Diseases of the Brain
(*Psychiatric* diseases of the brain)

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Why worry about mental illness?

- 26% of American adults with a mental illness each year
- Cost to treat mental illness
  - About 10% of health care costs per year are for mental illness
  - Serious mental illnesses (SMIs), cost society $193.2 billion in lost earnings per year
- Suicide
  - About 30,000 of suicides / year in US
  - Twice as many suicides as homicides every year

Why study the brain in mental illness - couldn't you just make yourself well?

- If you could make yourself well, who would be sick?
- Lots of people don't respond to the treatments we have
- Lots of illnesses don't have good treatments
- Lots of things happen in your brain that you aren't aware of

Big questions

- What the brain does
- Parts of the brain
- When things don’t work right

How do we know what the brain does?

2 main ways: ***What do you think?***

1)

2)

How do we know what the brain does?

Its really (*really really really*) hard to figure out how the brain works.

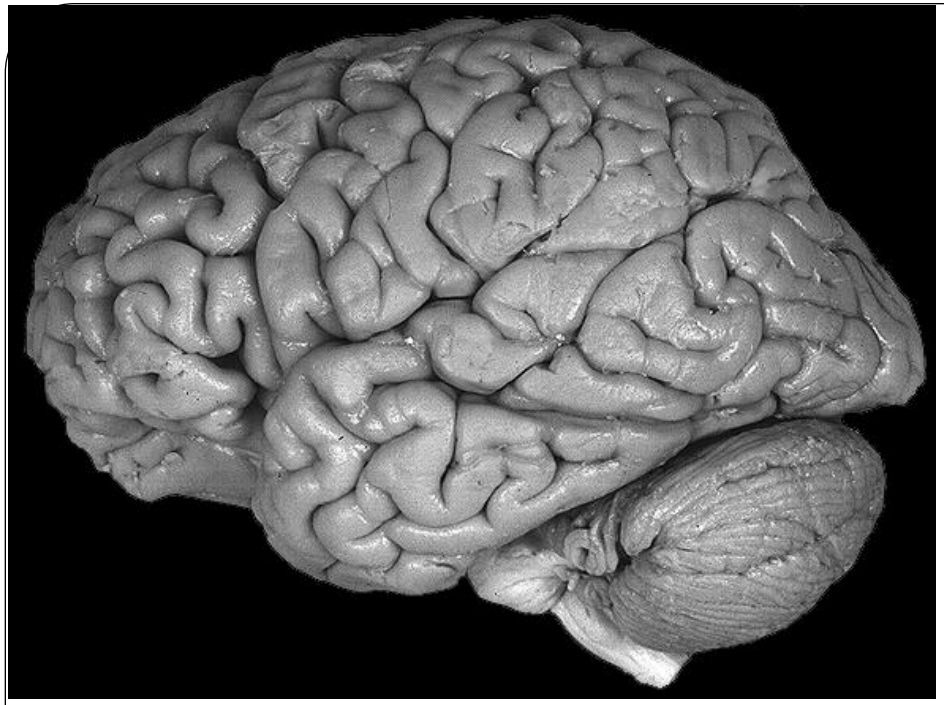
2 main ways:

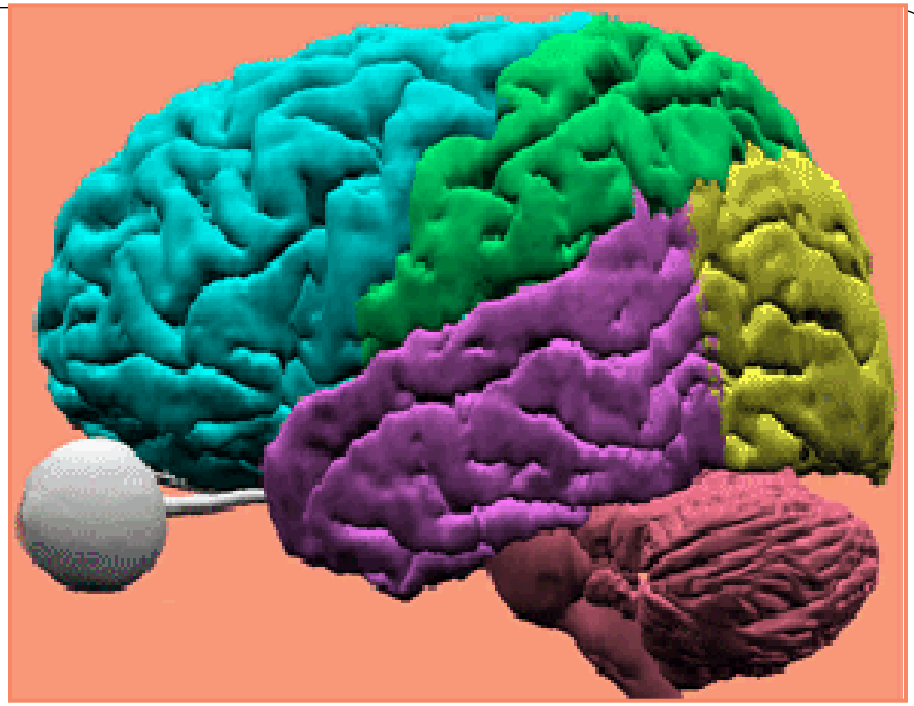
1) See what happens with brain damage

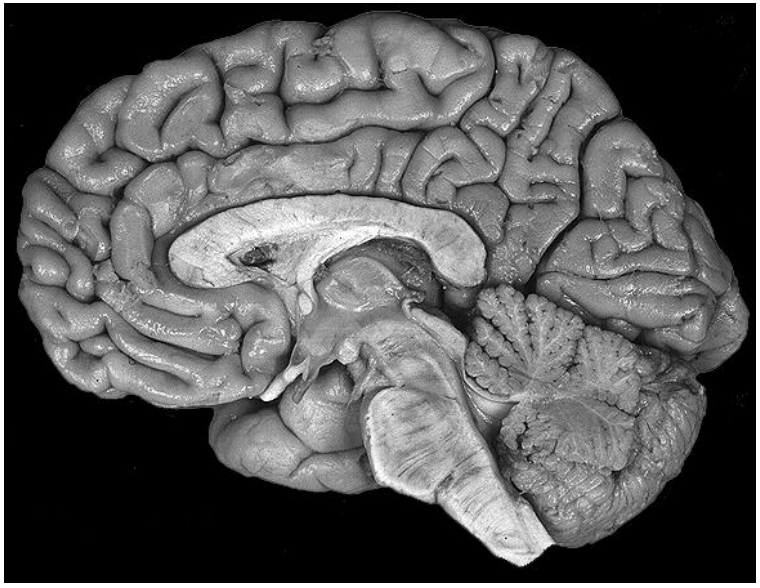
2) Use new machines to look through the skull into the brain

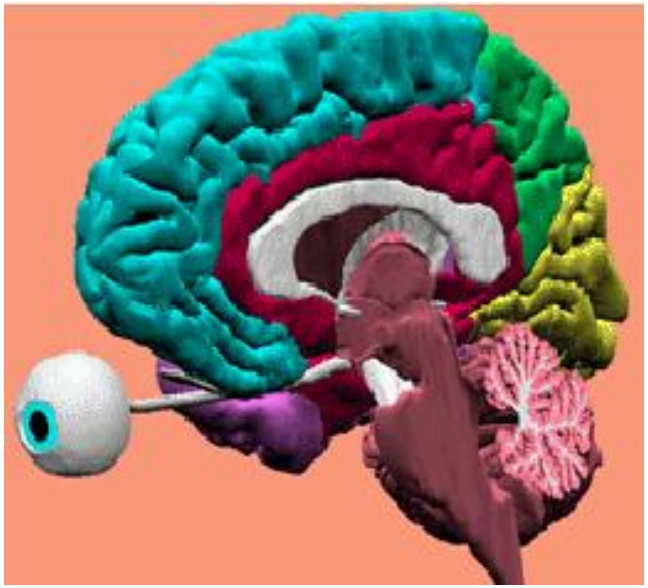
How to know what the brain does?

Look for what changes when the brain is damaged









Different jobs for different parts of the brain

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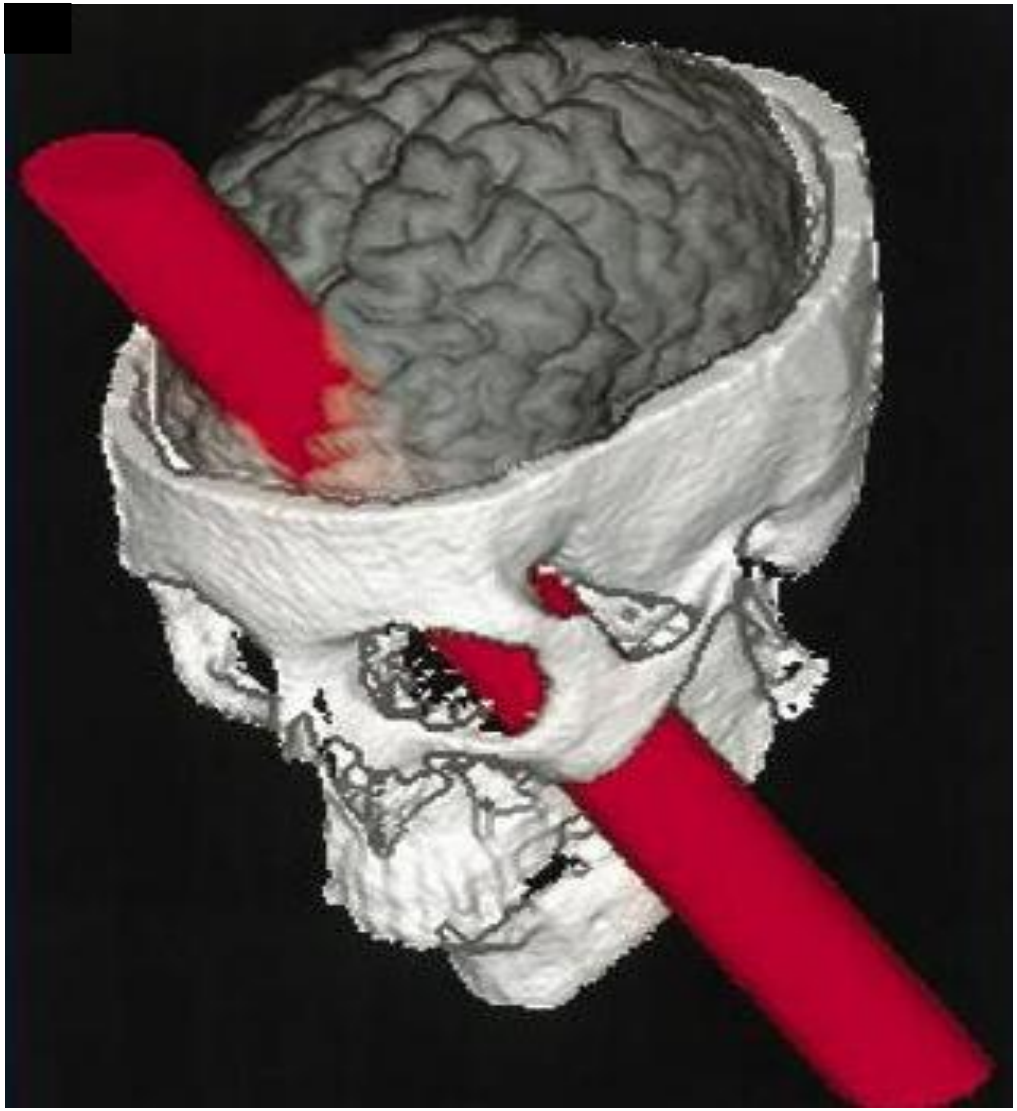
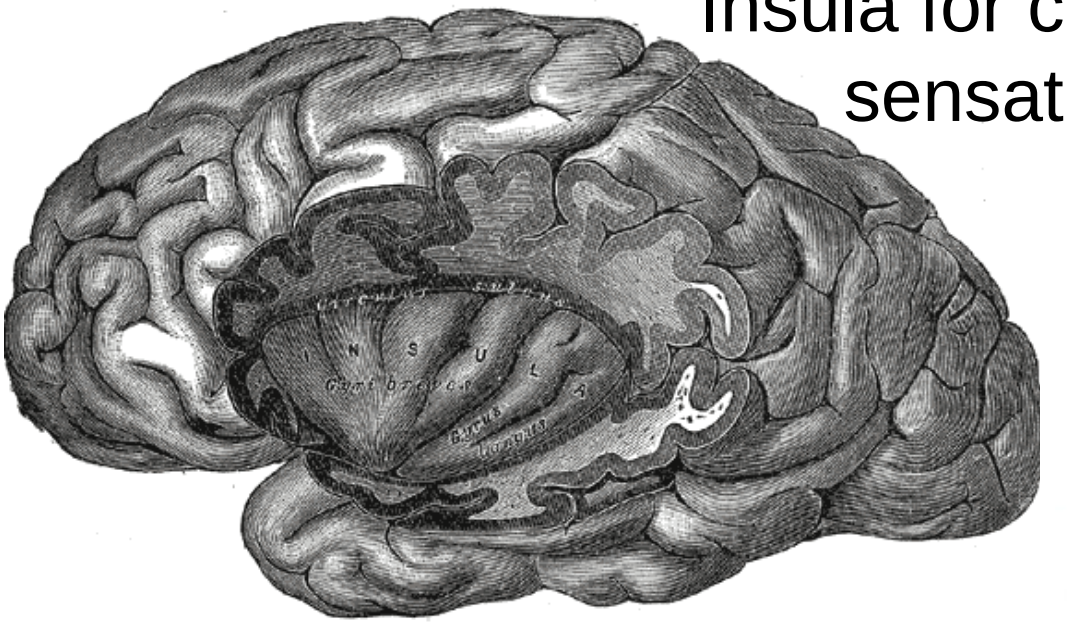
Phineas Gage & brain anatomy

