



Lecture Three: Pain and Mood—It's a Brain Thing





Pain and Mood: Who is to blame?

- People are often blamed for their persistent pain due to their depressed and anxious mood
- Which came first the pain or the bad mood?
- Is the question relevant?
- Mood disturbances and persistent pain are both brain based processes, occurring together, like two sides of the same coin

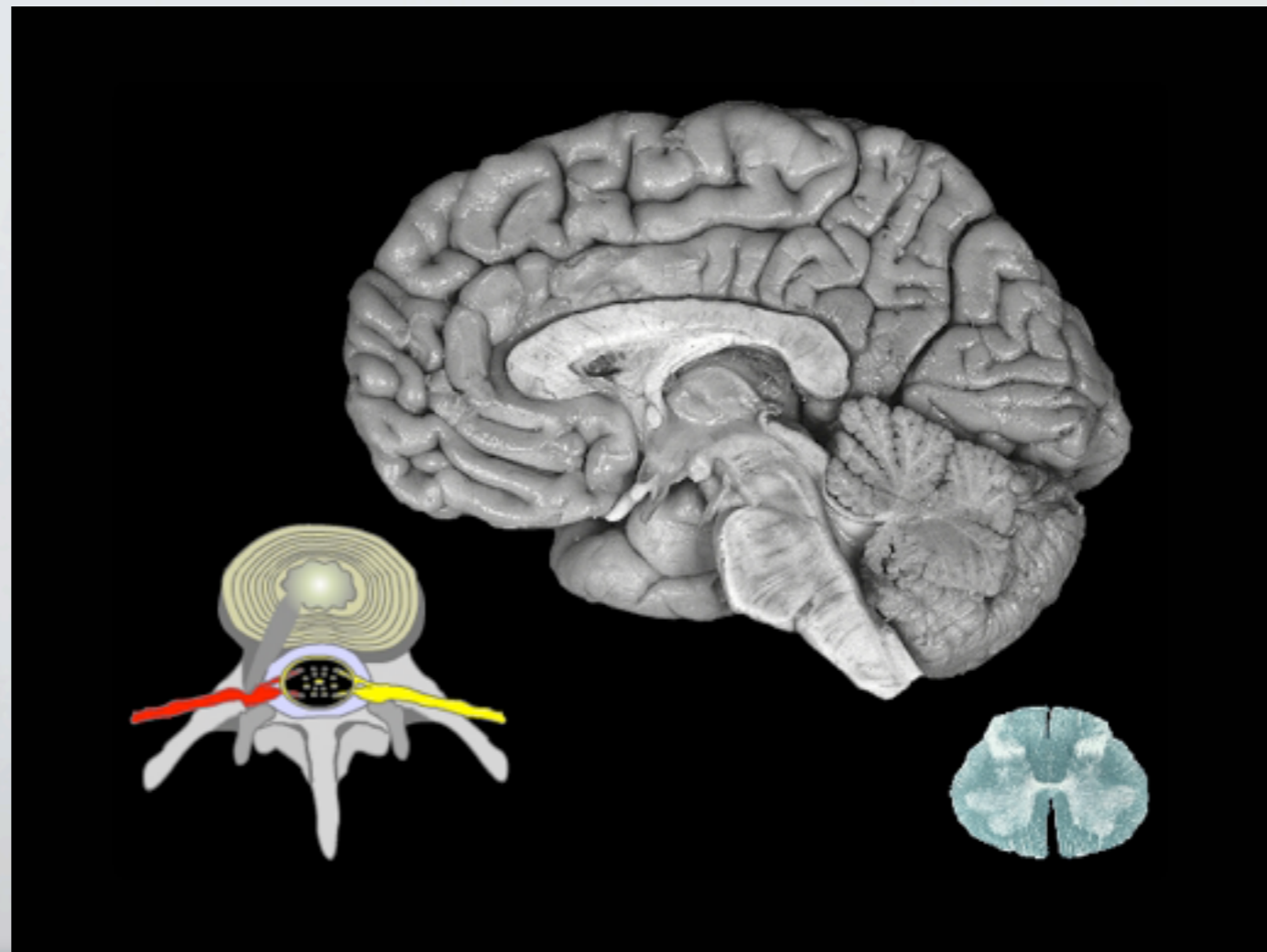


Pain, Mood and the 7-Dimensional Brain

- Anatomical
- Physiological
- Synaptic
- Cellular
- Circuits
- Regional Functions
- Neuroplasticity



