

Anatomy of feelings

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PSYC 888– Affective (Cognitive) Neuroscience

Spring 2023

Introductions

1. Preferred name
2. Pronouns
3. Year in X program
4. Advisor
5. Professional and/or research interests
6. Reason for taking class
7. Goal/s for semester

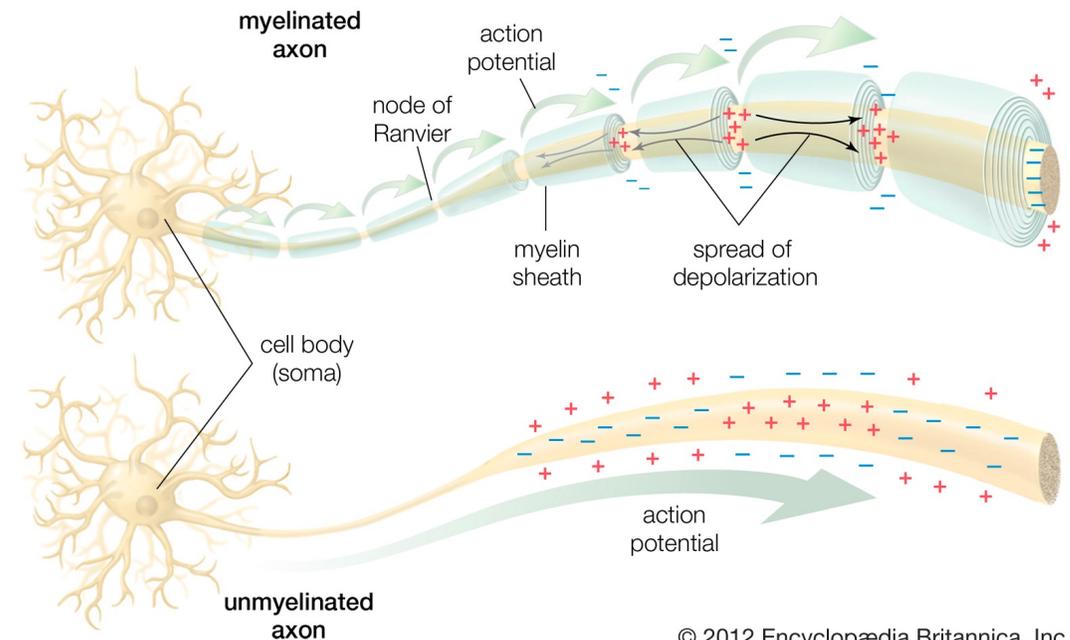
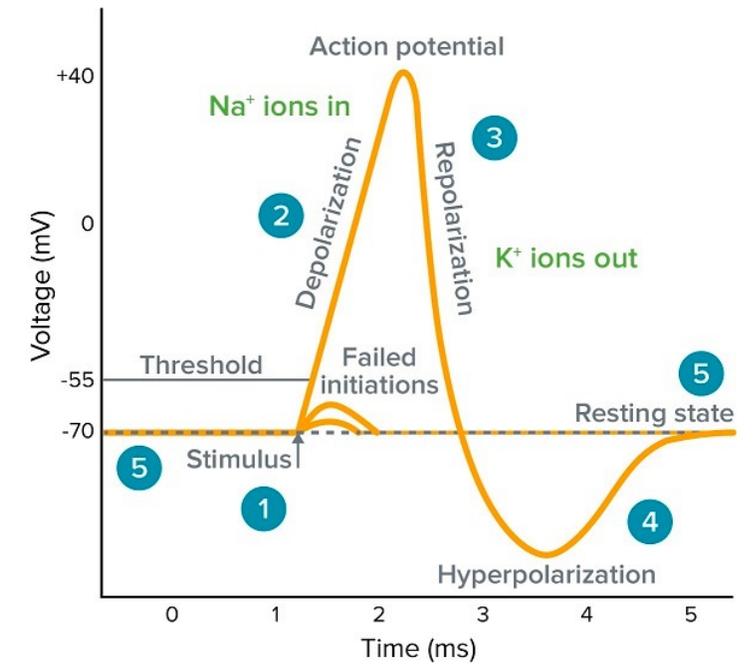
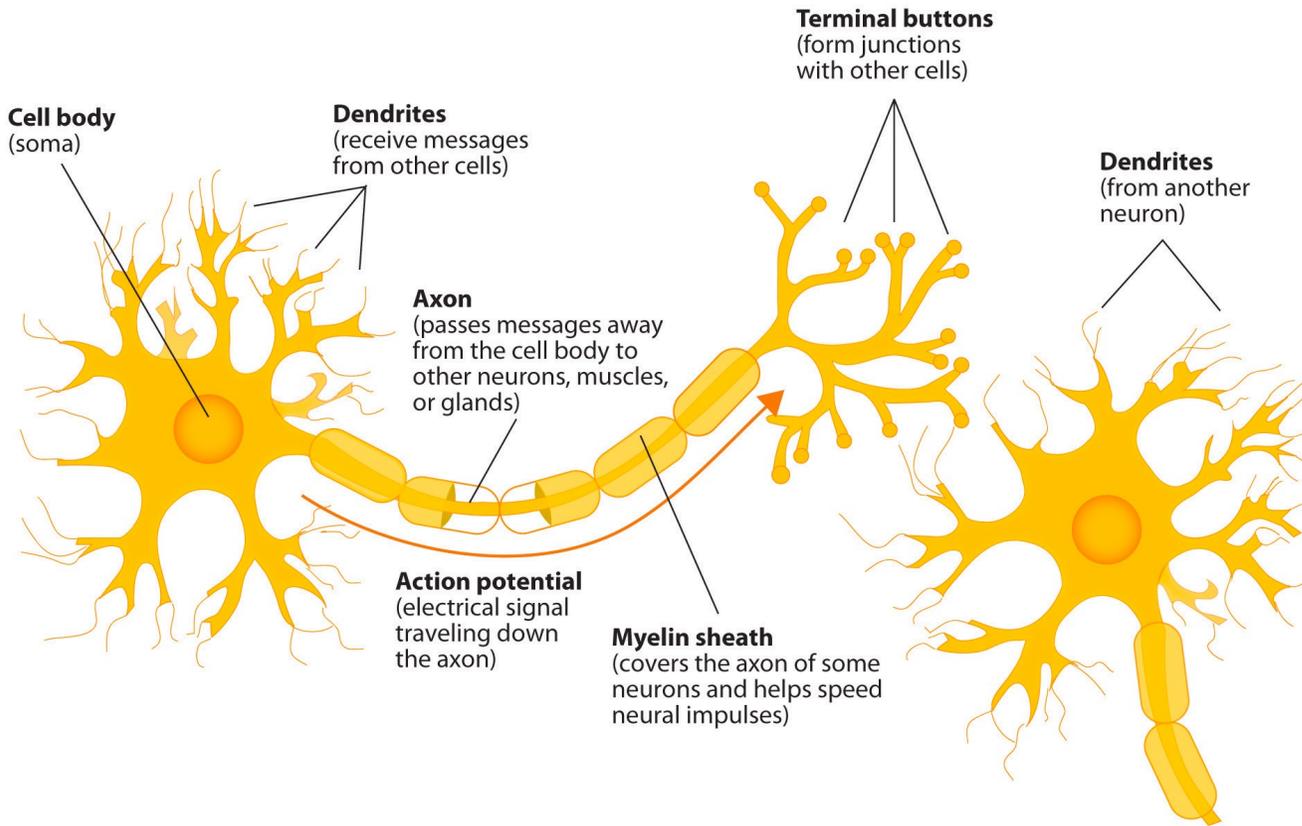
Overview

- Last week → Why study affective neuroscience?
- This week → What is the basis for affective and emotional processing
 - Basics of autonomic nervous system
 - Anatomical features and networks
 - Amygdala
 - Insula
 - Orbitofrontal cortex

Record?