- ***Before*** "shrewd, smart businessman", "possessed a well-balanced mind
- ***After*** accident 1848 – didn't care about other people, couldn't follow rules & couldn't make up his mind, drunk, friends said "he was no longer Gage"

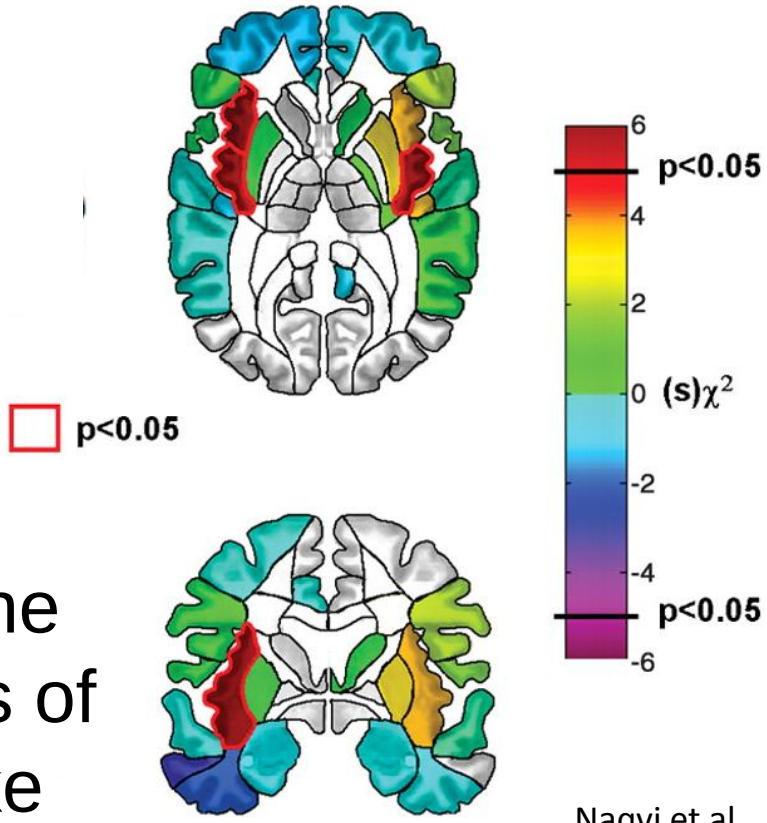


from Damasio H et al Science. 1994

“insula… bodily sensations & conscious emotions”



Insula for chest/abdomen sensation - “gut feelings”



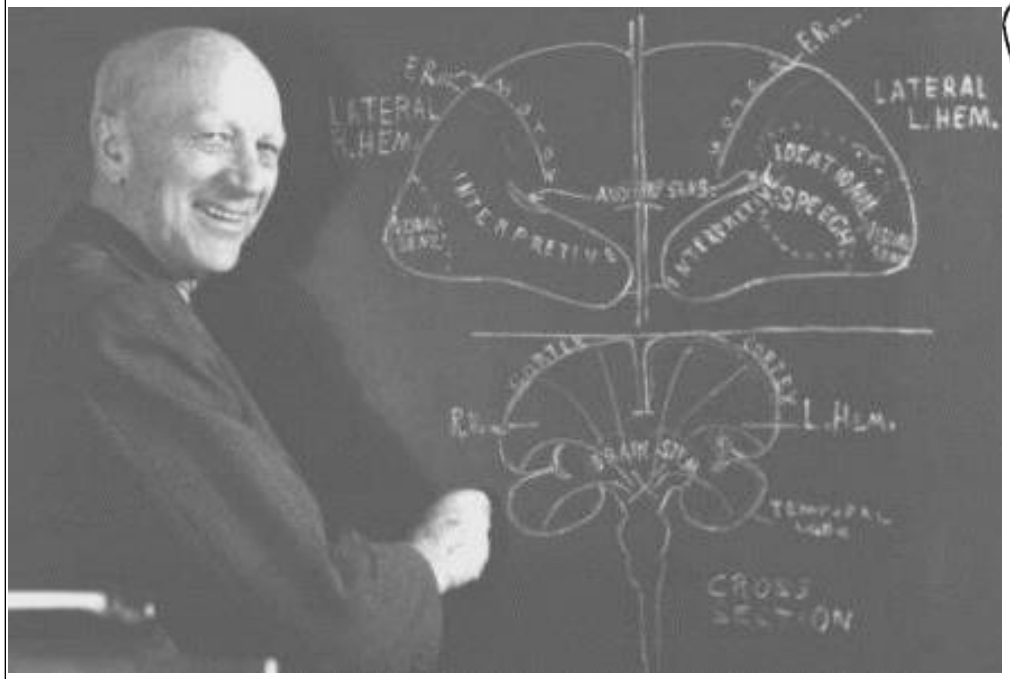
Damage to the insula ⇒ loss of urge to smoke

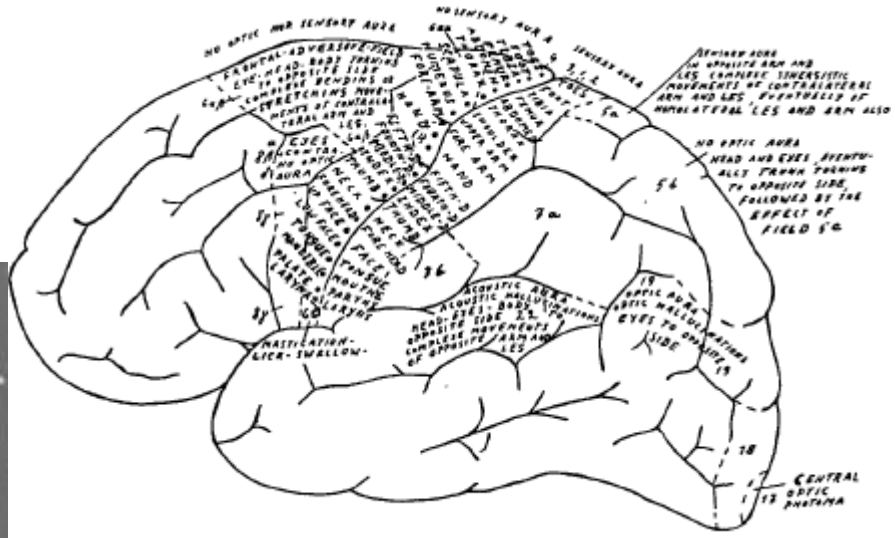
Naqvi et al ’07 Science

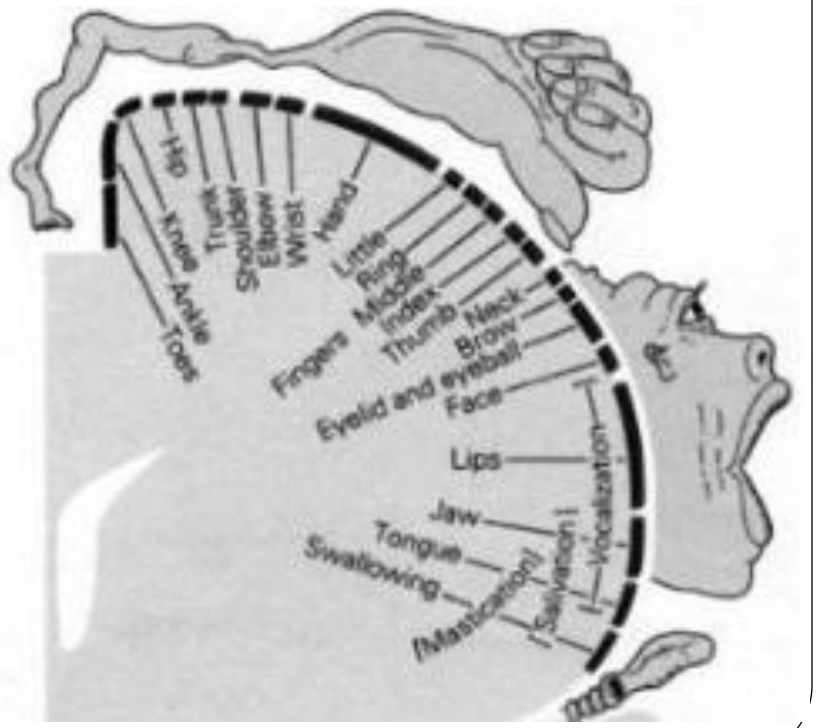
How to know what the brain does?

A different way to know what the brain does - see it working

Wilder Penfield







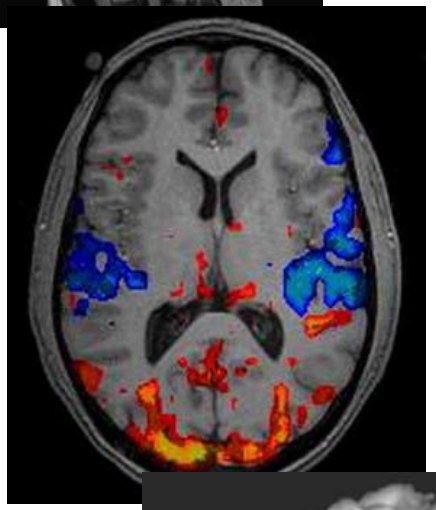
Stimulation of brain during surgeries told us about simple movements / simple sensations

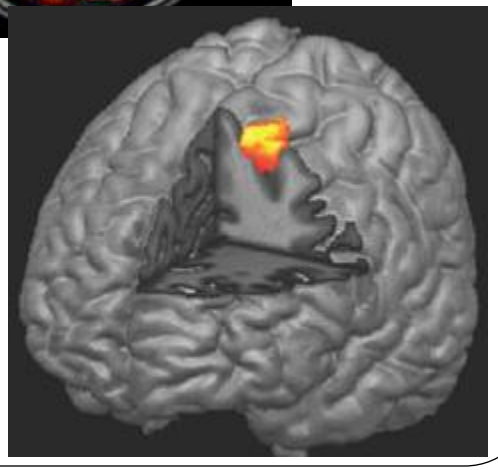
Structural and functional neuroimaging - "pictures of the brain & brain activity"