Anatomical



Brain From the Top of the Head

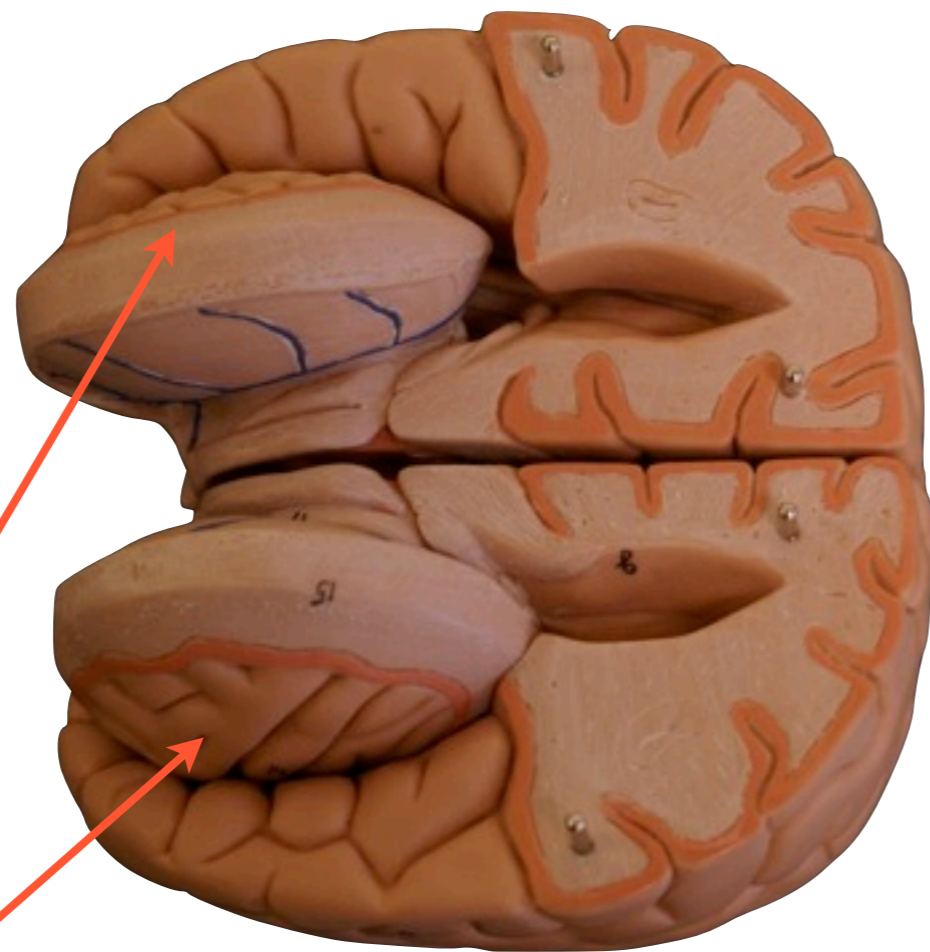


Access the Brain with:

Thoughts.....Images.....Sensations.....Memories.....Soothing Emotions.....Movement.....Beliefs