A neurochemical experience

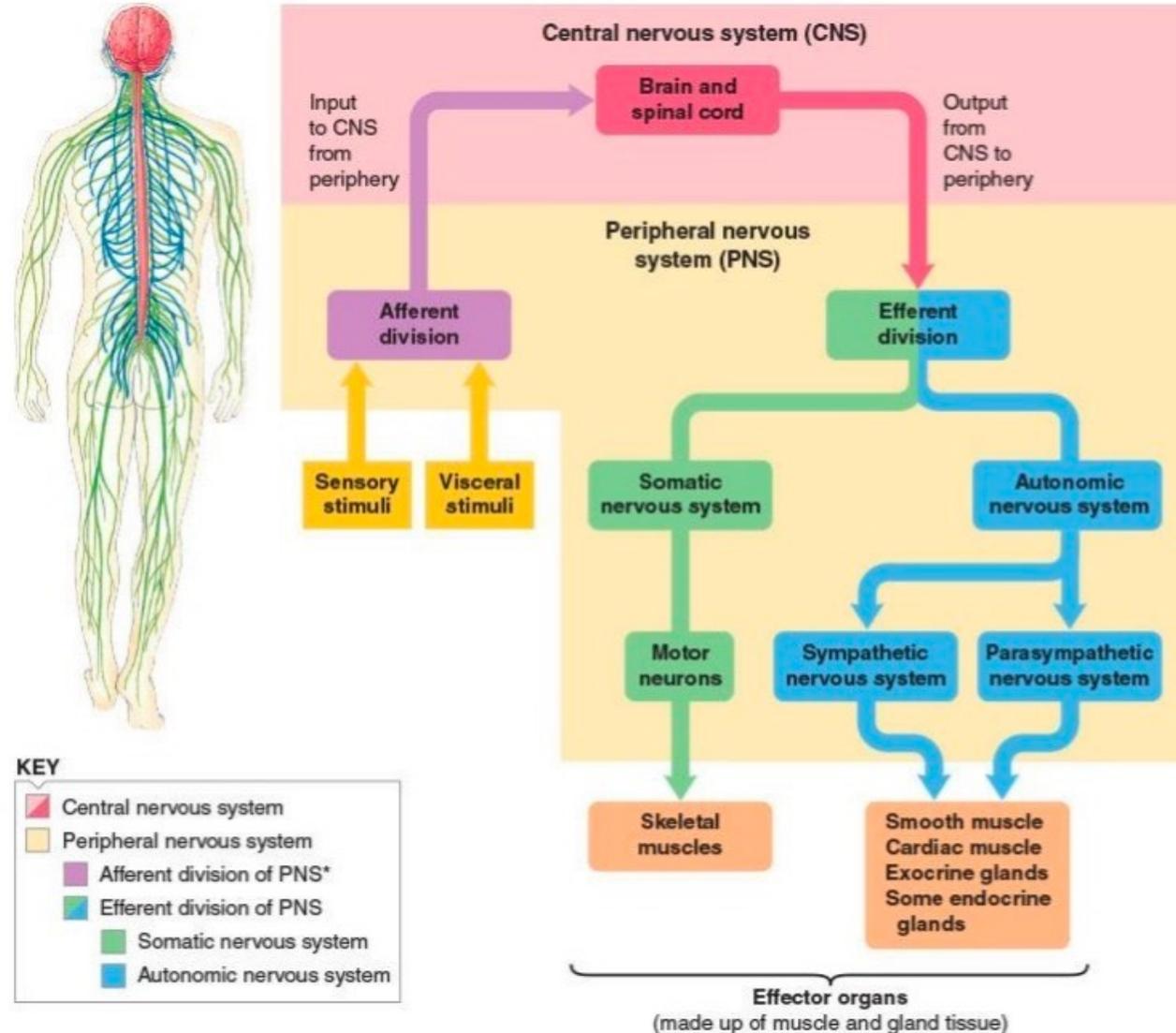


Autonomic nervous system

Afferent pathway: Carries sensory and visceral signals to CNS

Efferent pathway: Carries signals away from CNS (brain, spinal cord) to tissues, organs

- **Autonomic nervous system (ANS):**
 - Sympathetic → Fight or flight
 - Parasympathetic → Rest & Digest
- **Somatic nervous system:** striated muscles, motor neurons
 - Heavily myelinated



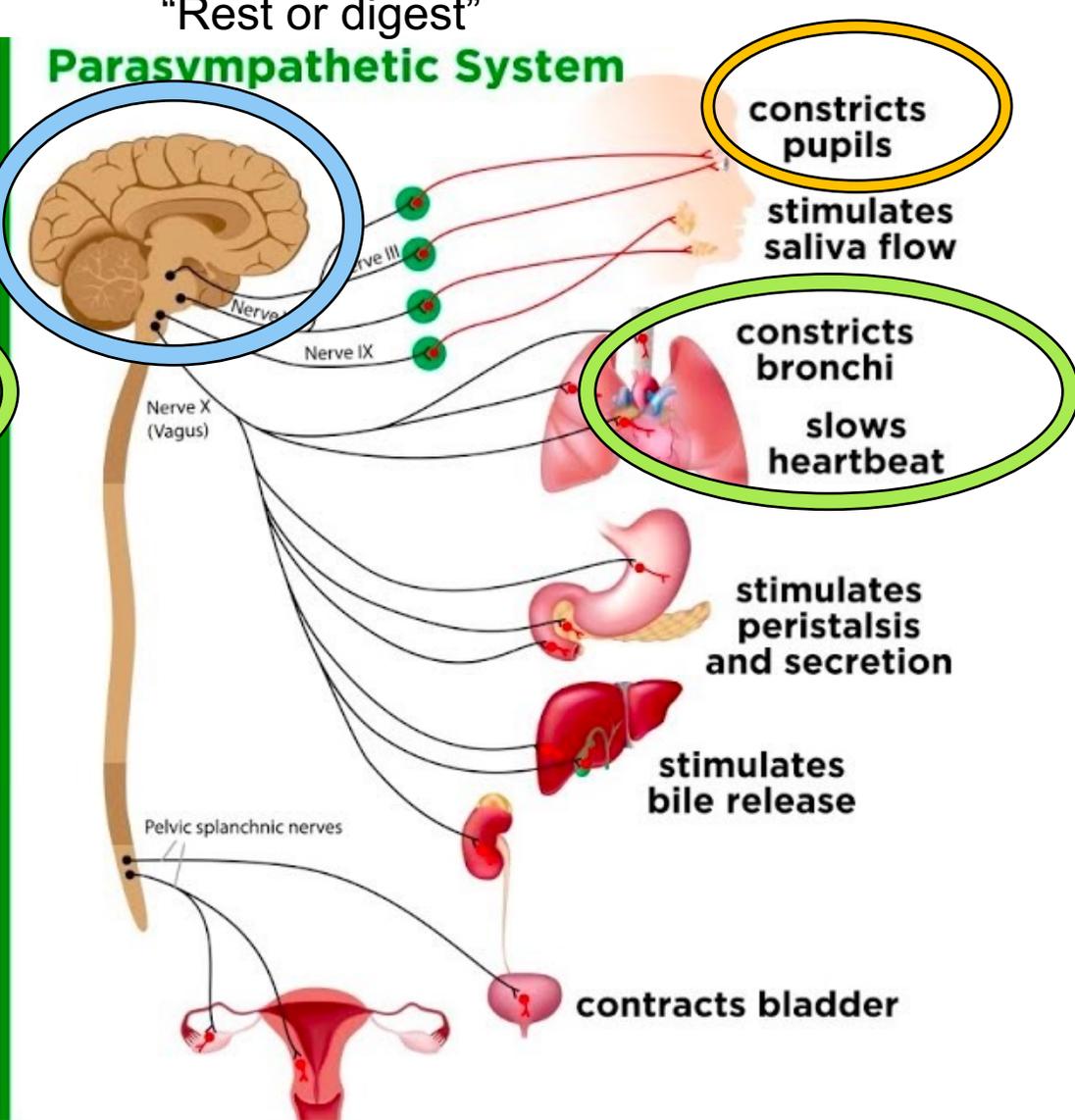
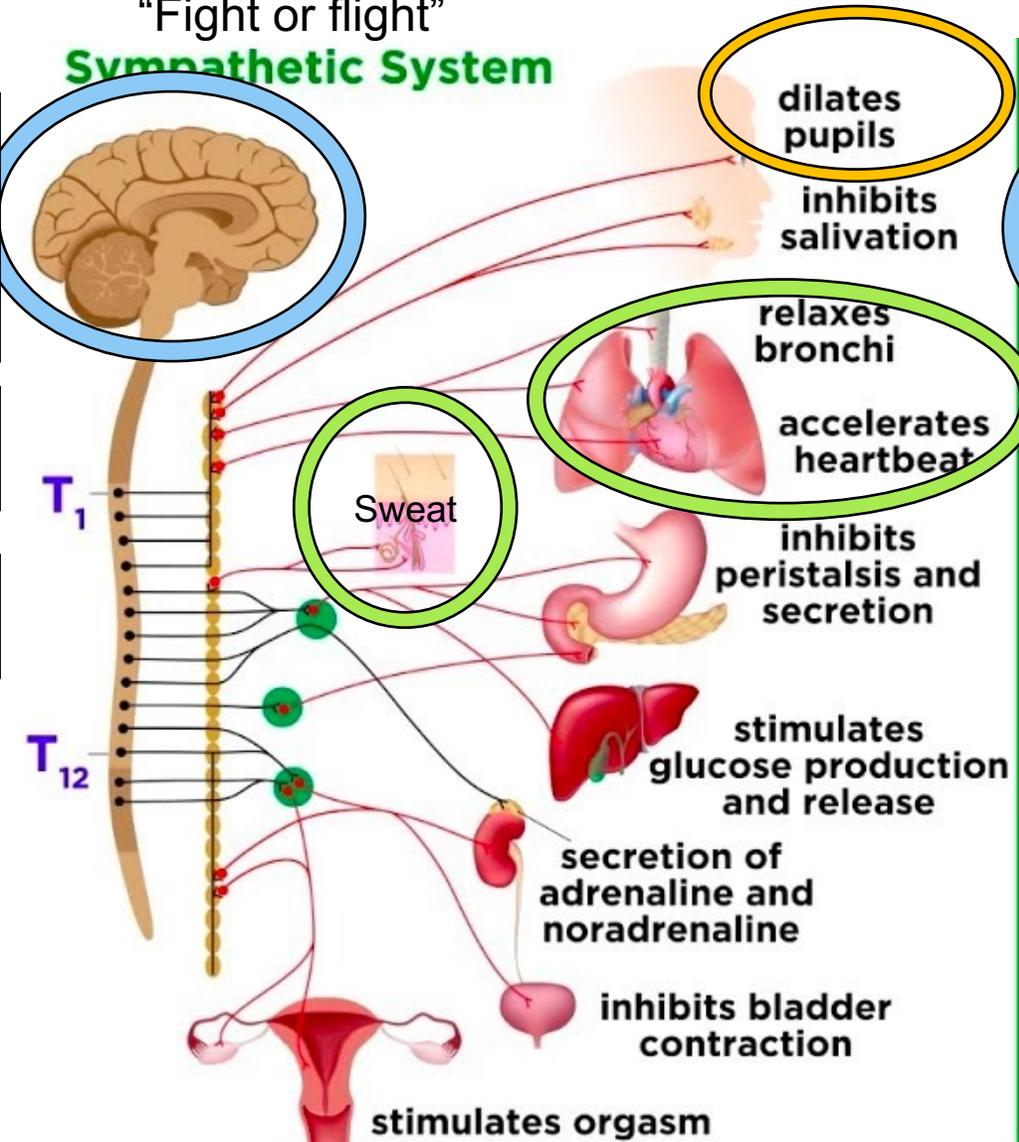
**“Fight or flight”
Sympathetic System**