- Structural
  - CT
  - MRI
- Functional
  - PET
  - SPECT
  - fMRI
  - MEG

You don't need to open someone's skull to do it - people like that

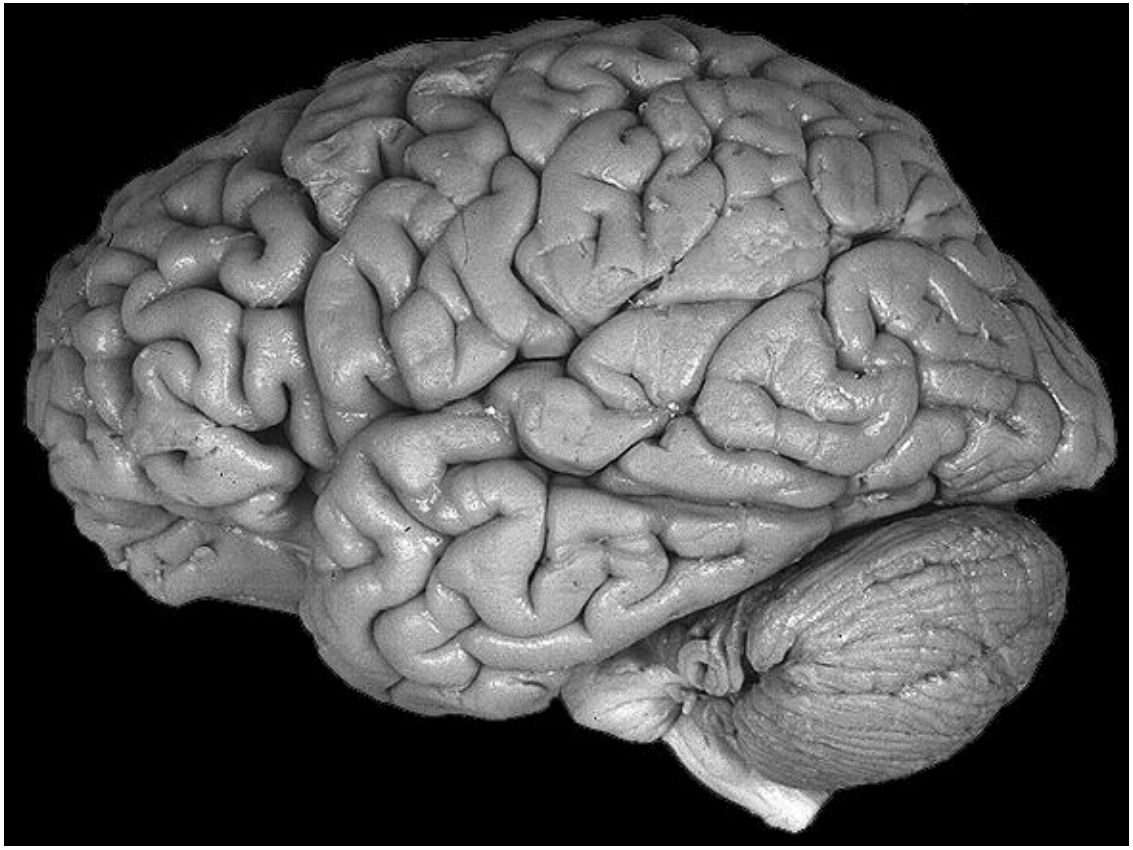
MRI scanner



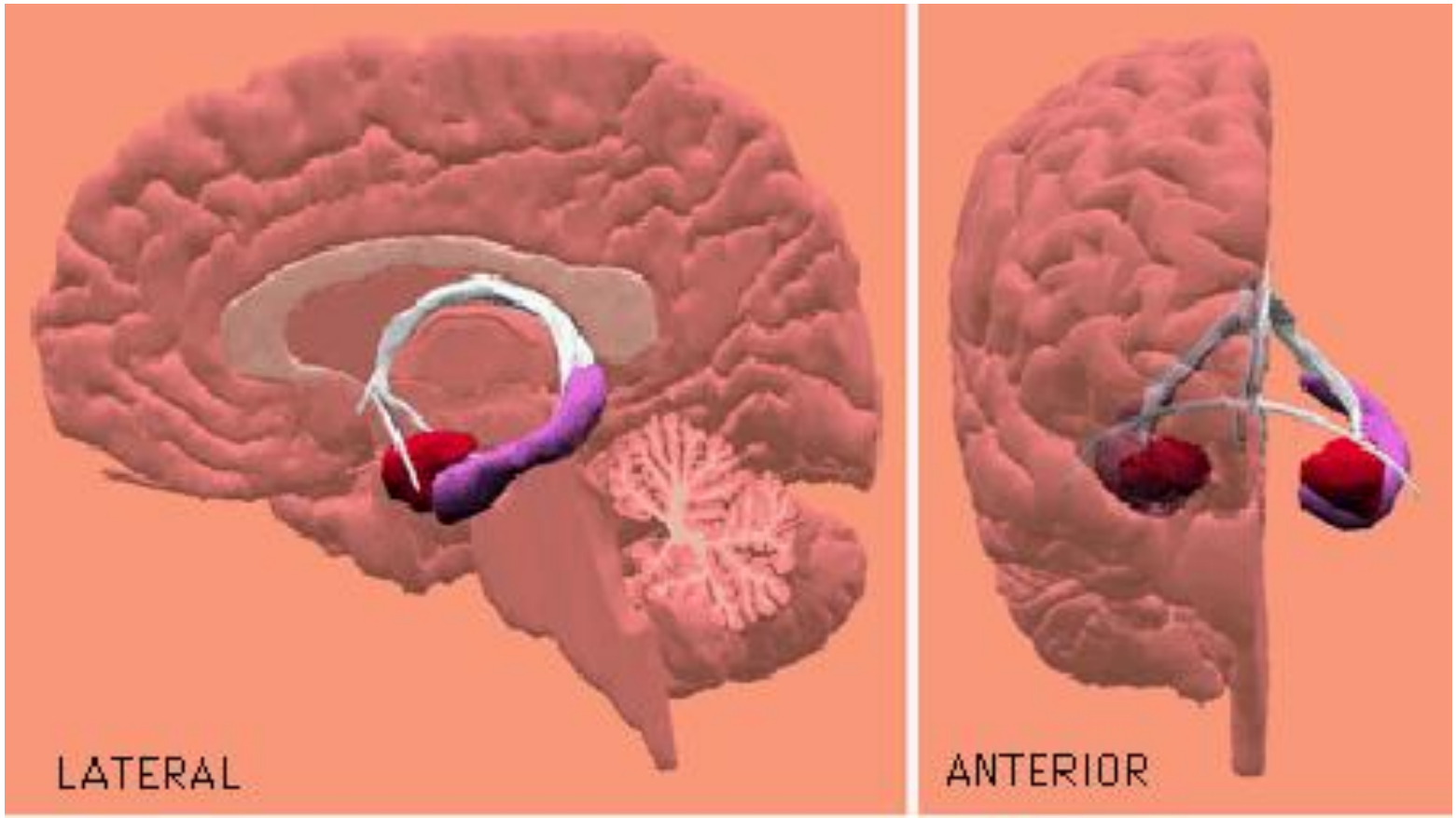


Some important parts of the brain

- Frontal Lobe – words/plans/actions
- Temporal lobe – put your senses together
- Amygydala and hippocampus



Amygdala & hippocampus in temporal lobe



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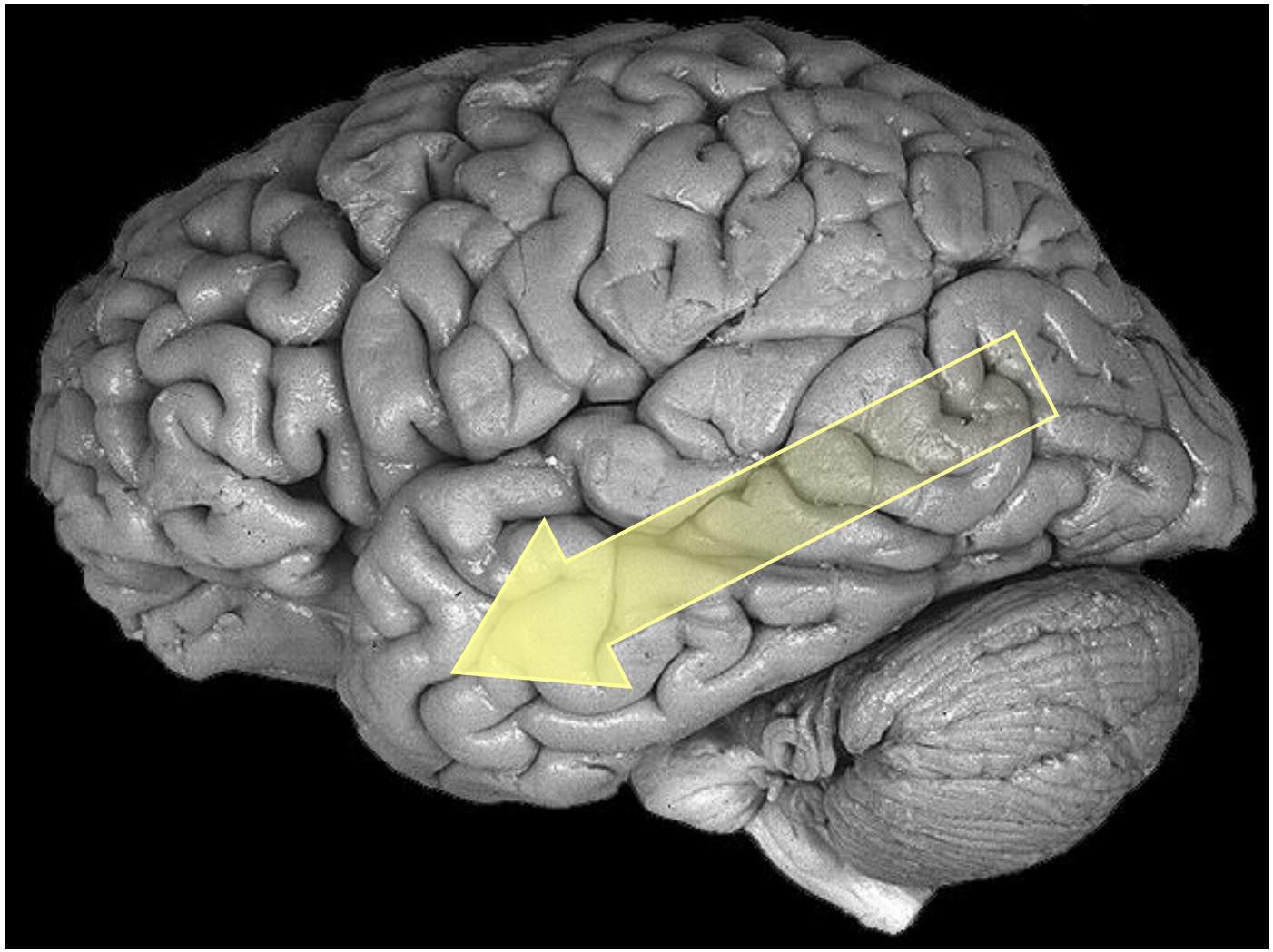
Amygdala & hippocampus

- Amygdala
  - Emotional knowledge and emotional memories
- Hippocampus
  - Memory about facts/places

How you know what your senses tell you



Senses start at the back and move forward

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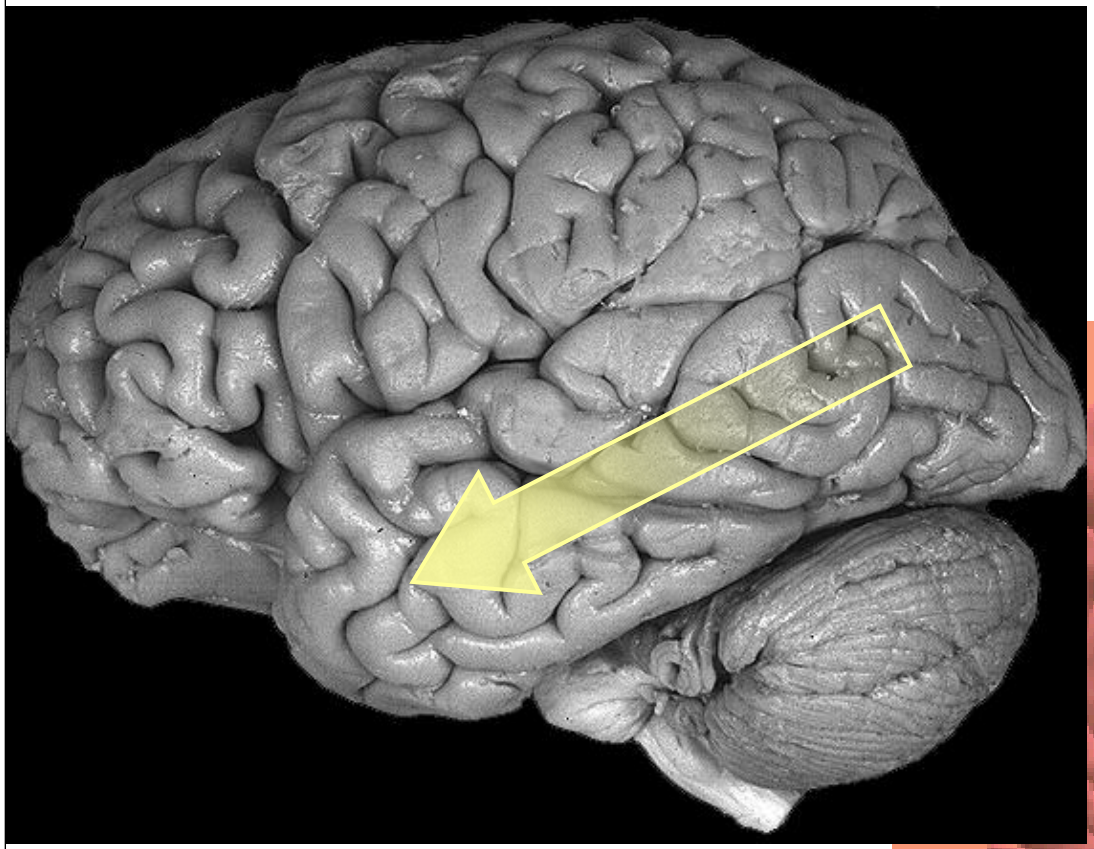
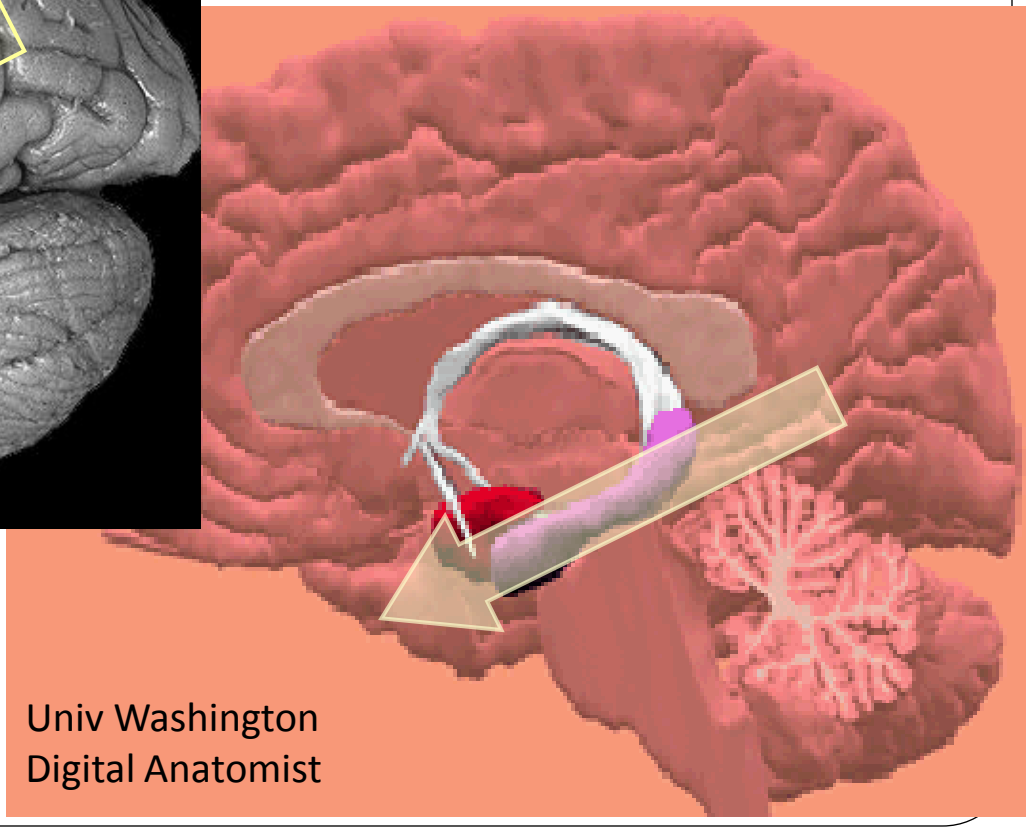
Mental picture of what your senses tell you - amygdala & hippocampus help