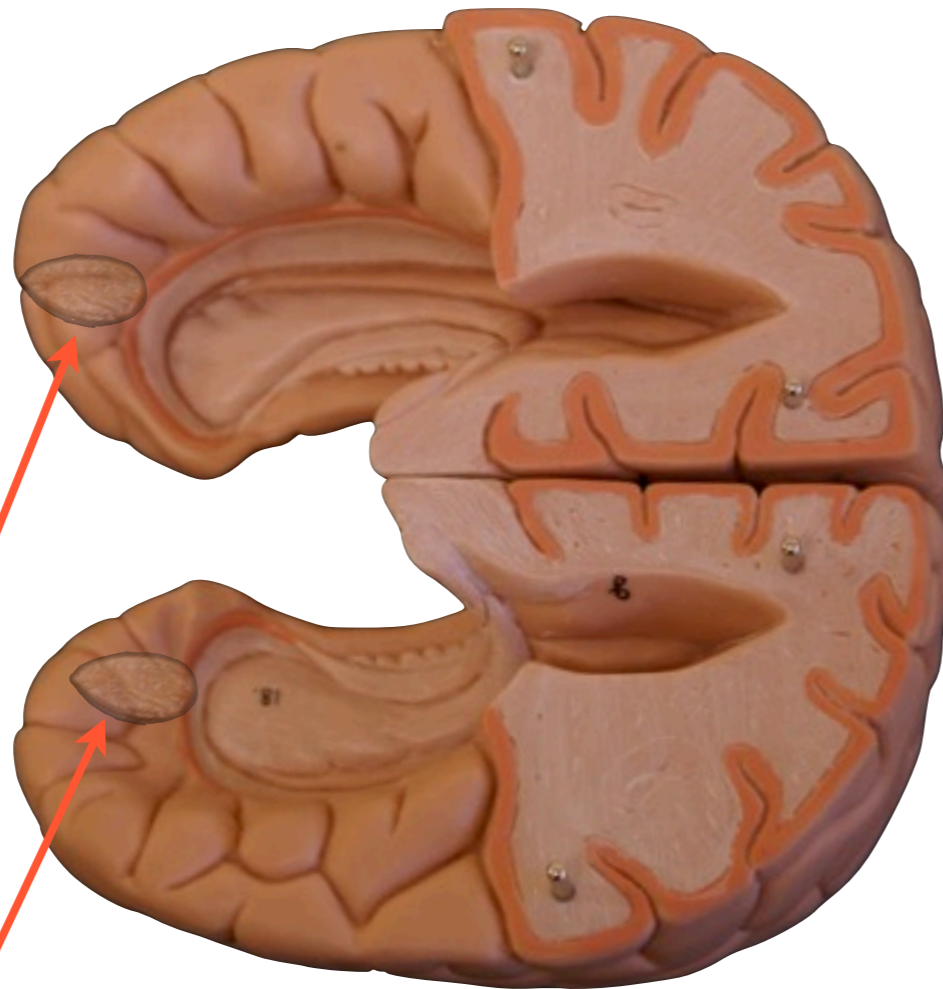
Brain with the Topmost Part Removed



Insula { pain, temperature and itch, input to amygdala and limbic cortex, emotional self awareness, sensual touch, taste, self-soothing, disgust connects emotion with body awareness, empathy, mirror neurons



Brain with the Insula Removed



Amygdala { pain, emotional experience, acquisition and consolidation,
recall of emotional memories, pleasure, sight, smell,
emotional extremes, fight flight, freeze