**“Rest or digest”
Parasympathetic System**

fMRI, fNIRS
EEG/ERP, MEG
tcMS
PET

Eye tracking

Physiology



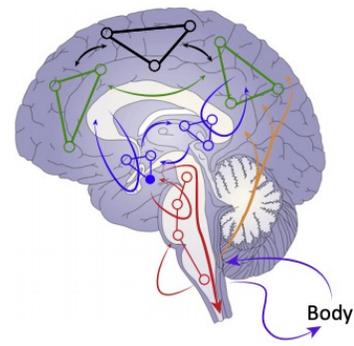
Efferent effects of emotion in ANS

- ANS is not *all-or-none*: Multiple functional subunits
- Example:
 - *Muscle vasoconstrictor neurons* (symp) aide in modulating blood pressure → receive inputs from body nociceptors, bladder/colon, inhibitory skin afferents; Modulated by arterial baroreceptors, breathing
 - *Cutaneous vasoconstrictor neurons* (symp) aide in thermoregulation; NOT modulated by arterial baroreceptors or breathing; excitatory skin afferents
 - Other non-vasoconstrictor pathways (e.g., adrenaline pathway)

Efferent effects of emotion in ANS

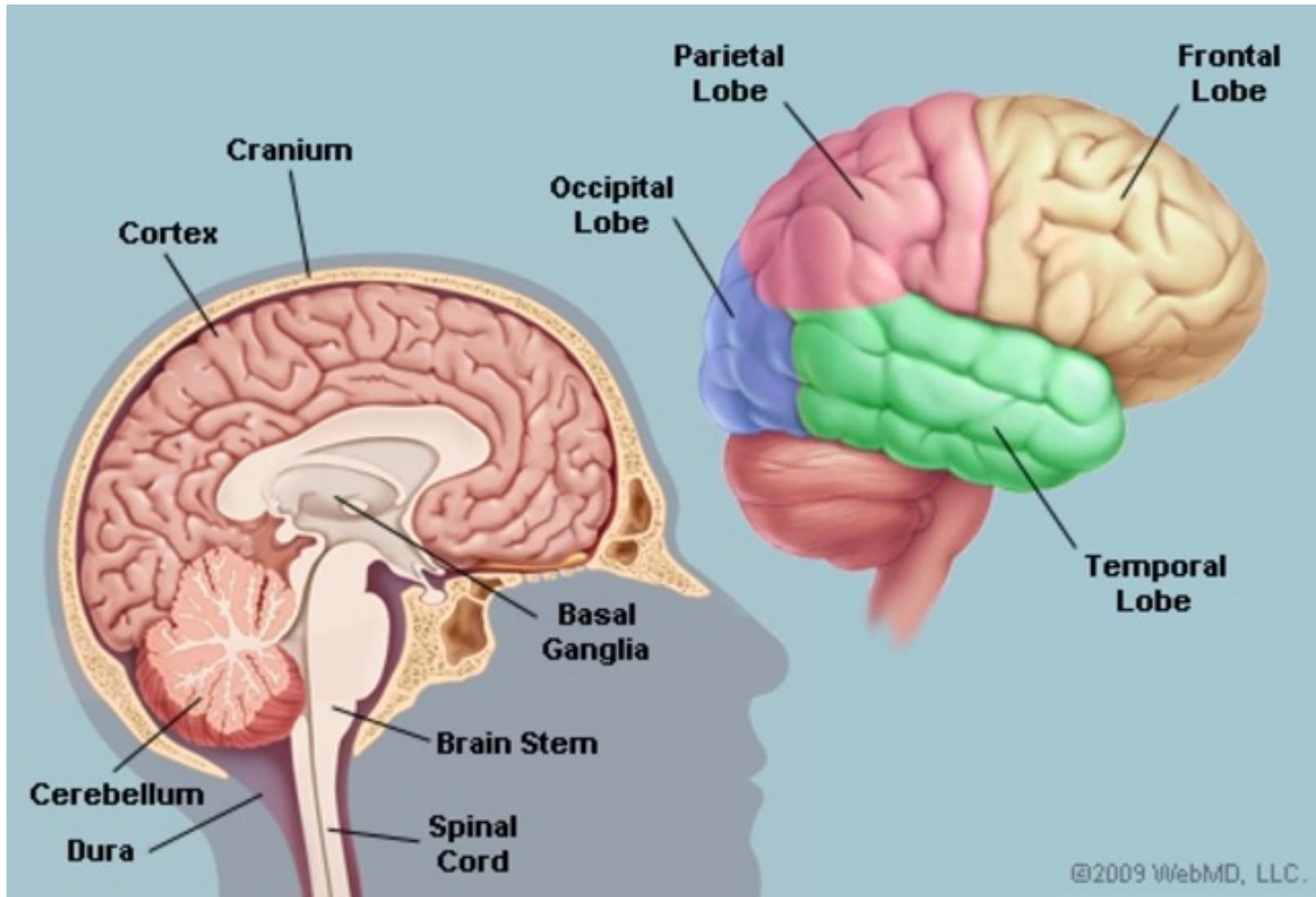
- Why are we talking about neurons?
 - No, emotions do not have an ANS signature (Feldman-Barrett, 2006)
 - If emotions are specific functions, then it is reasonable to assume that there is discrete ANS activity to execute behaviors (Stemmler, 2004)
 - Likely a mixture (Cacioppo et al 2000)
 - **Yes, there are reliable patterns that are *context specific***