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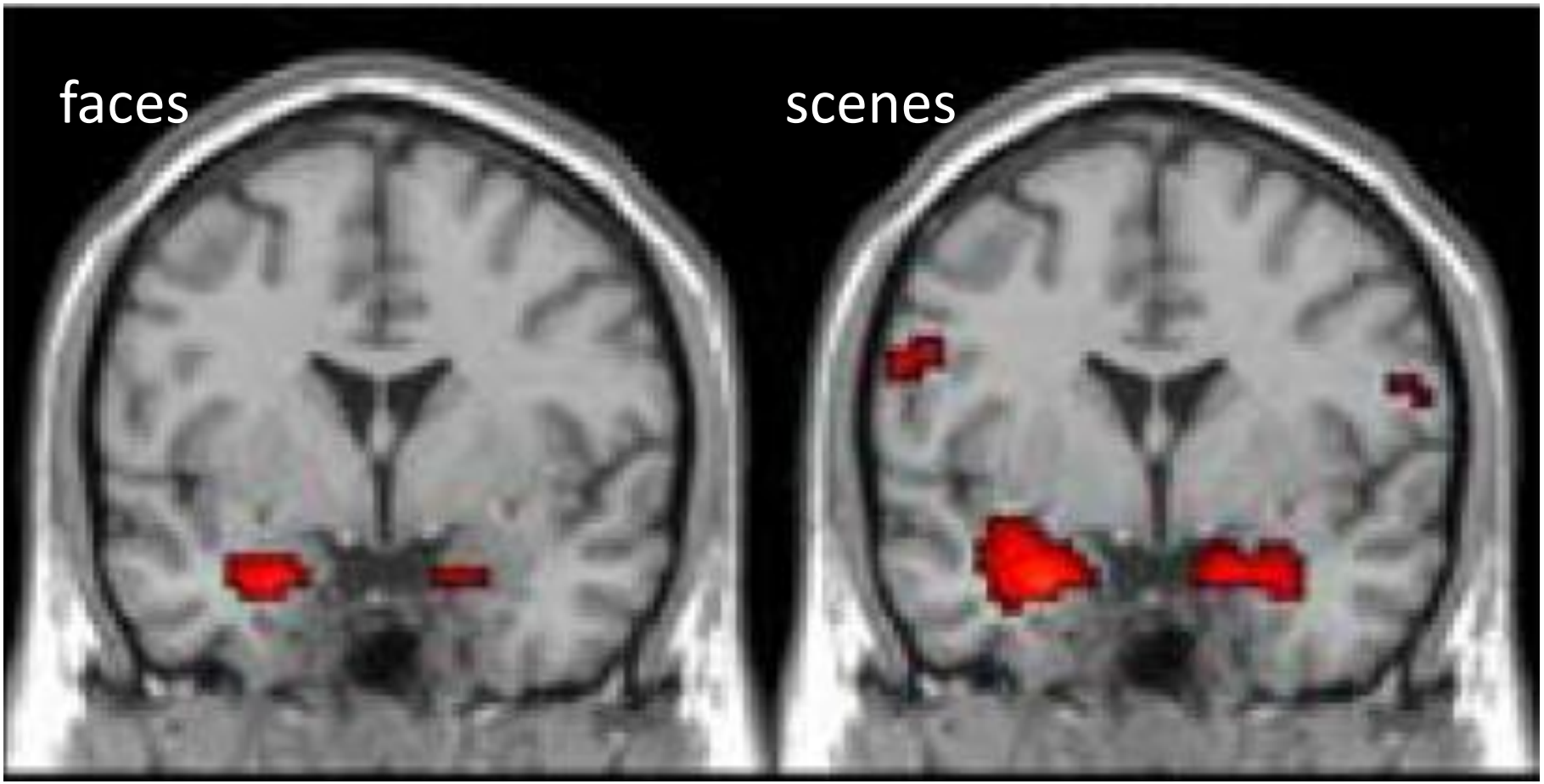
What happens when some brain parts don’t work right

Amygdala - fear & anxiety

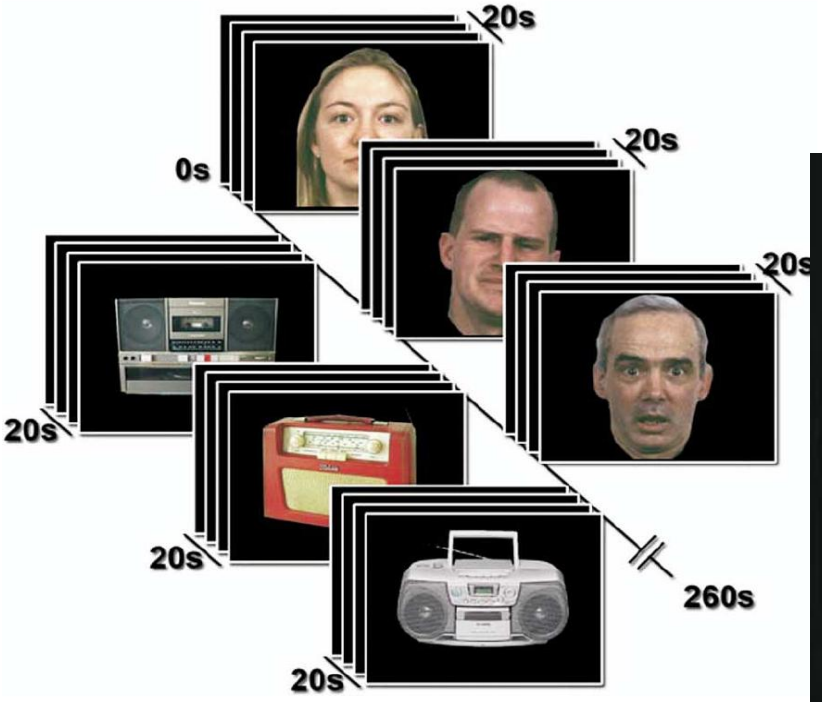
Frontal lobe - depression

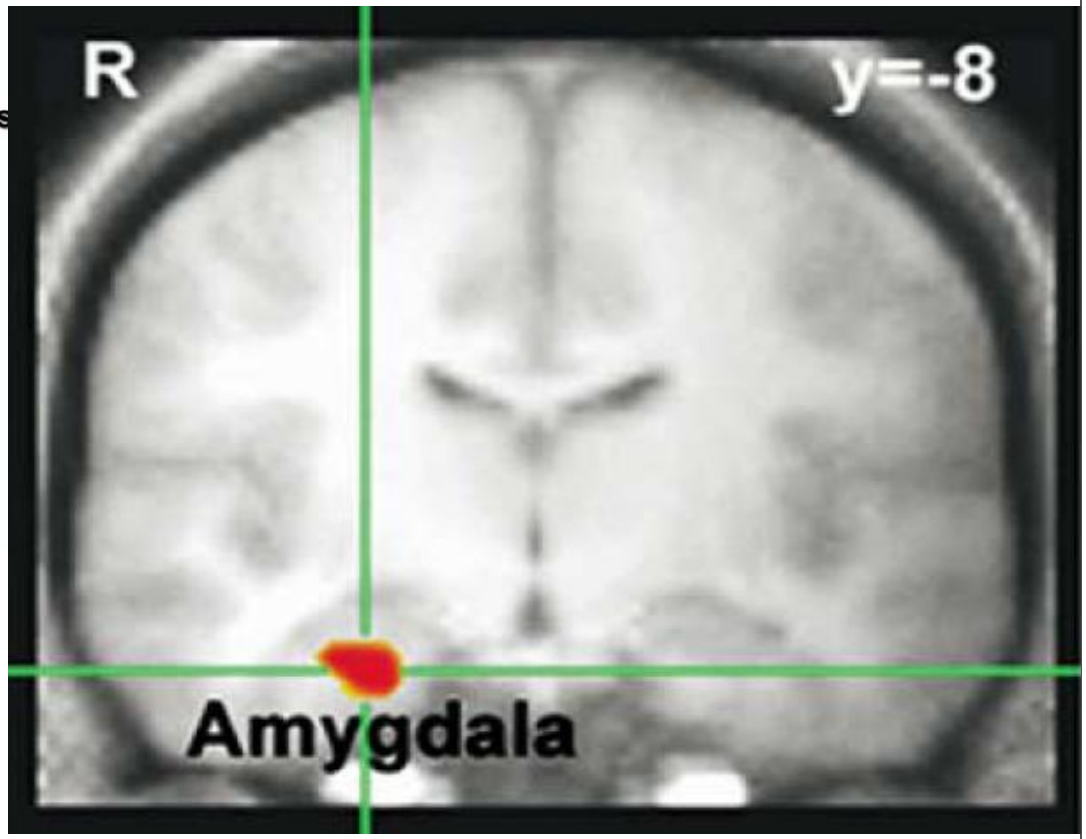
Fearful faces or frightening scenes increases amygdala activity