Brain from the Outer Left Side

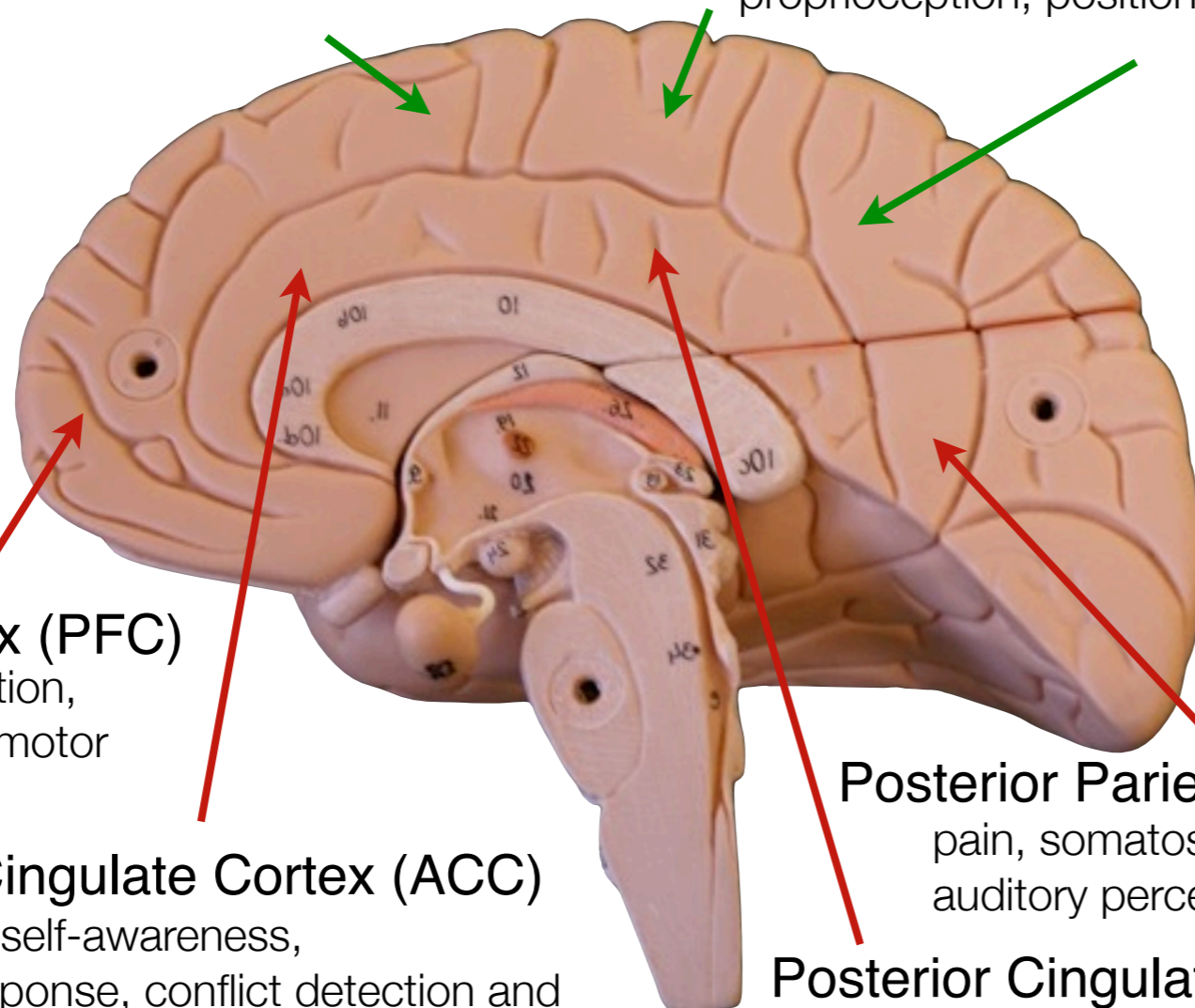


Brain Cut Through the Middle



Supplementary Motor Area
pain, motor planning, mirror neurons

Somatosensory One **Somatosensory two**
pain, temperature, pressure, touch, vibration
proprioception, position



Prefrontal Cortex (PFC)
pain, empathy, intuition,
executive function, motor
planning

Anterior Cingulate Cortex (ACC)
pain, emotional self-awareness,
sympathetic response, conflict detection and
resolution, problem solving

Posterior Parietal Cortex (PPC)
pain, somatosensory, visual &
auditory perception, mirror neurons

Posterior Cingulate Cortex (PCC)
pain, autobiographical memory
retrieval, visuospatial cognition