Anatomical networks of emotion

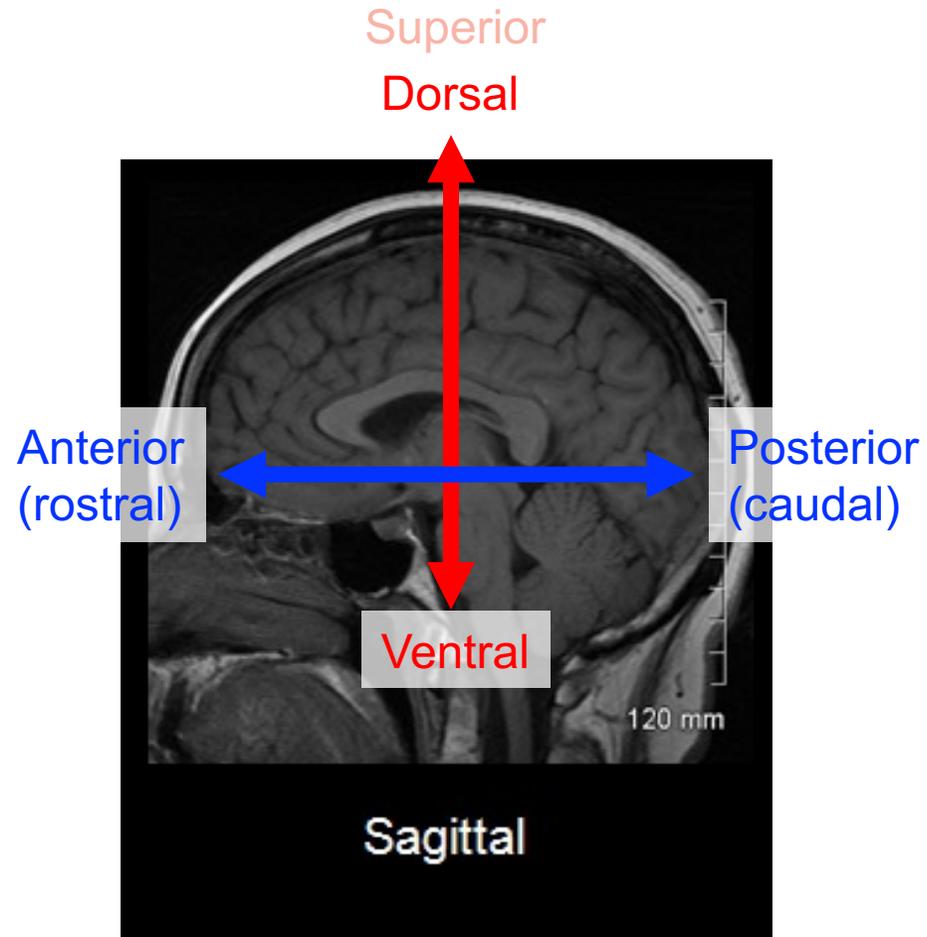
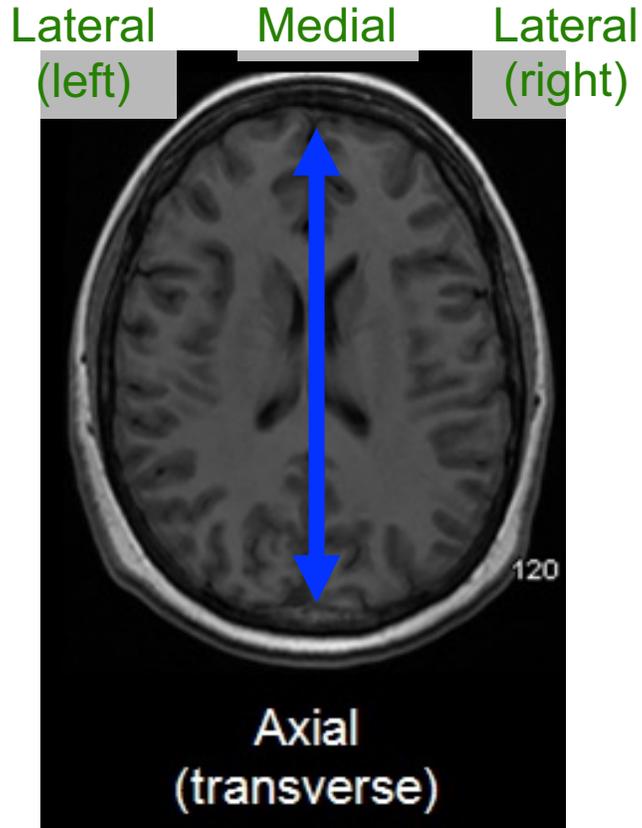


- Preview for discussion:
 - **Lindquist & Barrett, 2012**: Functional connectivity networks and key anatomical substrates
 - **Pessoa (2017)**: Networks
 - **Feinstein, Adolphs, Damasio, & Tranel (2011)**: Amygdala & induction/experience of fear
 - **Kontaris, East, & Wilson (2020)**: Thinking about neural circuits and mood through an odor model

