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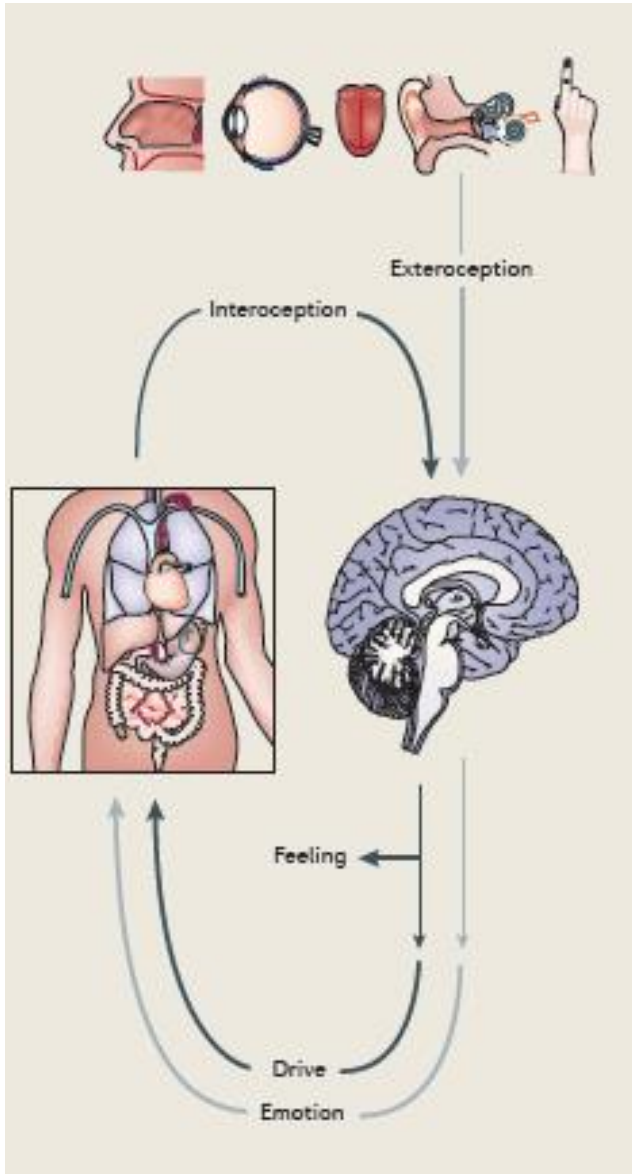
Neuroscience and Mindfulness

**Is it really that hard to just say “I’m hungry”?**

**Interoception (internal sensation) directly influences our feelings**



External information from the senses is without valence (neither good nor bad)  
...but they are labeled with valence by our body state (interoception)



## Emotion and Drive establish homeostasis

### Drive

An action program that is aimed at satisfying a basic, instinctual physiological need: hunger, thirst, libido, attachment, etc.

### Emotions

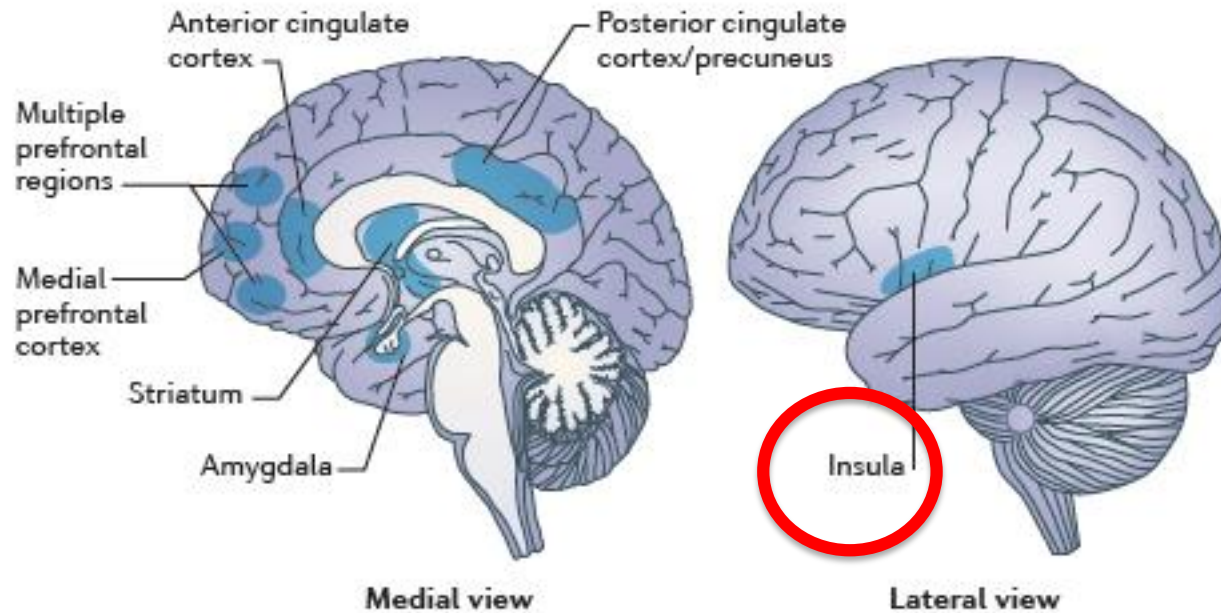
Action programs largely triggered by external stimuli (perceived or recalled): disgust, fear, anger, sadness, joy, shame