Kirsch et al ’05 The Journal of Neuroscience

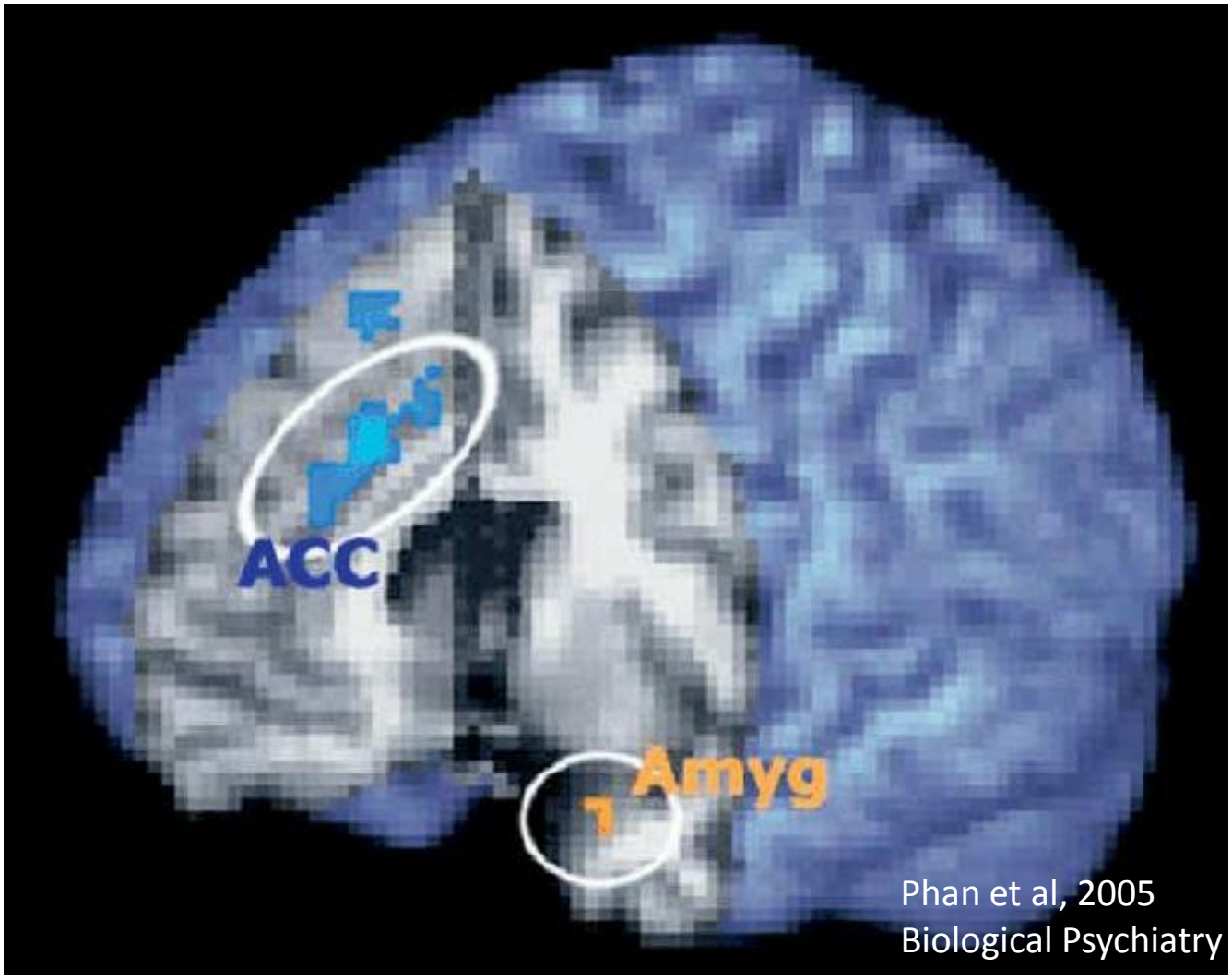
Amygdala has a stronger reaction in anxiety illnesses





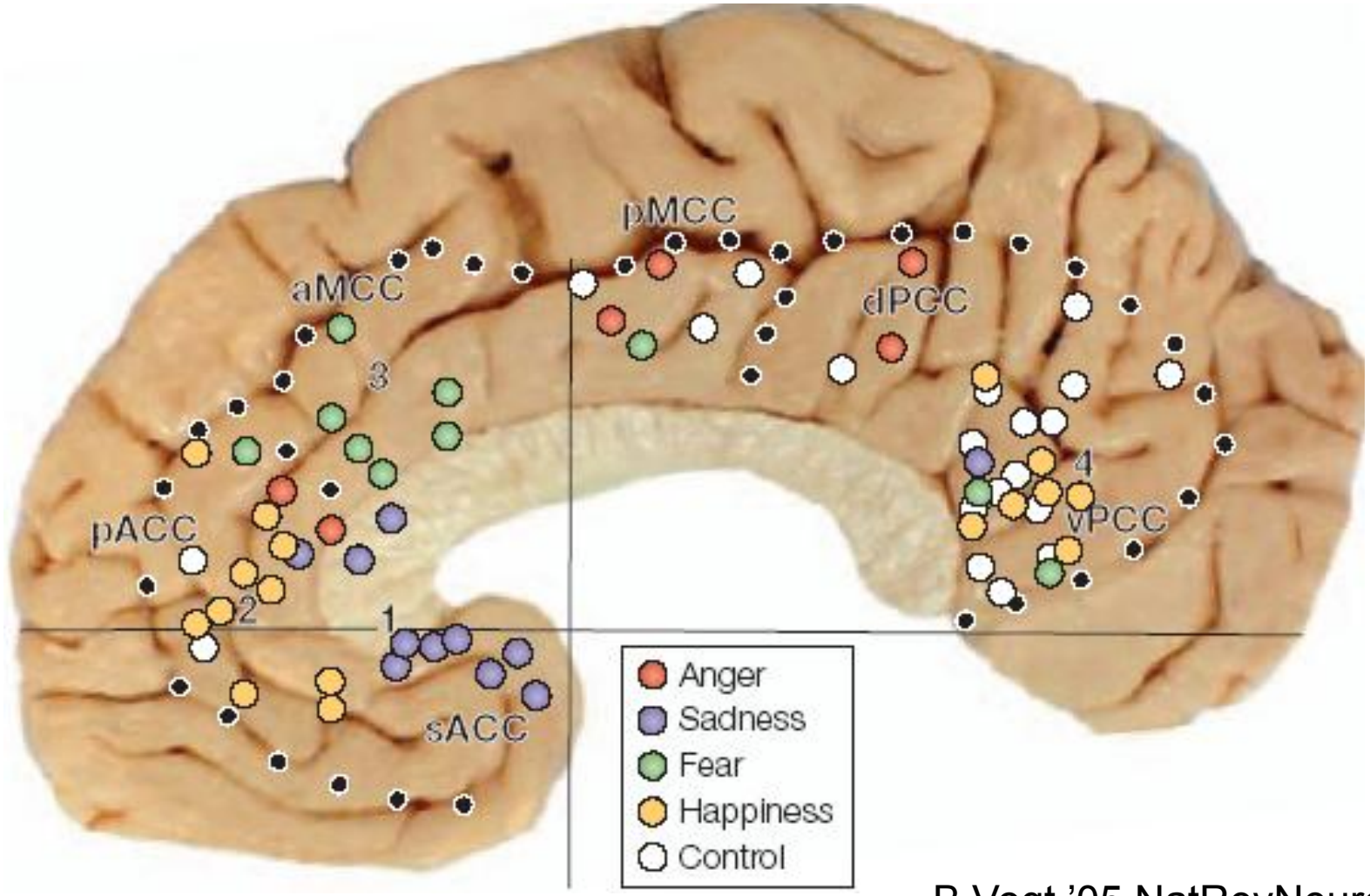
Phan et al 2006 BiolPsy

Top of the frontal lobe helps quiet down emotion



This can help decrease anxiety and sadness

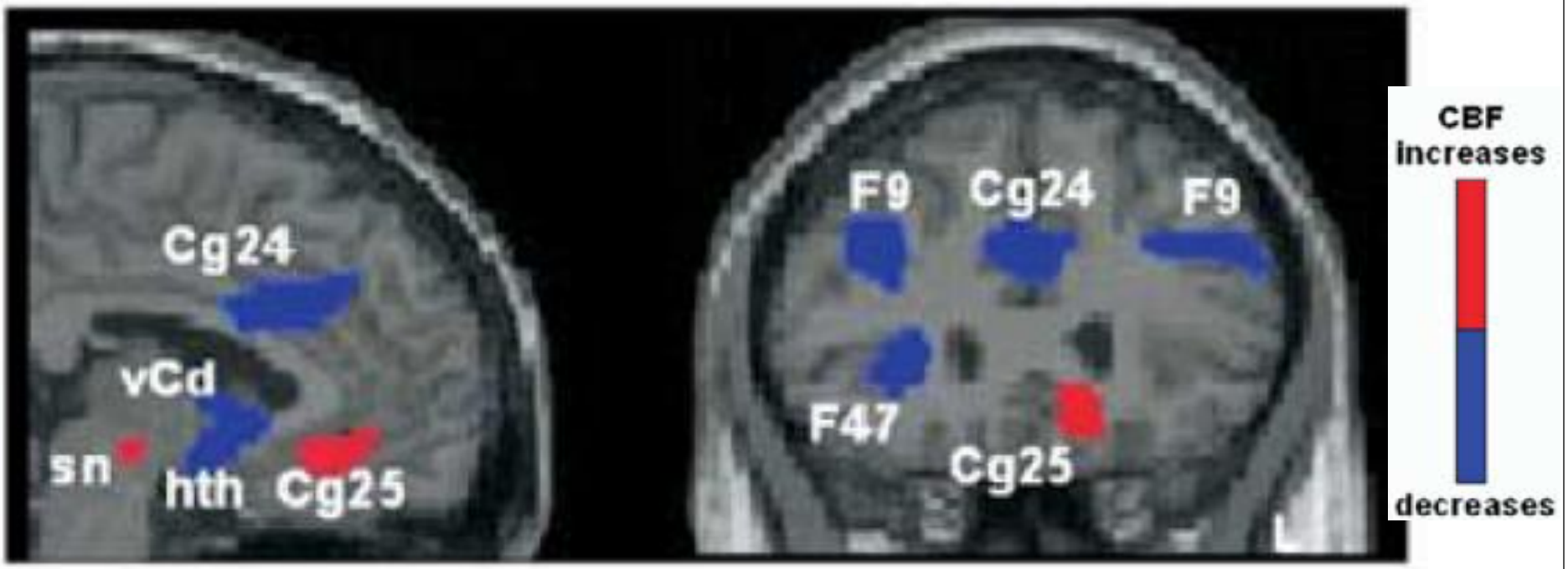
Middle of frontal lobe responds to emotion pictures / stories



B Vogt ’05 NatRevNeurosci

Depression in the brain

Depressed subjects vs non-depressed controls



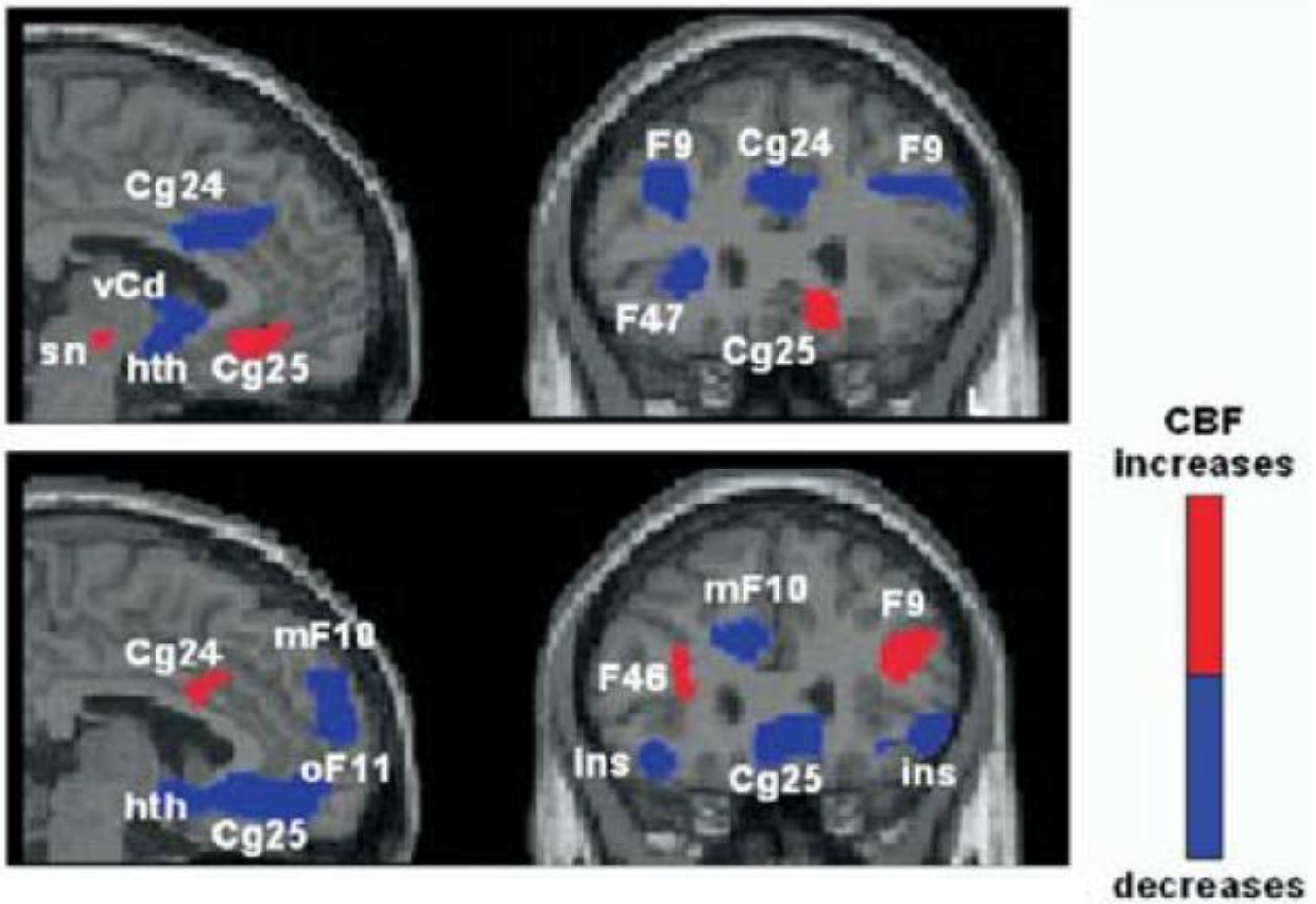
Red means more active, blue means less active