Pain, Mood and the Brain

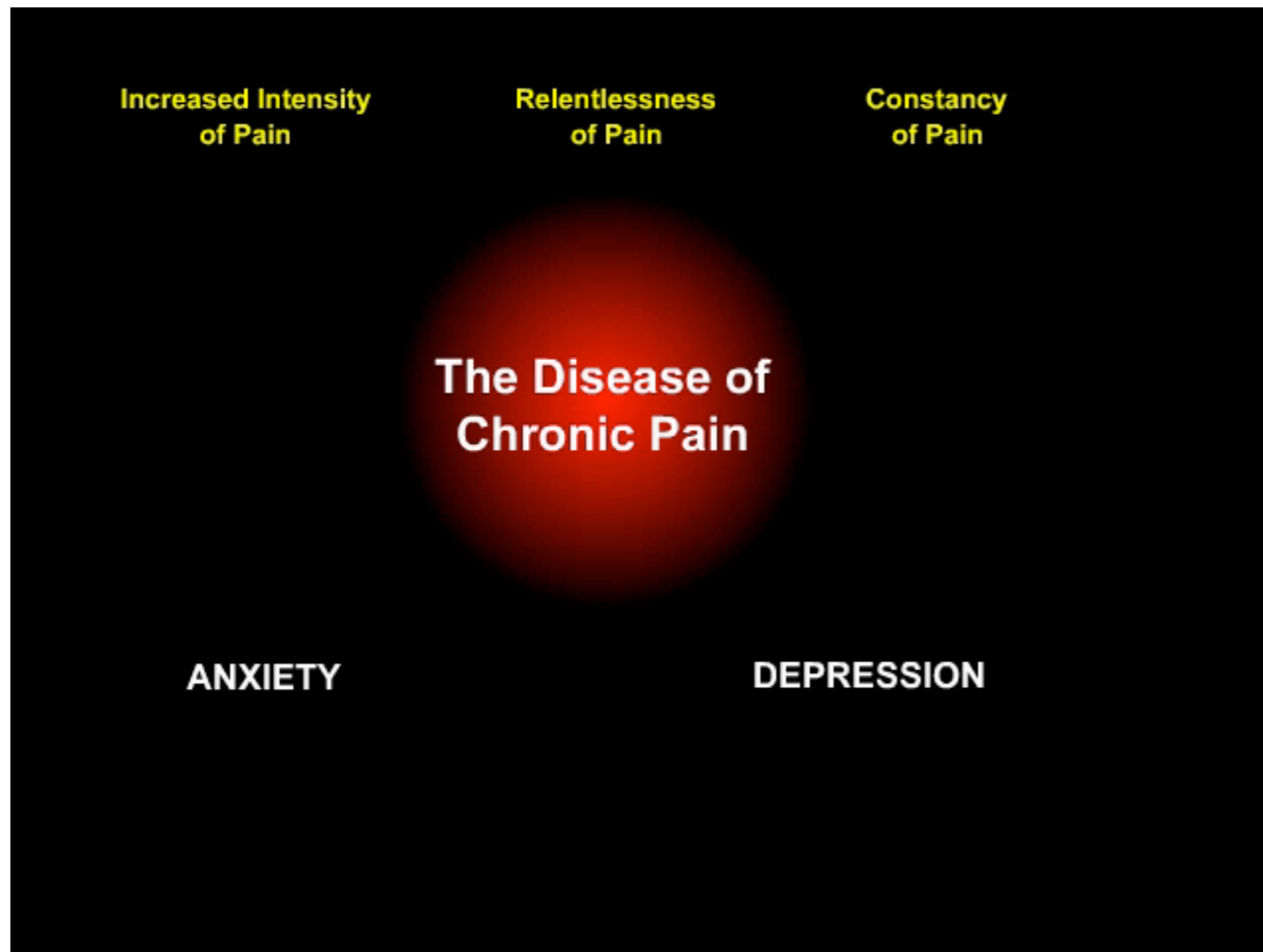
- Amygdala, Insula, PFC, ACC, PCC, PPC are thinking parts of the brain where both pain and mood are processed
- When pain is persistent it interferes with proper mood regulation
- Depression and pain occur commonly
- Anxiety and pain probably occur more commonly than depression and pain



Physiology of Brain, Pain and Mood

- From the molecular action of neurotransmitters and receptors in trillions of synapses, an electrical signal is generated and passed from one part of the brain to other parts of the brain
- The signal is turned into thoughts, images, sensations, memories, emotions, movement, beliefs
- Pain unpleasantness is the result of many parts of the brain being activated and interacting with each other

Pain Unpleasantness and Mood





Pain Unpleasantness and the Disease of Chronic Pain

- This phenomenon can only happen in the conscious, thinking brain
- No other part of our bodies is capable of generating the experience of pain
- This is based on how information comes to the brain, affects various parts of the brain and results in thoughts, images, sensations, memories, emotions, movement and beliefs