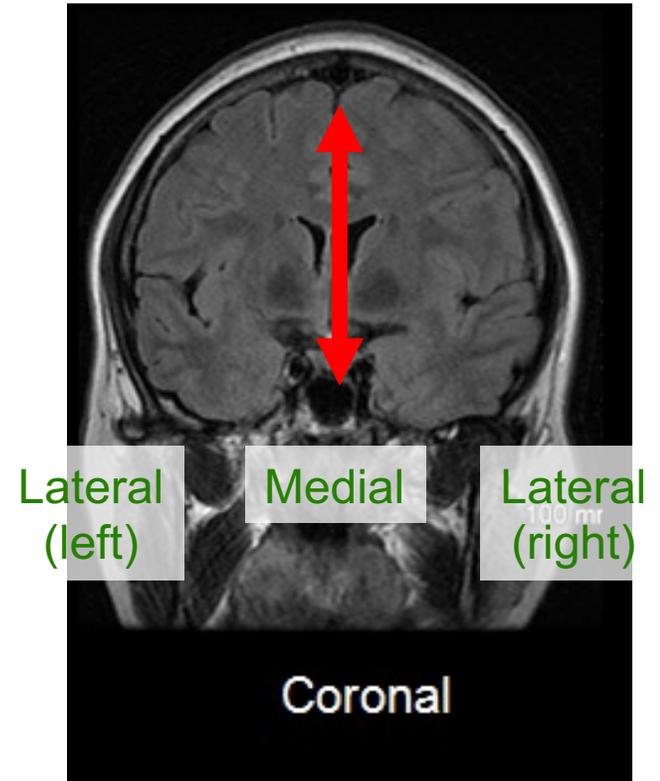
Anatomy of the brain



Anatomy of the brain

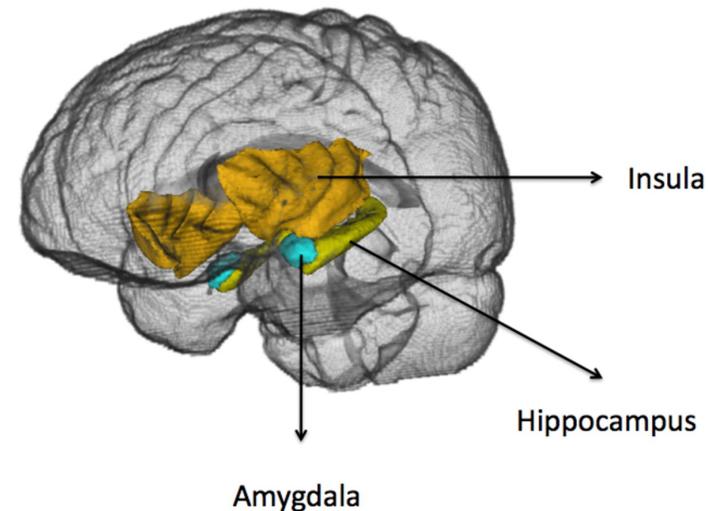
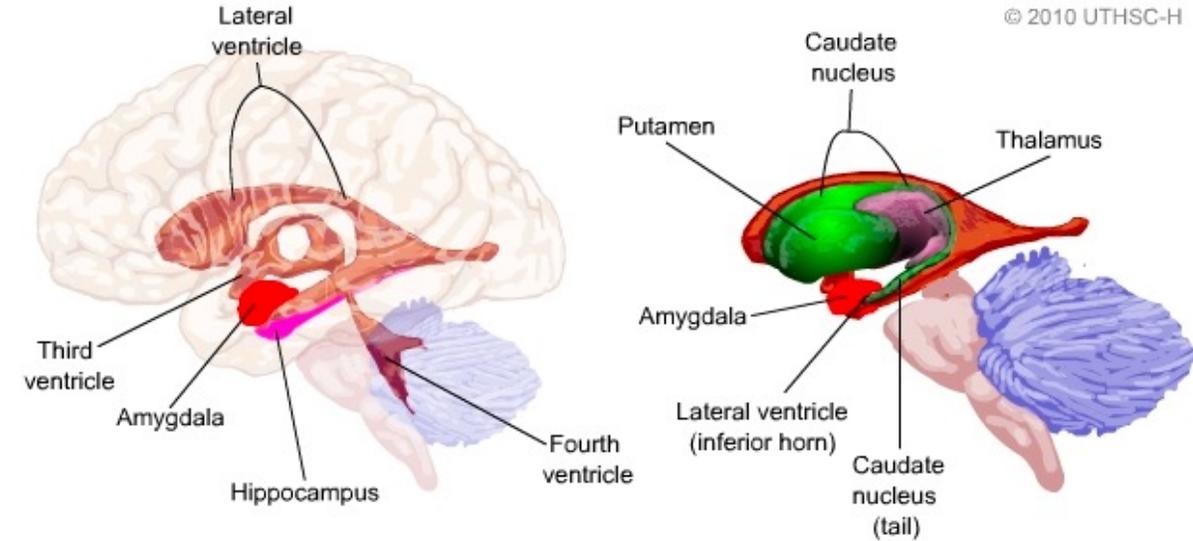


Inferior



Limbic network as the emotion network?

- Limbic brain regions:
 - Medial temporal lobe
 - Anterior cingulate cortex (ACC)
 - Medial orbitofrontal cortex (mOFC)
 - Lateral orbitofrontal cortex (lOFC)
- Other emotional brain regions
 - Insula
 - Thalamus
 - Hypothalamus
 - Striatum, caudate nucleus

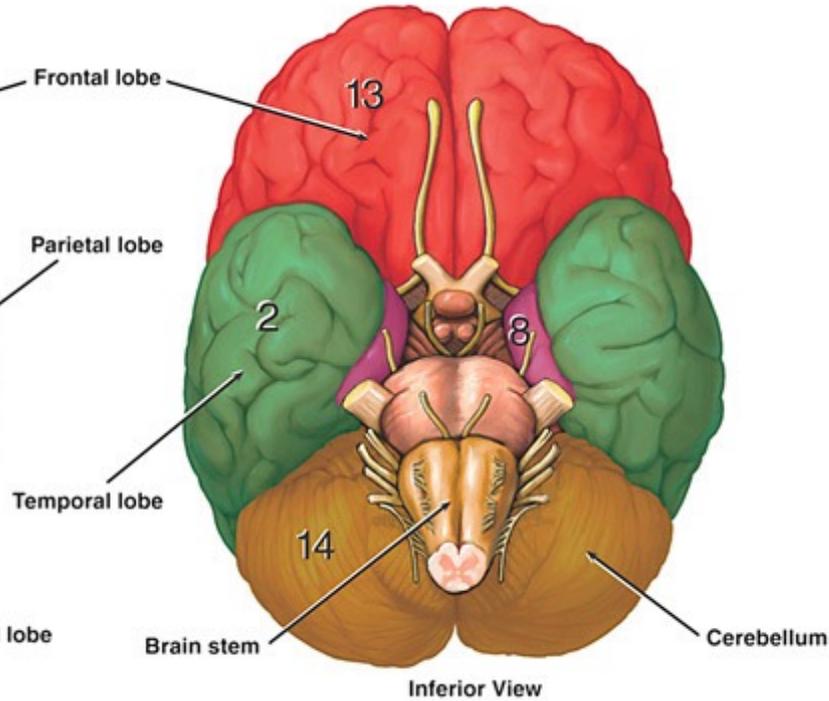
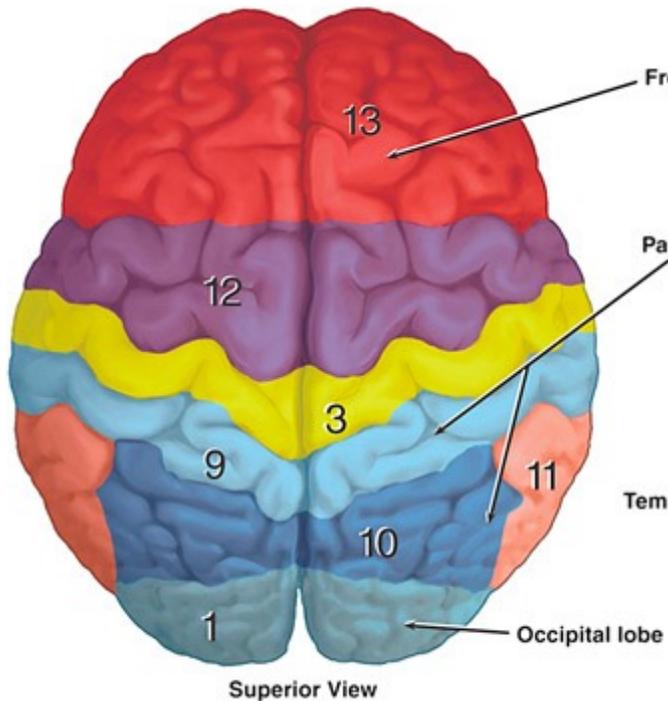
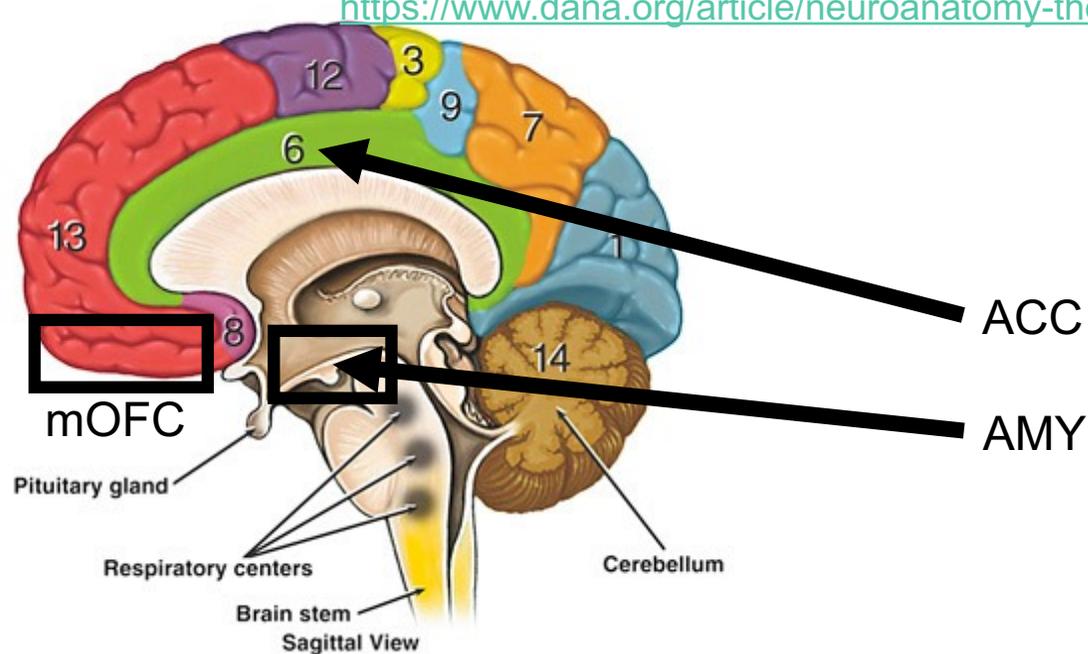
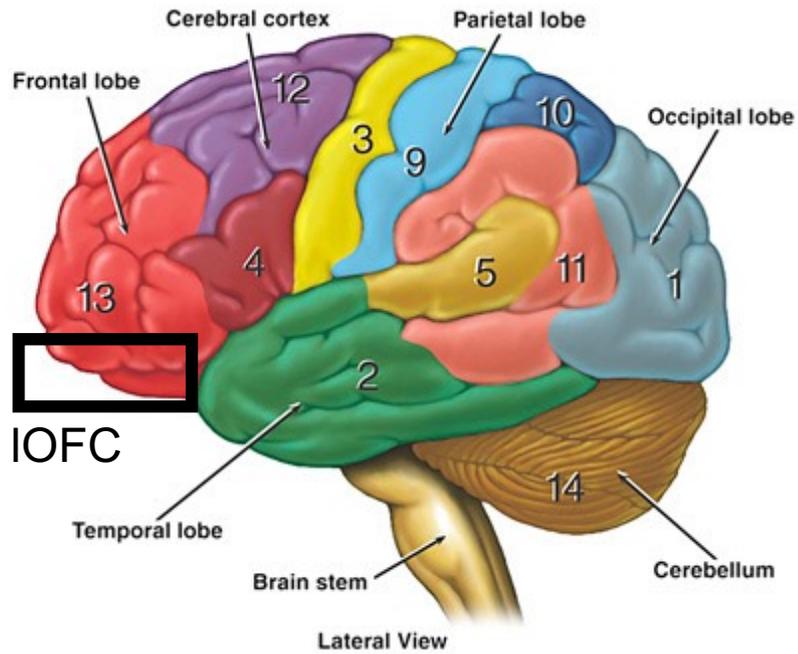