### Feelings

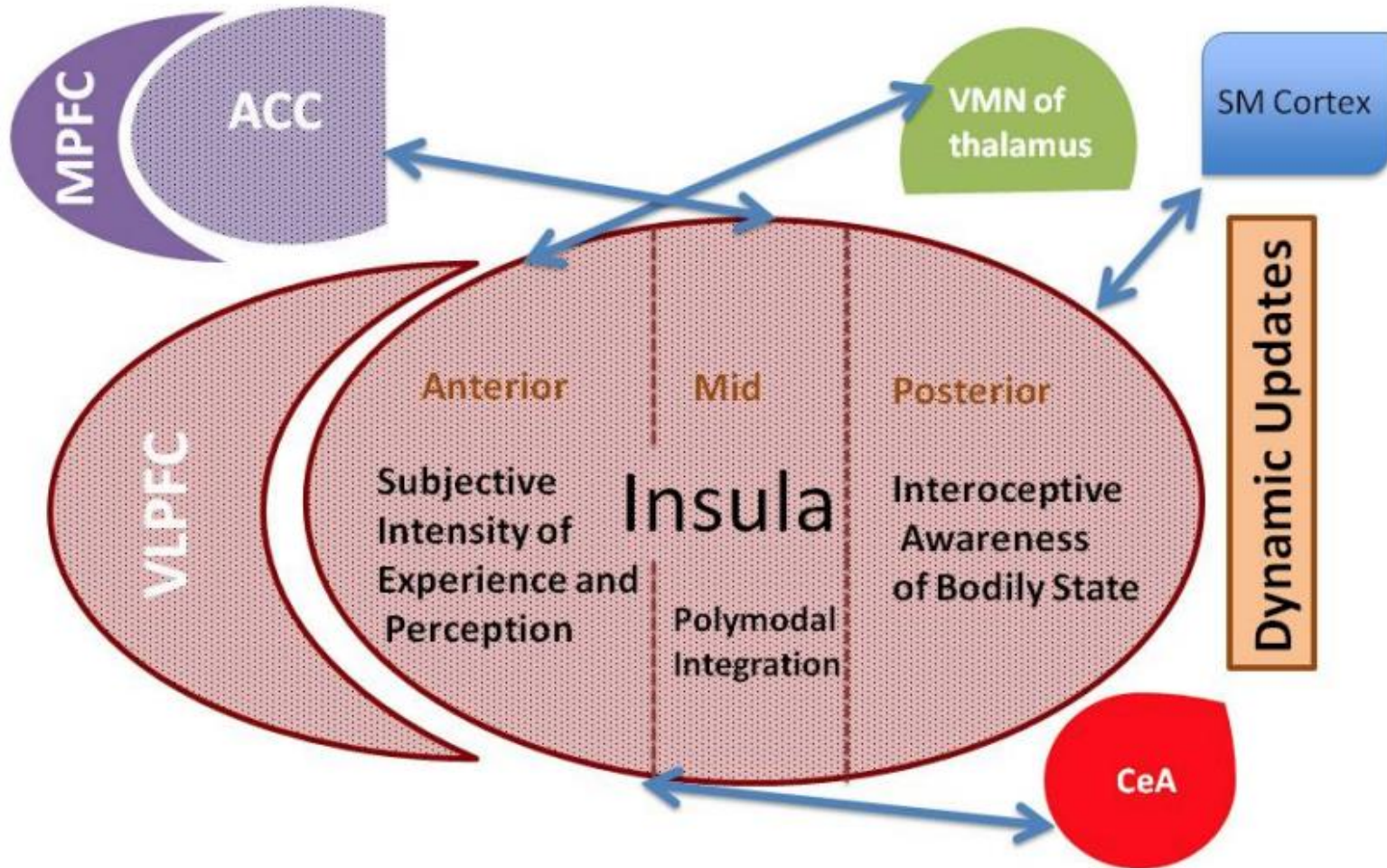
The mental experiences that accompany body states

(Adapted from: The Nature of Feelings, Damasio and Carvalho  
*Nature Reviews* 2013)