A normal function converted to abnormal function

Mayberg et al 2005 Deep brain stimulation for treatment-resistant depression. Neuron

Depression in the brain - treatment

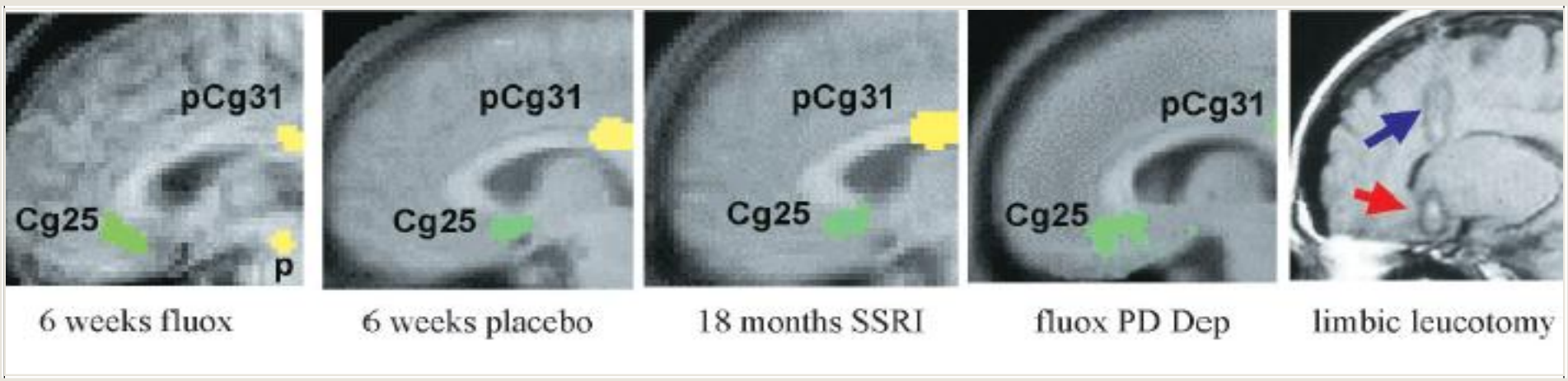
Patients vs Normals



Before treatment vs after treatment

Mayberg et al 2005 Deep brain stimulation for treatment-resistant depression. Neuron

Brain activity changes when depression improves



Mayberg ’03
BrMedBull

So….

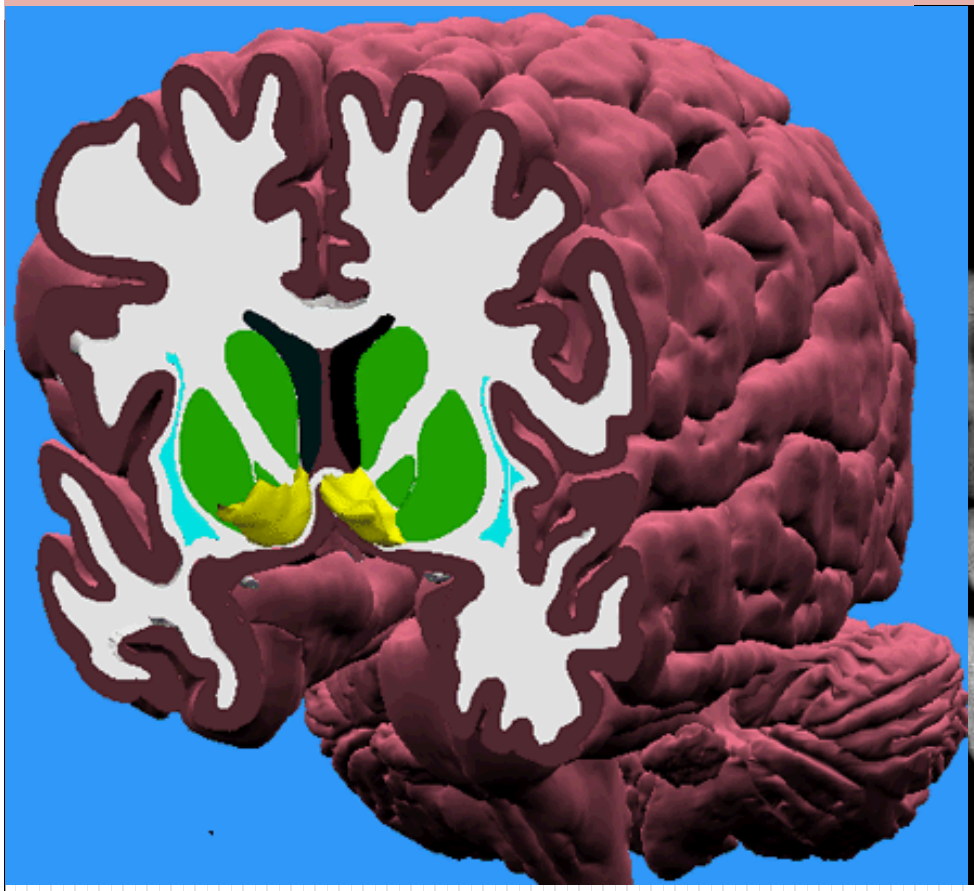
Psychiatric diseases are due to changes in the how the brain works.

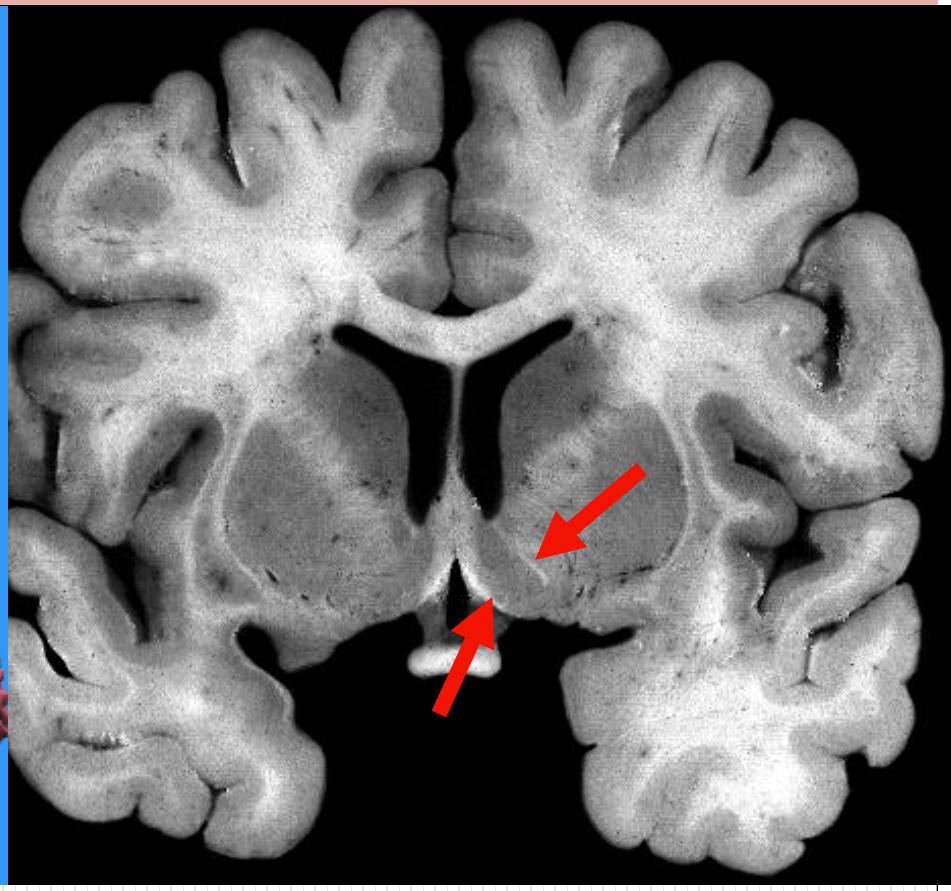
Depression & anxiety diseases are exaggerated normal functions.

Questions

- 1. Are you in control of your thoughts?
- 2. What diseases do you know about and how do they affect your life?
- 3. What is the importance of treatment in psychiatric disorders?

Behavior and the basal ganglia





What is this yellow thing?

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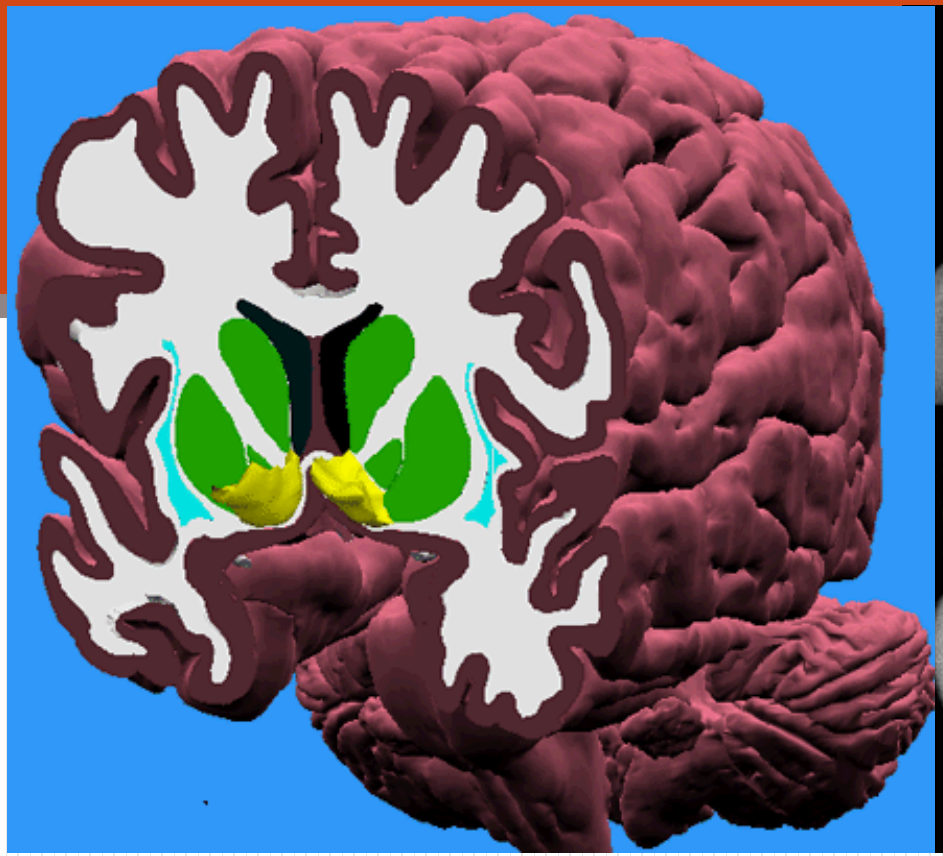
Reward systems