Functional Areas of the Cerebral Cortex

- 1 **Visual Area:**
Sight
Image recognition
Image perception
- 2 **Association Area**
Short-term memory
Equilibrium
Emotion
- 3 **Motor Function Area**
Initiation of voluntary muscles
- 4 **Broca's Area**
Muscles of speech
- 5 **Auditory Area**
Hearing
- 6 **Emotional Area**
Pain
Hunger
"Fight or flight" response
- 7 **Sensory Association Area**
- 8 **Olfactory Area**
Smelling
- 9 **Sensory Area**
Sensation from muscles and skin
- 10 **Somatosensory Association Area**
Evaluation of weight, texture, temperature, etc. for object recognition
- 11 **Wernicke's Area**
Written and spoken language comprehension
- 12 **Motor Function Area**
Eye movement and orientation
- 13 **Higher Mental Functions**
Concentration
Planning
Judgment
Emotional expression
Creativity
Inhibition

Functional Areas of the Cerebellum

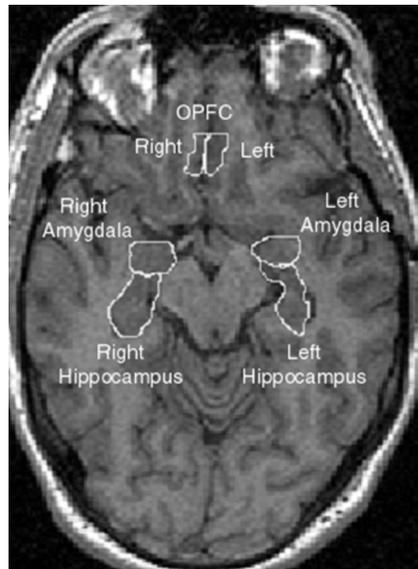
- 14 **Motor Functions**
Coordination of movement
Balance and equilibrium
Posture



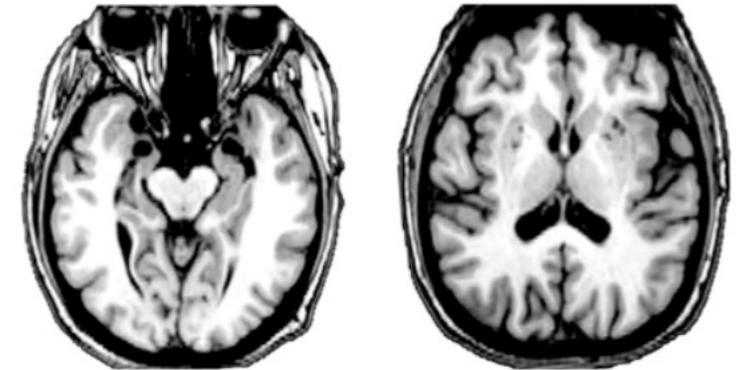
Amygdala

- Most often implicated in fear and negatively valence affect and emotional processing
- *Preview:* Feinstein et al. 2011: Patient SM with bilateral AMY lesions

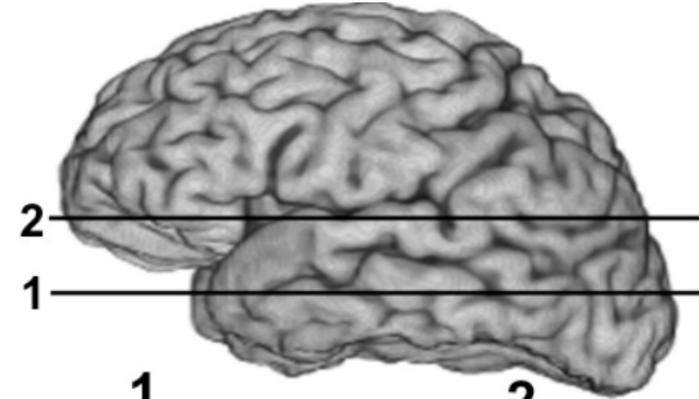
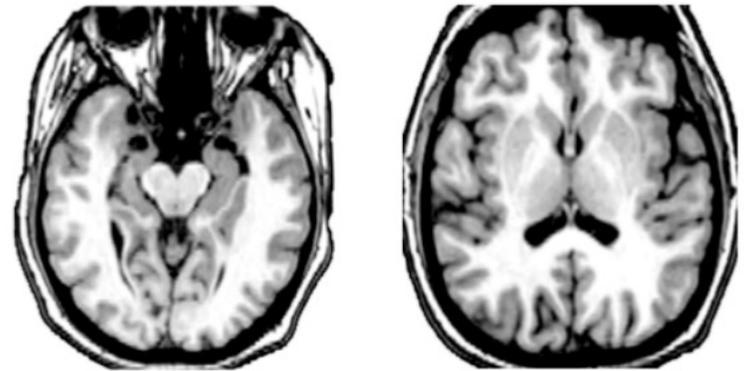
Control
brain