# The insula maps our body awareness/sensation.



Adapted from: The neuroscience of mindfulness Meditation. Tang, *Nature Reviews* 2014



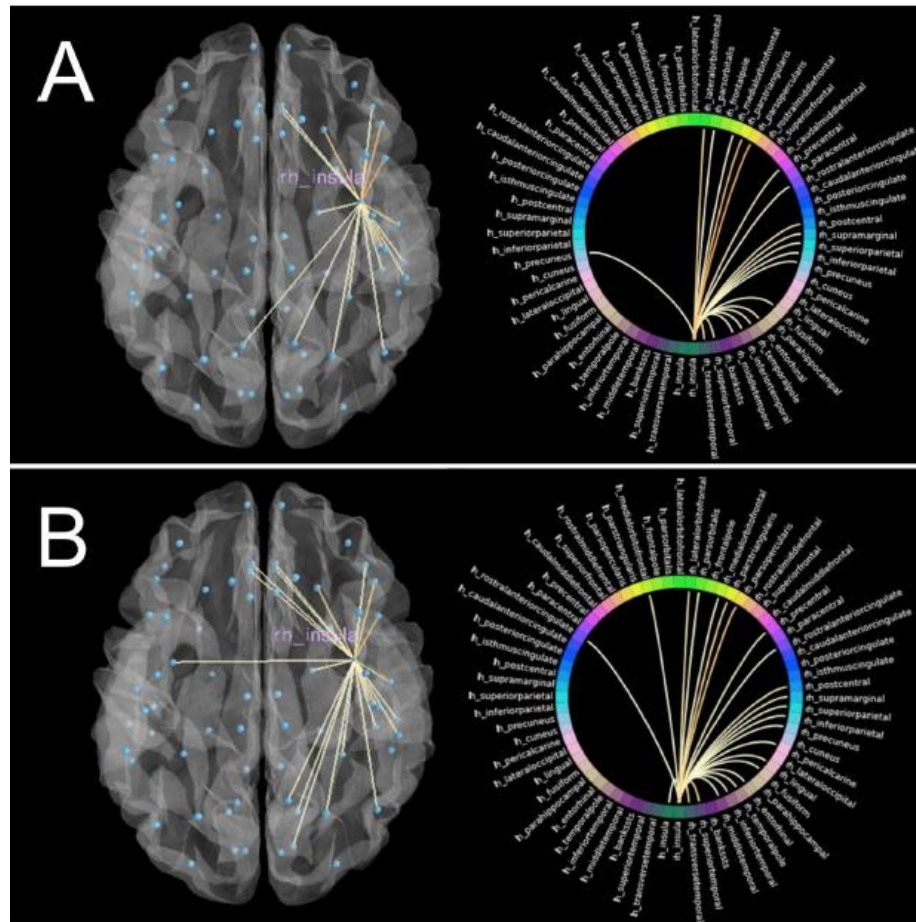
Adapted from: I Feel, Therefore, I am: The Insula and Its Role in Human Emotion, Cognition and the Sensory-Motor System. Pavuluri & May. *AIMS Neuroscience* 2014



# Mismatch of Exteroception and Interoception in Psychiatric Disorders

Psychiatric Disorder	Symptoms	Signs
Panic Disorder	Palpitations, chest pain, dyspnea, choking, nausea, dizziness, flushing, depersonalization/derealization	Elevated heart rate and/or blood pressure, exaggerated escape, startle, and flinching
Depression	Increased or decreased appetite, fatigue, lethargy	Weight gain, weight loss, psychomotor slowing
Eating Disorders	Hunger insensitivity, food anxiety, gastrointestinal complaints	Severe food restriction, severe weight loss, bingeing, purging, compulsive exercise
Somatic Symptom Disorders	Multiple current physical and nociceptive symptoms	Medical observations do not correspond with symptom report
Substance Use Disorders	Physical symptoms associated with craving, intoxication, and/or withdrawal (drug specific)	Elevated/decreased: heart rate, respiratory rate, and/or blood pressure, pupil dilation/constriction, others (drug specific)
Posttraumatic Stress Disorder	Autonomic hypervigilance, depersonalization/derealization	Exaggerated startle, flinching, and/or escape responses, elevated heart rate and/or blood pressure
Generalized Anxiety Disorder	Muscle tension, headaches, fatigue, gastrointestinal complaints, pain	Trembling, twitching, shaking, sweating, nausea, exaggerated startle
Depersonalization/Derealization Disorder	Detachment from one's body, head fullness, tingling, lightheadedness	Physiological hyporeactivity to emotional stimuli

# Reorganization of right insula (enhanced connectivity) following 20 week body awareness mindfulness



(Adapted from: Mindfulness training induces structural connectome changes in insula networks. Sharp, et al *Scientific Reports*, 2018)