Ventral striatum / accumbens

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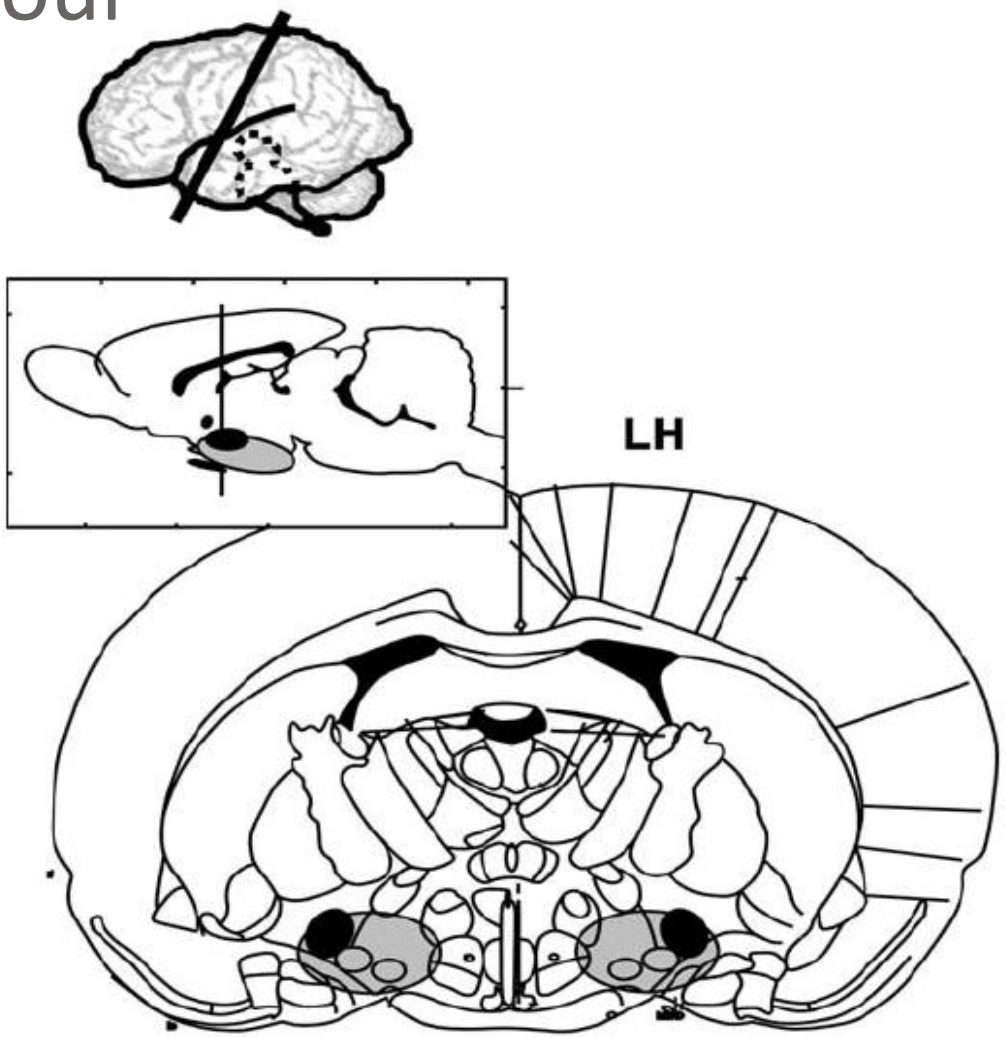
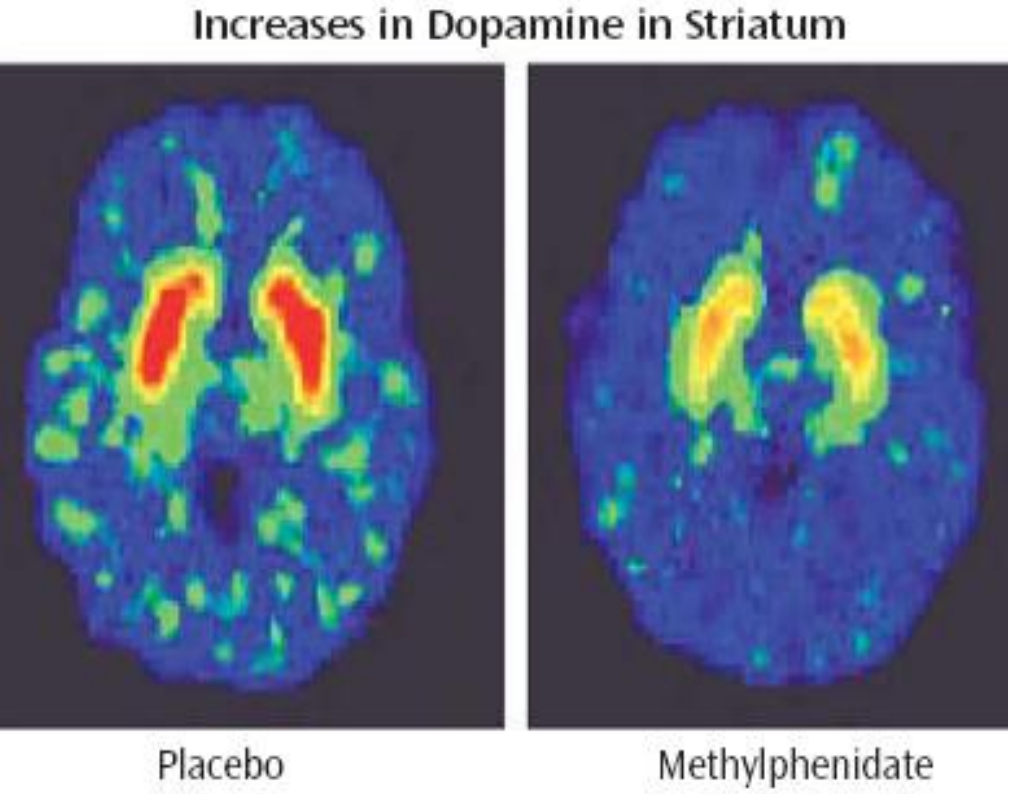
Lesion in ventral striatum makes sweet "taste" sour

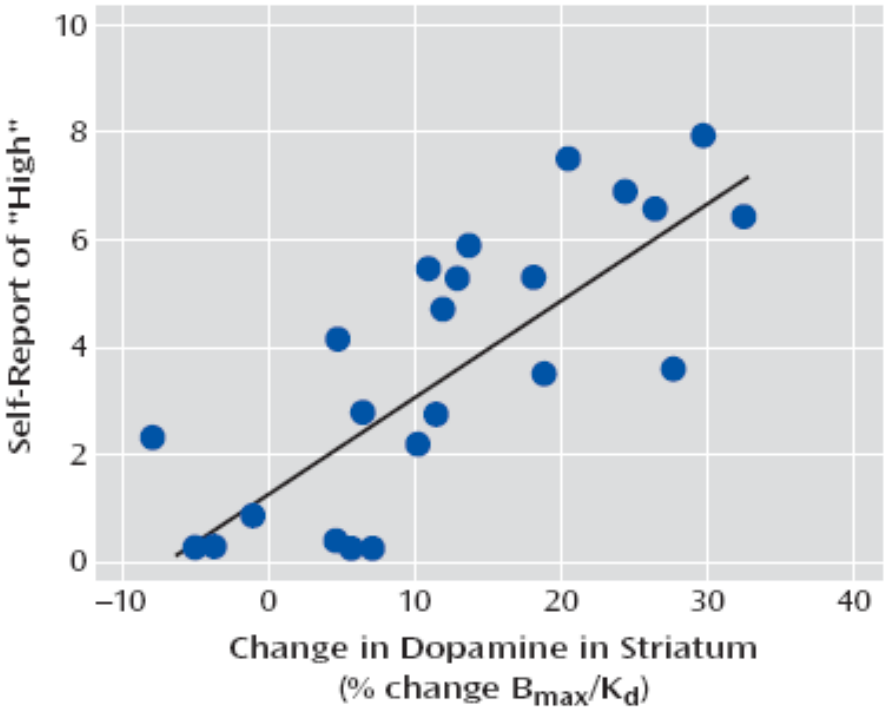


Ventral Pallidum
'Aversion lesion'

Berridge '03
Brain & Cognition

Ventral striatum & high

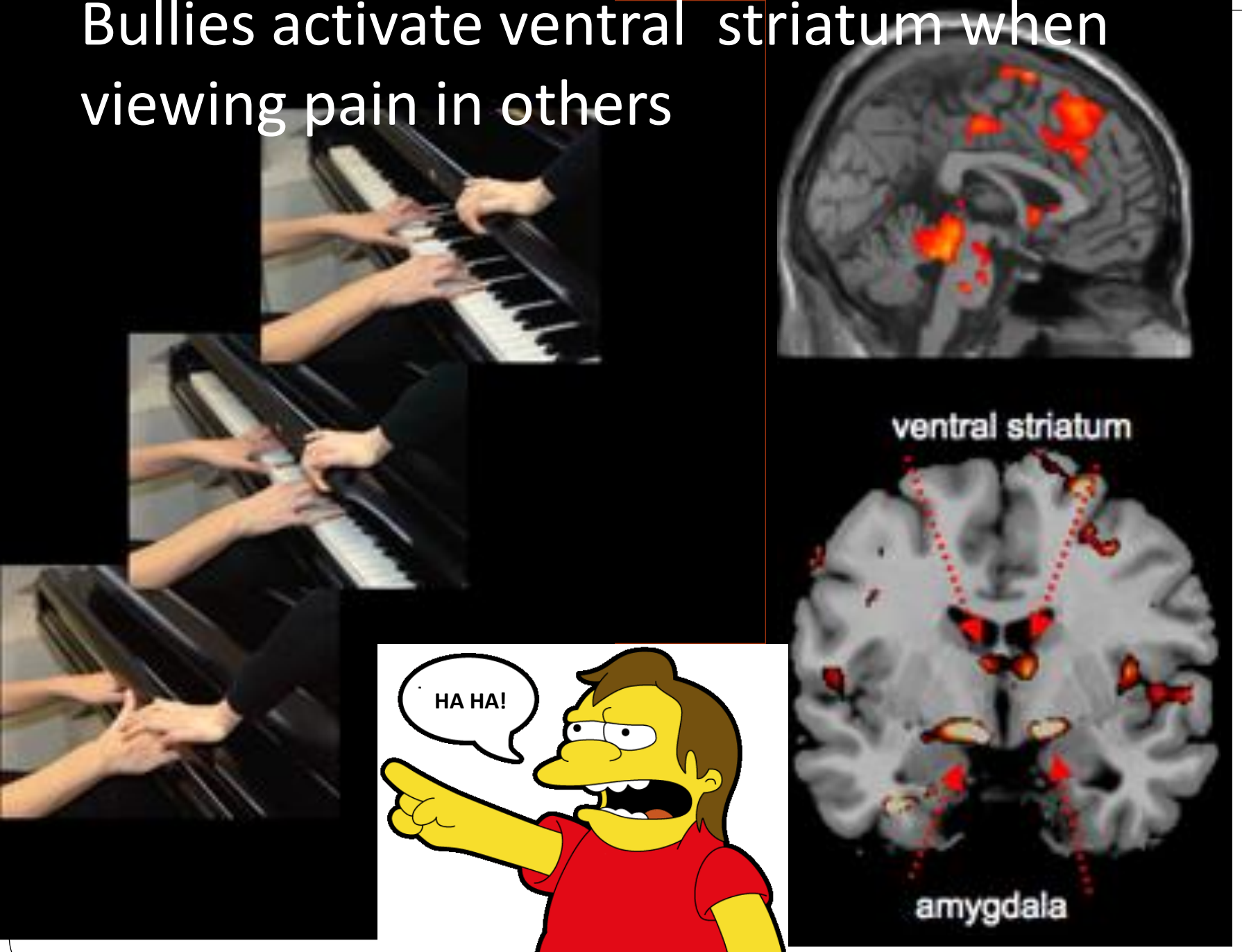




KALIVAS & VOLKOW ’05 American Journal of Psychiatry

NEURAL BASIS OF ADDICTION

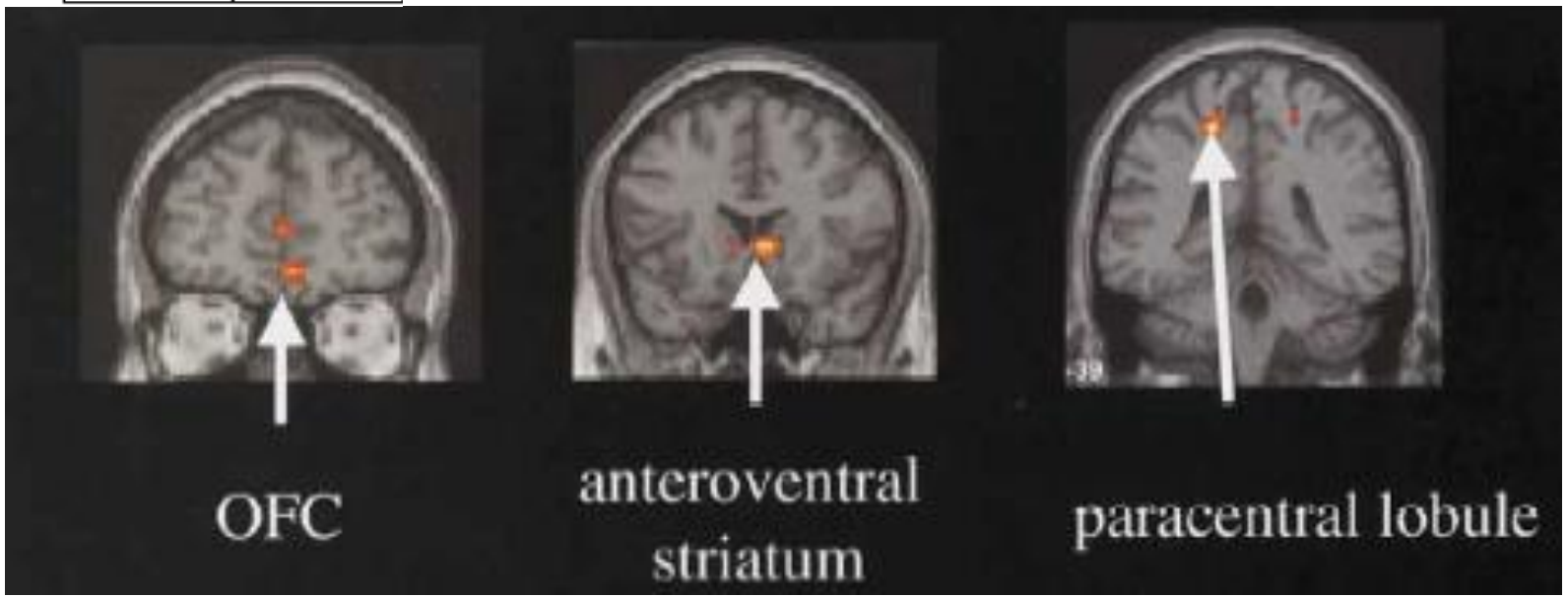
Bullies activate ventral striatum when viewing pain in others