Trauma and Pain

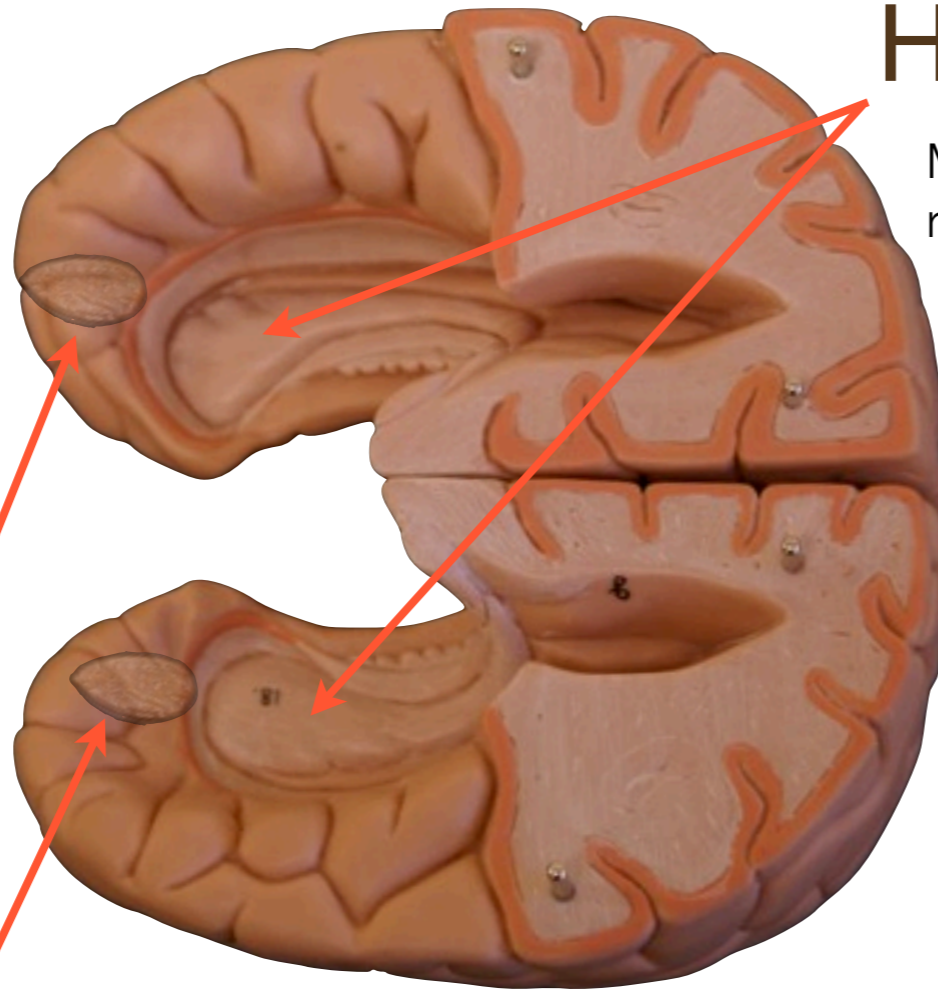
- Trauma is not integrated into our personal narratives
- Speech area of the brain becomes stunned during trauma and we cannot find the language to integrate the story into our cohesive narrative
- The information is passed to the amygdala, the fight flight center of extreme emotions
- It is laid down in the memory area of our brain and whenever a similar experience or similar emotion is recalled it is done so by the Amygdala
- We experience this as fight, flight or freeze, and the trauma stays outside of our ability to put language and understanding onto it

When the amygdala dominates we go into Fight/Flight.
We lose any executive function or problem solving that
does not serve the acts of fighting or fleeing



Hippocampus

Memory and memory
retrieval



Amygdala

{ Fight/Flight– rage, terror, despair, panic, attack, run, freeze
Lays down emotional memory in the Hippocampus
and retrieves it when pain or anxiety rise