Current
study

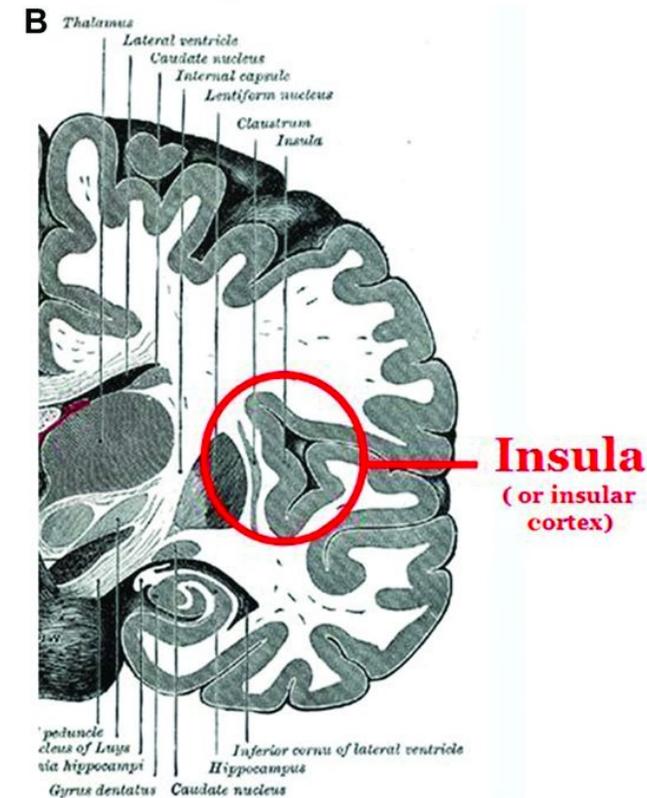
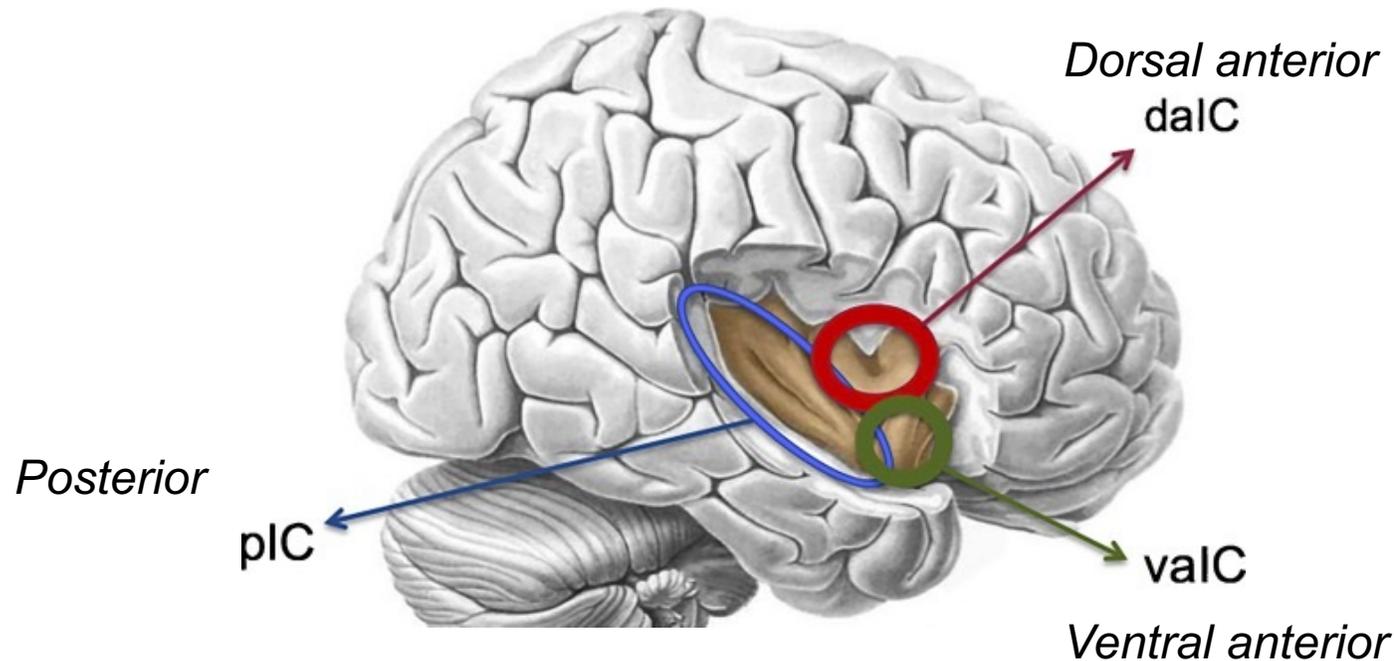
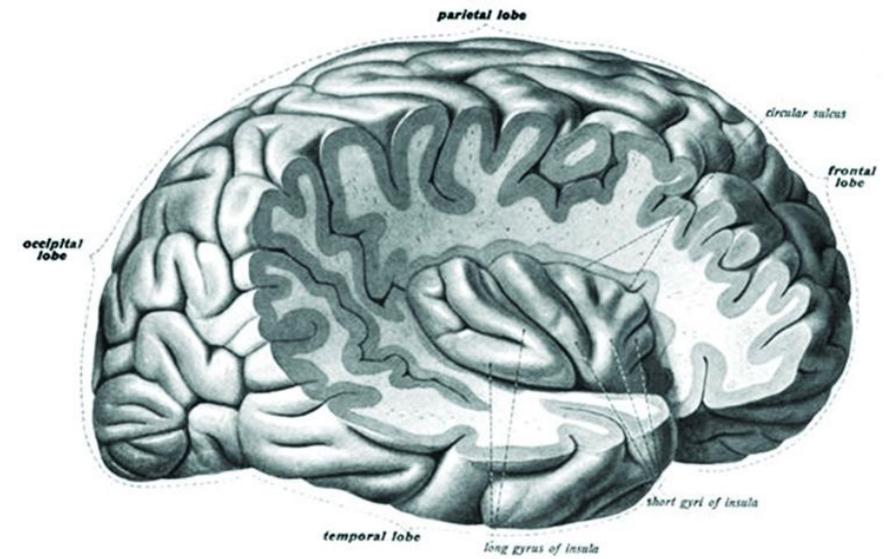


