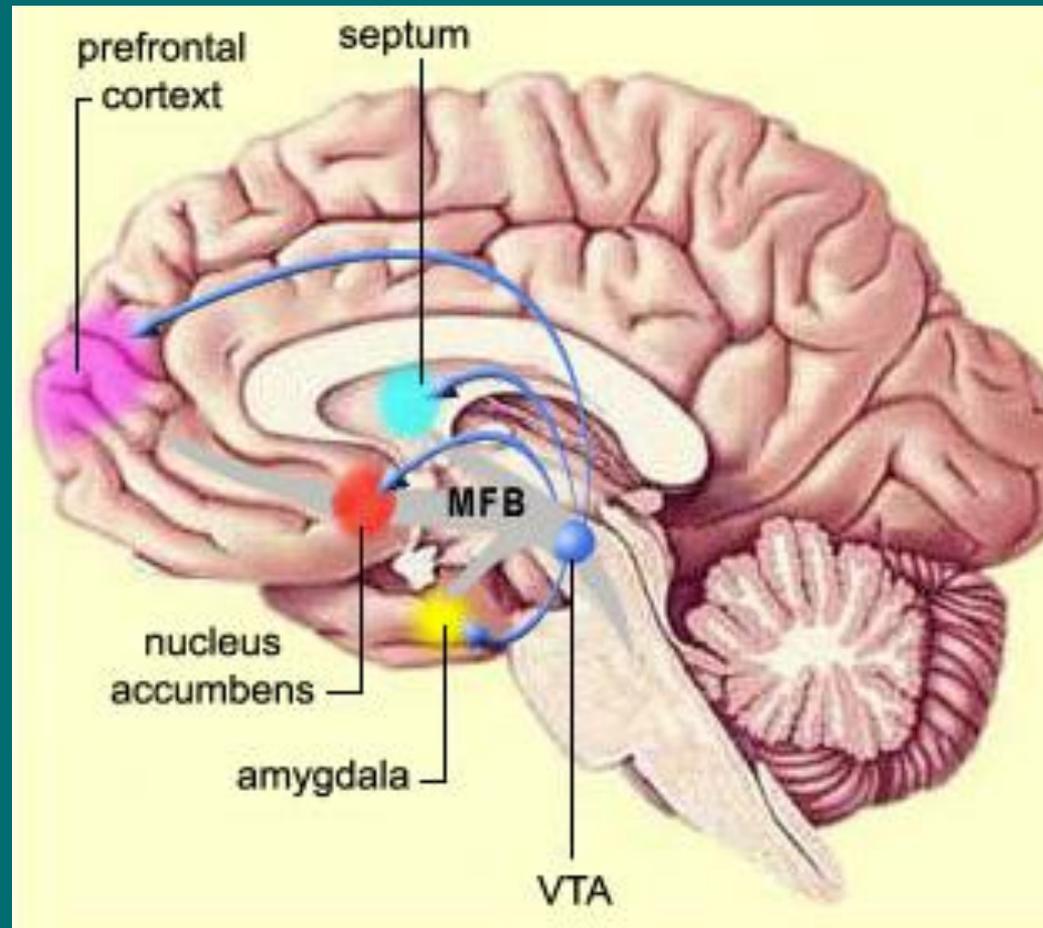
Facial Expressions: Emotional Stimuli with studied brain responses



The Amygdala (in red, below) is important for perceiving the emotional significance of stimuli



The medial prefrontal cortex (pink area, below) regulates emotional responses



Brain Activation in Response to Facial Expressions In Healthy Adults and Children

- ▣ Amygdala responses to fearful faces are often observed (Phillips et al, 2001; Williams et al., 2001; Hariri et al, 2000).
- ▣ Amygdala responses to angry, sad, and happy faces are also reported(Phillips et al,1998;Whalen et al,2001;Blair et al 1999)
- ▣ Children may show amygdala responses to neutral faces (Thomas et al., 2001)
- ▣ The medial frontal, anterior cingulate, fusiform, and superior temporal regions also respond to facial expressions (Morris et al,1998; Vuilleumier et al, 2001)

Functional Neuroimaging of adults with PTSD

- ▣ Increased amygdala activation to trauma-related stimuli (Liberzon et al., 1999; Rauch et al., 1996, 2003; Shin et al., 1997) and fearful faces (Shin et al., 2005; Rauch et al., 2000)
- ▣ Reduced blood flow in the medial prefrontal/anterior cingulate (Bremner et al., 1999; Shin et al., 1999, 2000;2001) together with increased amygdala blood flow (Shin, 2004)
- ▣ Do children and adolescents with symptoms of PTSD show aberrant activation in mPFC and/or amygdala during emotion-related tasks?

Neuroimaging studies of children with symptoms of PTSD: responses to faces

- ▣ Amygdala and medial prefrontal activation
- ▣ Altered timing of activation
- ▣ Sensitization to trauma-related stimuli?
- ▣ Possible directions for further research, especially new treatments