From Jean Decety, PhD

Activation with mutual cooperation

		Player A: Coop	Player A: Defect
Player B	Coop	$2 (2)	$3 (0)
Player B	Defect	$0 (3)	$1 (1)

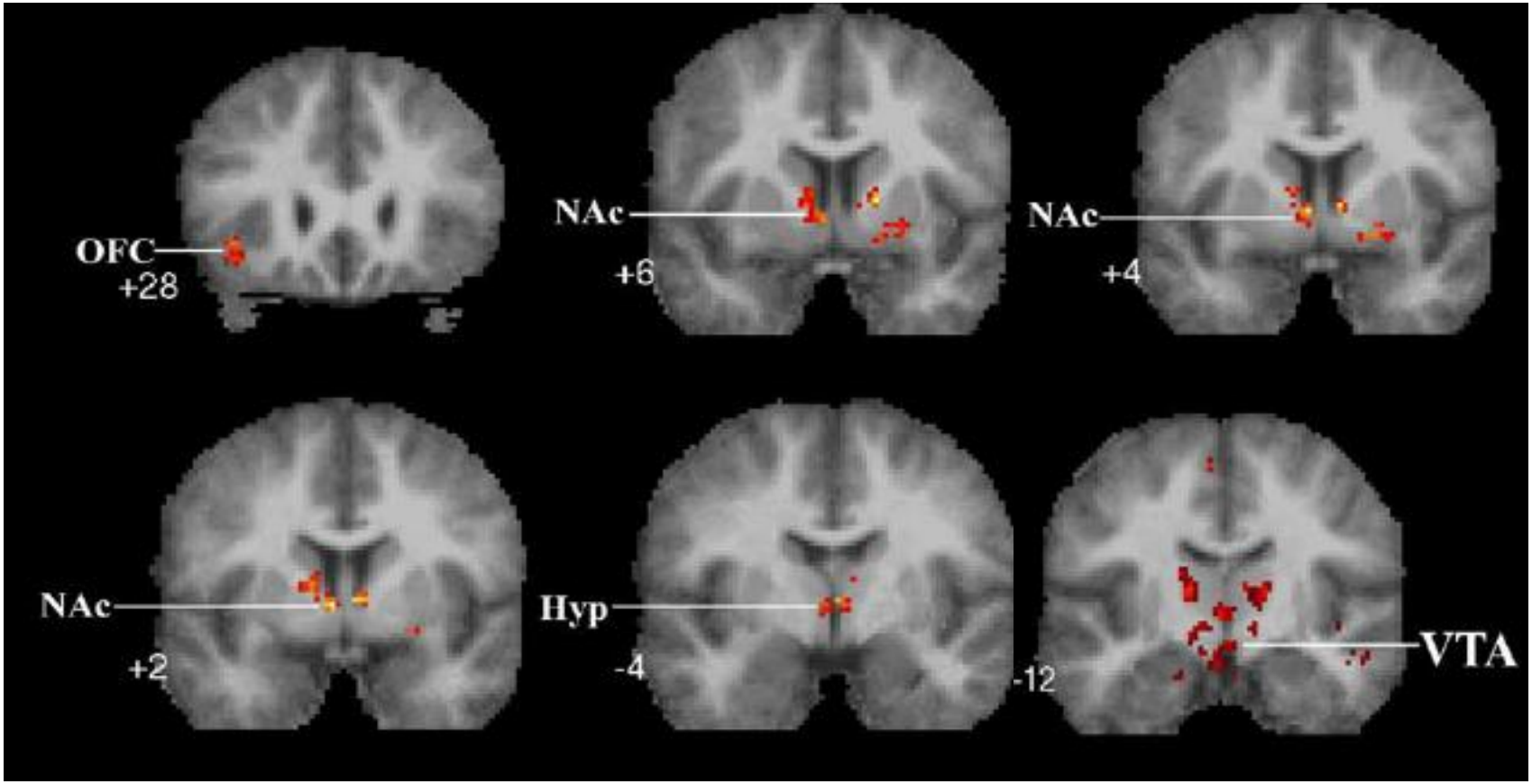


OFC

Anteroventral striatum

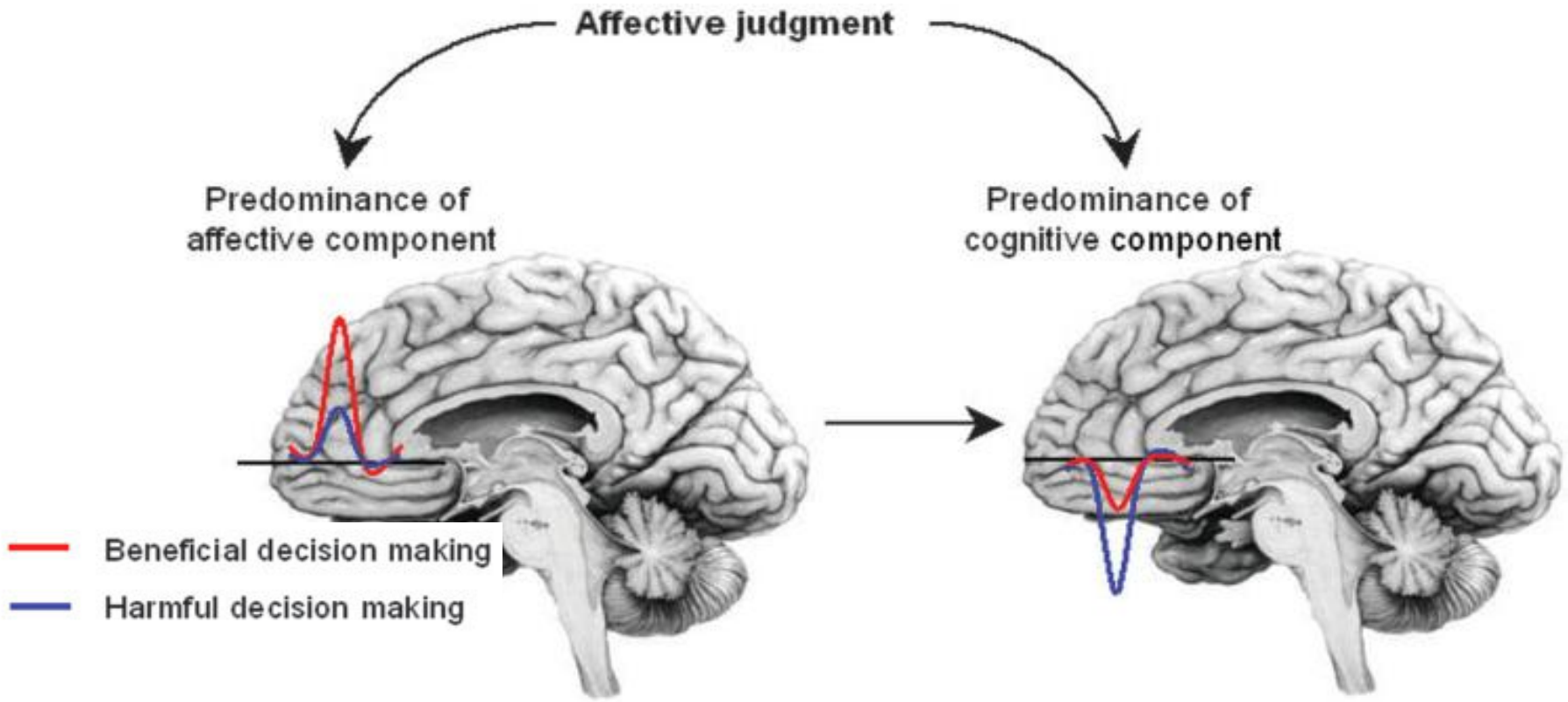
Rilling et al ’02 Neuron Neural Basis for Social Cooperation

Pleasurable music – scrambled music



Menon, Levitin ’05
NeuroImage

Ventromedial frontal cortex & beneficial decision making

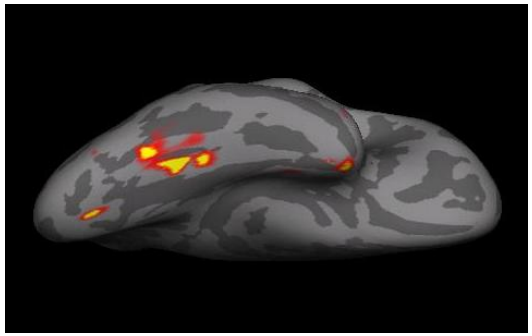


"higher VMPFC activity is associated with better decision-making performance"

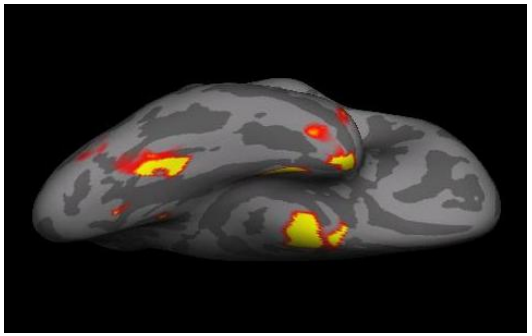
Northoff et al '06 Affective Judgment and Beneficial Decision Making Human Brain Mapping

Facial expressions in ventral temporal lobe

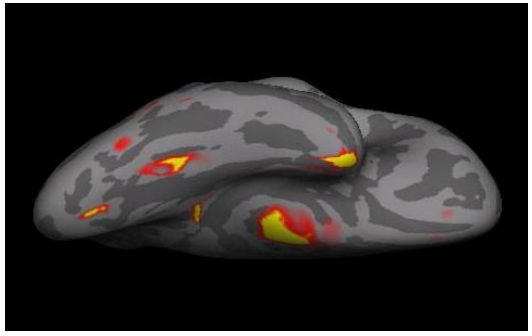
Anger



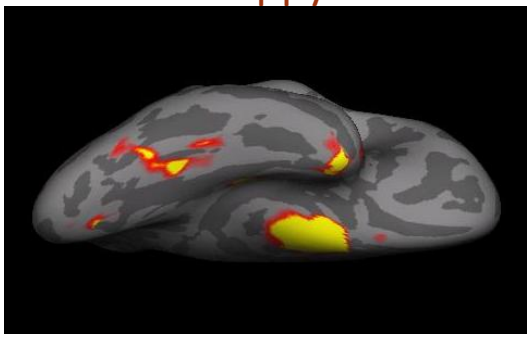
Disgust



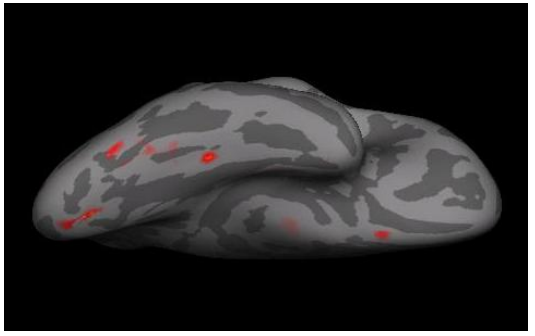
Fear



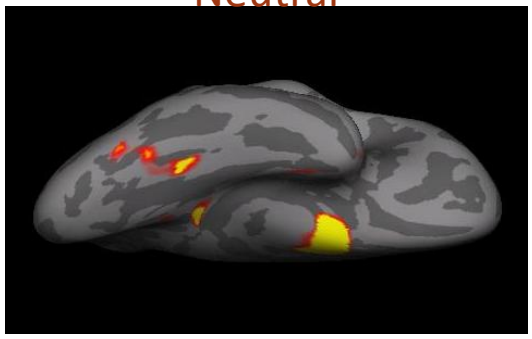
Happy



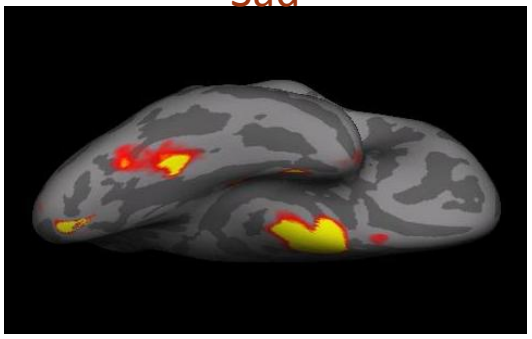
Swirl



Neutral



Sad



Steve Lewis - 2008