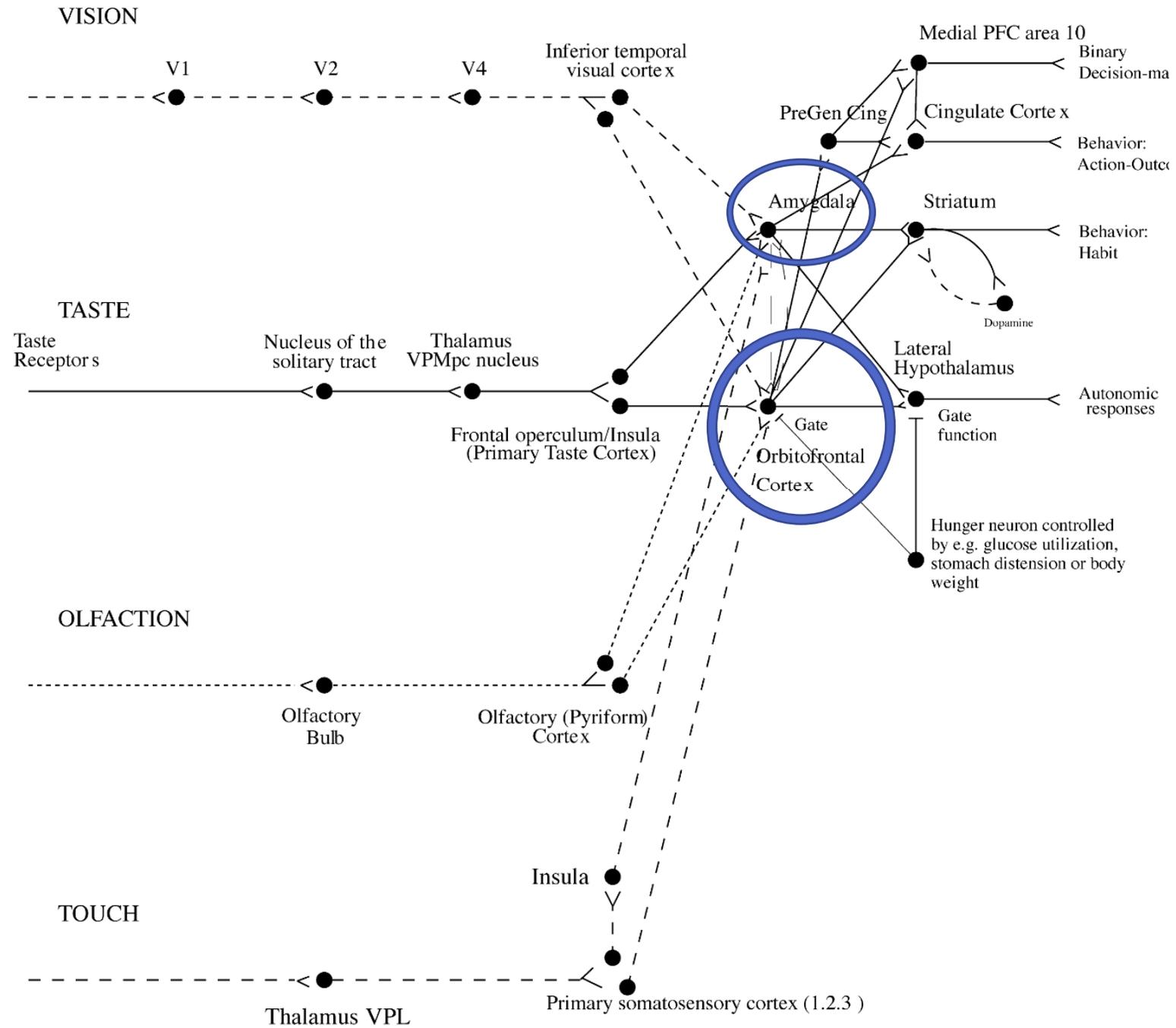
10 years
before
study



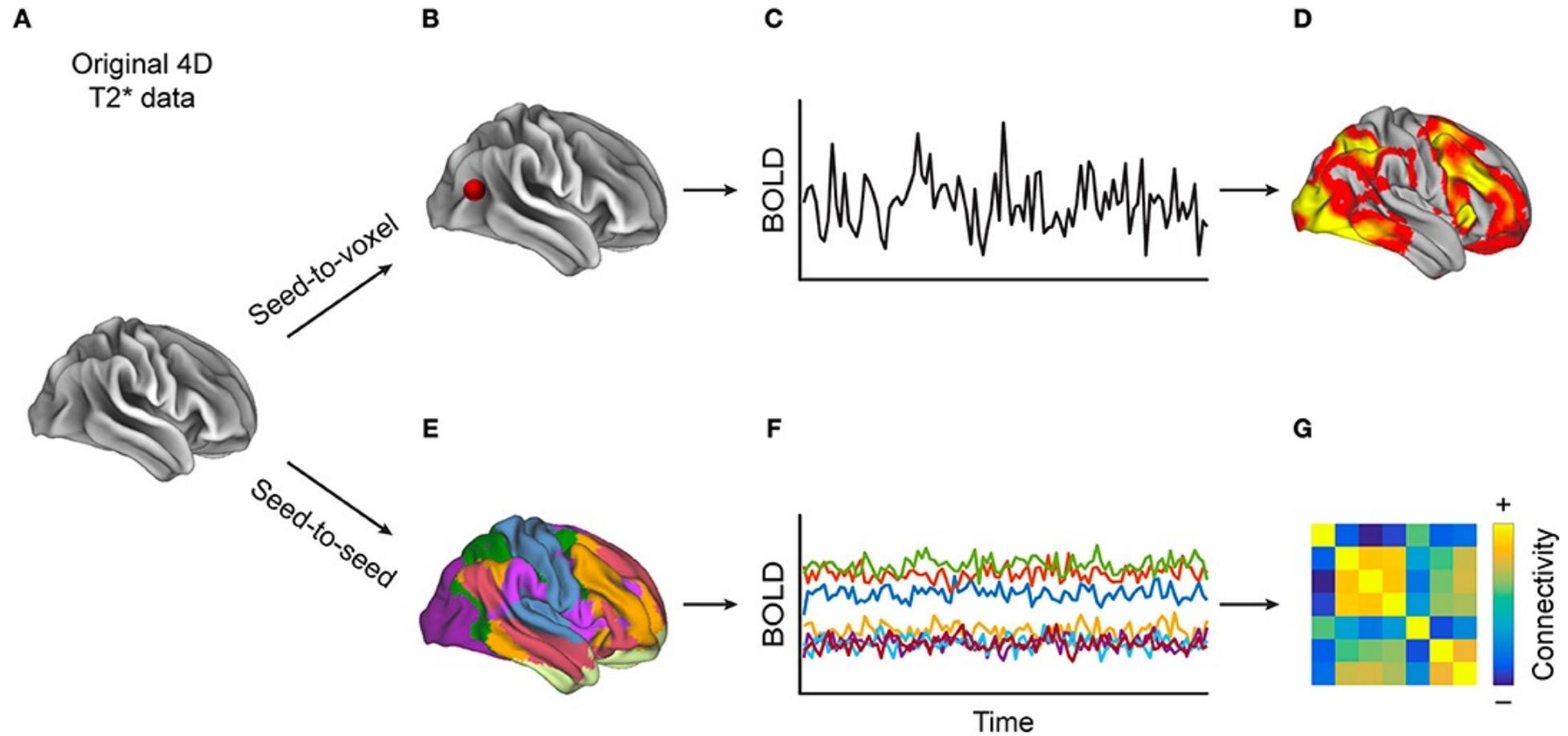
Insula

- Most often implicated in disgust; sometimes also other negative affective/emotional responses
 - Includes affective touch

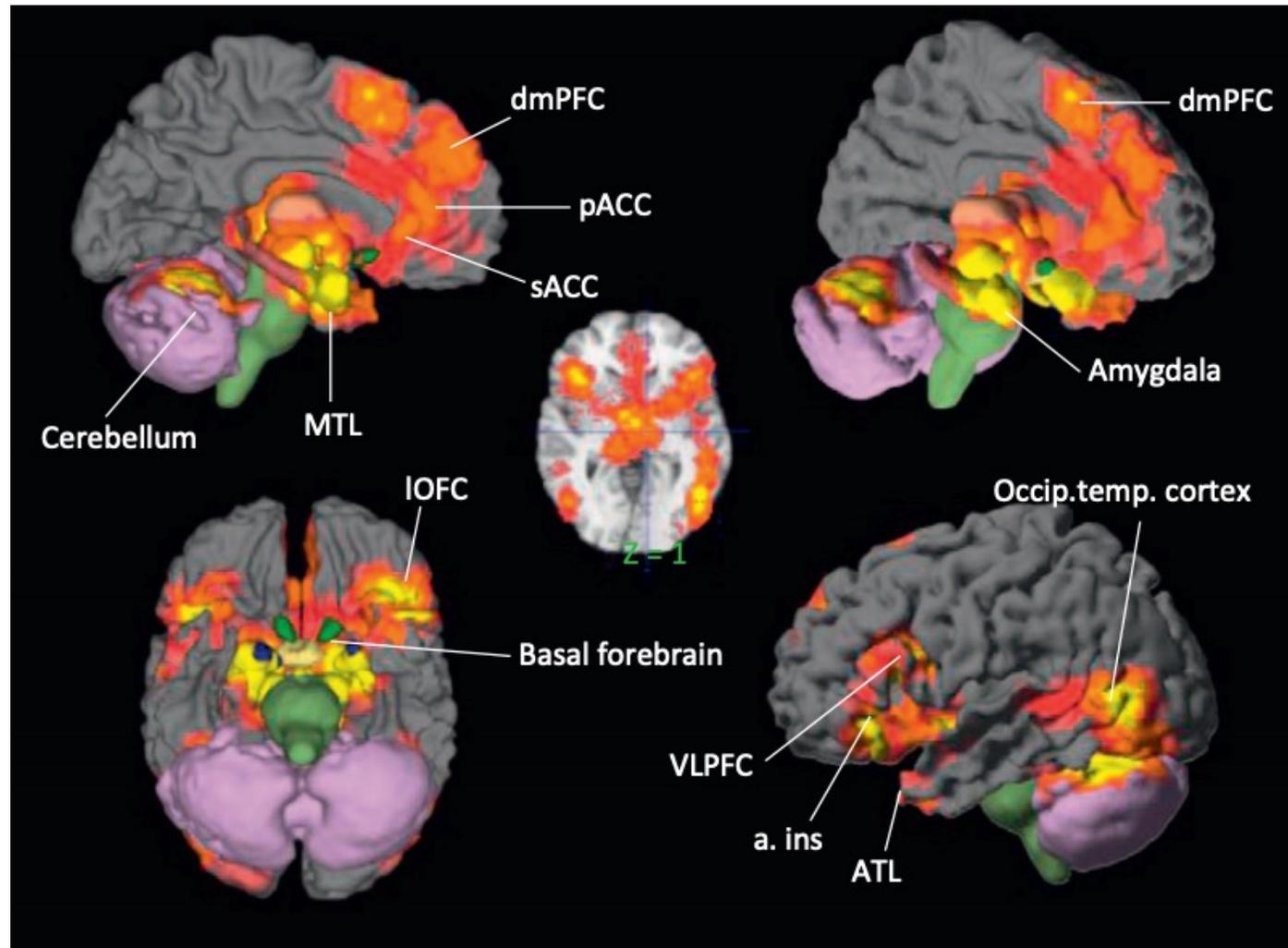




Functional connectivity studies



Functional connectivity studies



Questions? Chat?