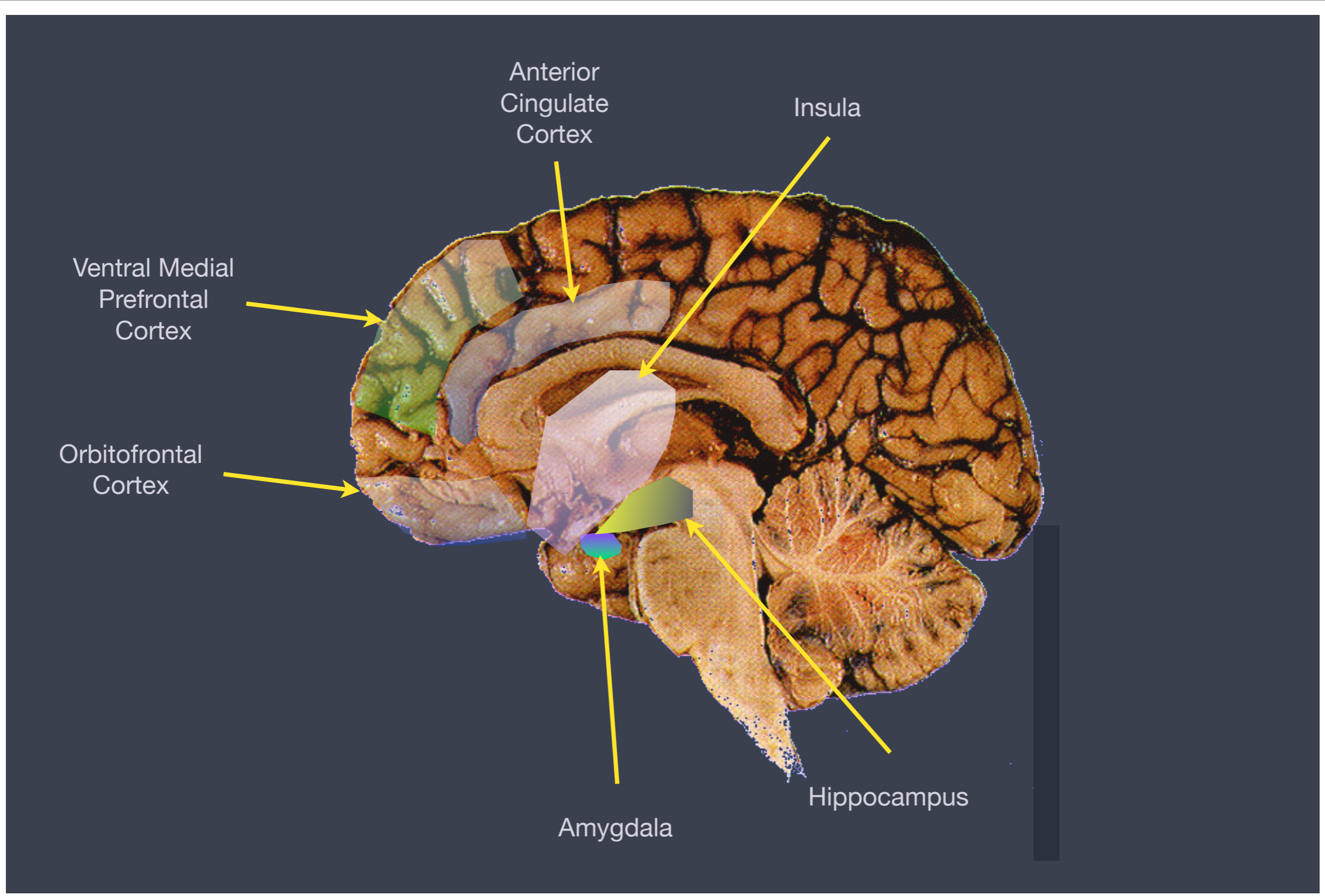
Self-soothing circuit

- ■ It all starts with maternal touch
- ■ The infant is held by the mother and stroked while being fed
- ■ Fight-flight distress is replaced with the soothing maternal child bond
- ■ Over time the child learns with help of whole family to self-soothe



Self-soothing circuit

- Amygdala: fight-flight, emotional memory deposition and retrieval, extremes of emotions
- Hippocampus: memory storage and retrieval
- Insula: Interoception, mirror neurons, modulation, mini-brain
- Orbital Medial Frontal Cortex: Social synapses, attunement
- Ventral Medial Prefrontal Cortex: executive function, empathy, compassion
- Anterior Cingulate Cortex: Sympathetic control, emotional self-control, conflict detection, problem solving





Learn self-soothing

- In persistent pain the ability to self soothe is lost
- People in pain seek soothing, just as the infant is first soothed by their mother
- Learn from mom the neuroscientist—it is not enough to be soothed we must learn to reignite self soothing circuits damaged by persistent pain, hopelessness, anxiety and despair
- Learn to rein in the runaway amygdala with thoughts, images, sensations, memories, soothing emotions, movement, beliefs
- Start where it began- use of touch to reignite self soothing circuits



Sound Circuits

- Long Term Potentiation (LTP)—a presynaptic nerve fires a post synaptic nerve at high frequency causing the post synaptic nerve to continue to fire even after the presynaptic nerve stops firing it
- LTP is a major problem with chronic pain and can last for a very long time
- Long Term Depression (LTD) uses a low frequency electrical signal to stop independently firing nerves from continuing to fire, even with subsequent high frequency input
- Sound circuit is located throughout the perceptive thinking brain
- Use 32 hz frequency 1 hz oscillation signal played over several minutes to try to induce LTD to turn off LTP in pain, anxiety and depressive circuits in the brain